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Application of Green Building Technology in Rural Houses

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Abstract: Green buildings and beautiful countryside are hot topics in the field of architecture and planning in the new century. The core purpose of both is to provide people with ecologically healthy living environment. The content and characteristics of beautiful green buildings perfectly meet the development requirements of beautiful countryside, and promoting the green and ecological development of beautiful countryside is an inevitable trend of the times. However, the problem now is that a lot of work has been done in the beautiful villages in the country including the cold regions, but there is little systematic summary and application of green building technology in rural houses, and many provinces in the cold regions have not carried out the evaluation of green rural buildings. The research in this article is necessary. This paper adopts research methods such as literature retrieval, comparative analysis, and empirical analysis. It combines "green building technology" and "beautiful rural house" construction, and applies practice and design examples to further discuss the green technology in beautiful rural areas in cold regions. The application proves the practicability and feasibility of green building technology. Taking the green building evaluation system as the starting point, this article objectively analyzes the technical strategies applicable to green residential buildings. Combined with the design strategies of multiple green residential projects, the feasibility analysis of the main points and technical strategies corresponding to the standards was carried out. The feasibility of the scheme was studied and quantitative results were obtained. Experimental results show that 80% of household heads said that miscellaneous domestic water is very necessary to build green rural houses.

1. Introduction

Beautiful countryside is "an important way to implement the construction of ecological civilization, and also a practical action to promote the construction of beautiful China in the

countryside." In the vast cold regions and villages, due to the weak ecological consciousness of people, environmental problems such as water and soil loss and sharp reduction of resources have also set off alarm bells for environmental protection issues in rural areas, making the construction of rural ecological civilization on the agenda. "Eco-livable, efficient production, beautiful life, and harmonious humanities" are the core and goal of beautiful rural construction. Green buildings and smart energy perfectly meet the requirements of beautiful rural construction. It can be seen that residential construction, as a core part of the construction of beautiful countryside, guides its design through green theory and technology, which has extremely high practical significance.

Due to the importance of green building technology research, many research teams have begun to research green building technology and have achieved good results. For example, Zhang introduced DGNB, which includes ecological quality, economic quality, social cultural and functional quality, technical quality, and process There are more than 60 standards in 6 areas of quality and base quality. Since the 21st century, some other countries in the world have also established their own green building assessment systems and updated them in time to meet new needs. Relying on the continuous improvement of the evaluation system and market mechanism, reproduction has produced numerous green building projects, spreading the concept of green buildings, and deepening the existence of green buildings, which in turn has promoted the maturity of evaluation systems and market mechanisms. [1]. Zhang Shuai studies the application of green building technology in public building reconstruction, with a view to providing design and technical reference for green building renovation of public buildings such as office buildings, providing selection and basis for key technologies for large-scale green building applications, and practically promoting green building Application of technology in public building renovation and sustainable development of green buildings [2].

In the study of beautiful countryside, the use of green building technology is a good method that can solve many problems, so it is widely used in the study of building beautiful countryside. For example, Feng Xiong pointed out in the article that the current domestic green building design Some green building technologies imported from abroad are commonly used in China. These technologies are not accepted by China in actual application. Therefore, it is necessary to further develop passive localized green buildings suitable for local climate and production conditions [3].

This article researches and elaborates the basic concepts and theories. Through the review and induction of the literature, it comprehensively understands the concept and development of green building technology, the content and construction of beautiful countryside, and the characteristics of rural houses in cold regions. A systematic study of the current situation and design requirements of residential construction in beautiful villages in cold regions, focusing on the problems in their residential design. Aiming at the problems existing in the construction of beautiful rural houses in cold regions, the applicability, superiority and necessity of green design are put forward. Research on the application system and practice of green building technology in beautiful rural residential buildings in cold regions. The development prospects of green building technology in the construction of beautiful rural houses in cold regions are prospected, and feasible suggestions and conclusions are put forward. Investigate the specific projects of existing green buildings, fully understand the development of green building technology in the region, and combine the analysis of green building technology strategies to propose a corresponding green building implementation plan.

2. Proposed Method

2.1 Status of Beautiful Rural Houses in Cold Regions and Green Building Technology

The climate characteristics of cold rural areas are: long and cold winters, hot and humid summers in some areas, relatively dry and cool plateaus, relatively concentrated rainfall, relatively short spring and autumn seasons, drastic climate change, and rare precipitation in spring; temperature The annual difference is large and the sunshine is abundant; windy sand [4].

(1) Problems Existing in the Construction of Beautiful Rural Houses in Cold Regions

At present, the construction of beautiful rural villages in cold regions is undergoing vigorously, but in the course of its development, many twists and turns still appear. There are also many problems in its residential construction:

1) The technical means lag behind, the energy consumption of the house is large, and the environmental protection is poor. In cold regions, the mode of self-construction and decentralized construction is generally adopted in rural dwellings. Without reliable technical guarantee, it is difficult to improve the quality of projects, and environmental protection and habitability are relatively poor. Due to the lagging of technical means, the houses mostly adopt traditional construction techniques and structural structures, which have low degree of assembly and low production efficiency. The lack of technological means and backwardness make the level of rural residential construction low, slow progress, huge energy consumption, and extremely poor ecology.

2) The lack of unified building planning and design makes the whole house and living environment look dirty and messy. The single unit also has unreasonable functional zoning and inconvenient use.

3) Due to the lack of design, the structural layout is unreasonable and the construction quality is poor. Low energy efficiency and poor comfort. Houses blindly seek high and large, poor thermal insulation performance, hot in summer and cold in winter. The main energy sources are straw and coal, with low utilization rate and serious pollution.

4) Low energy utilization and poor comfort. Houses blindly seek high and large, poor thermal insulation performance, hot in summer and cold in winter. The main energy sources are straw and coal, with low utilization rate and serious pollution [5].

5) Domestic garbage and sewage are not treated centrally. There is no sewage treatment system or equipment, and the problem of random discharge of domestic sewage.

6) The building materials and the structure of farm houses are single and backward, and the safety is poor.

The solid red brick and concrete construction not only makes the house a single appearance, the material strength is low, but also the continuous damage to local land resources and the ecological environment. The structure is single. Survey statistics show that among the township houses in China, brick-wood and mixed-structure houses account for 87.4% of the built houses. The structure is poor in integrity. When major natural disasters such as earthquakes occur, great safety problems will occur. [6].

7) Regional characteristics are missing. economic development,

The emancipation of culture and the convenience of information have caused a huge impact on the countryside in the vast cold regions. At the same time, the original rural houses with regional characteristics have lost the constraints of local culture and customs, and have become convergent. Some residential designs have directly copied the city. The design pattern makes the rural appearance uniform and boring.

(2) Suitable green building technology for beautiful rural houses in cold regions

1) Green structure technology—Assembled reinforced concrete structure Reinforced concrete

structure is a relatively common structural form in residential construction in China. Compared with clay bricks commonly used in rural areas, reinforced concrete is a relatively green and energy-saving material. High strength, strong integrity, convenient material acquisition, convenient construction of prefabricated reinforced concrete, short construction cycle, convenient disassembly, low pollution and very environmental protection. Compared with the traditional wooden beam frame, it saves materials, has a high degree of assembly, and greatly improves the seismic safety. In the choice of concrete, green high-performance concrete, eco-friendly concrete, renewable aggregate concrete, etc. can be effective Use of industrial waste [7-8].

2) Green Structure Technology-New Masonry Structure

The new masonry structure has a very high price-performance ratio, and its economy and practicability are in line with China's conditions, and it is suitable for popularization in the design of beautiful rural houses in cold regions. The so-called new type of masonry is to use technology to transform traditional masonry, so that the various properties of the masonry are continuously strengthened, and a more modern and structural form of masonry is formed. Using new masonry to replace traditional clay bricks and adobe bricks can achieve great economic benefits. The green advantages of the new masonry structure are as follows: reduce energy consumption and save energy. Multifunctional conformable material. The unity of traditional masonry materials is improved, and a variety of materials with complementary advantages are compounded, which makes the new masonry obtain the excellent performance of multiple materials. The solid waste produced by the industry can be recycled, saving materials [9].

4) Envelope insulation technology

The surface area of the outer envelope is the main heat dissipation part of the building, and it is also a key part of the thermal insulation design of rural houses in cold areas. According to statistics, the average heat dissipation per outdoor envelope structure in rural houses in cold areas is 73.5W / m2, compared with Urban multi-story dwellings have doubled. Of the total heat consumption of their homes, the heat transfer rate of the external wall accounts for more than 40%, and the heat transfer rate of the roof also accounts for about 20%. Obviously, the use of green energy-saving technology in the outer envelope structure of beautiful rural houses in cold regions is an effective method to reduce building energy consumption [10].

5) Green building materials

Building materials are an important part of building structures and envelopes, as well as an important part of building green design. Statistics show that the cost of building materials accounts for 2/3 of the cost of finished products. During the use and use, a large amount of energy and resources will be wasted and the ecological environment will be adversely affected, which also greatly limits the sustainability of the building. The energy consumption (including production of building materials and building energy) produced by buildings in China accounts for 25% of the total national energy consumption, so the choice of material resources has a great impact on the building's ecological energy saving and material saving. In the construction of beautiful rural areas in cold regions, the good use of green building materials can greatly help the green design of houses [11].

(3) Technical analysis

1) Biomass energy utilization technology

Biomass energy is a kind of clean energy contained in biomass. It is a green sustainable energy that green plants directly or indirectly use photosynthesis to convert solar energy into chemical energy and store it. Recycling is a very ecological renewable energy. For the beautiful villages in the cold regions, crops and their wastes, wood, green plants, livestock manure, and other biomass

materials are abundant and easy to obtain. They are a natural treasure house of biomass energy. Common straw, rice husks, etc. can be transformed into various forms of fuel through physical, chemical, and biological interactions. One of the representatives is biogas technology [12].

2) Passive energy-saving technology

Passive energy-saving technology is a kind of green energy-saving technology commonly used in cold areas. Its working principle is that without the use of mechanical power and electrical equipment, through the reasonable choice of building orientation in the building planning and design, the scientific setting of shading, The effective application of heat-preservation and heat insulation technology for the envelope structure and the design of openings for houses with natural lighting and ventilation can reduce the energy consumption of the building in heating, heat preservation, ventilation and lighting, etc., thereby achieving building energy conservation.

3) Water saving technology

Rainwater utilization technology. Rainwater is a natural water resource, and water can be greatly saved through proper rainwater utilization technology. The principle is to set up a storage tank, use the storage tank to collect rainwater, purify it, and use it for toilet flushing and green irrigation. In addition, rainwater can be stored and purified for use in low-lying land before and after the house, which can both conserve groundwater and save water. Increase the use of water-saving appliances. At present, there are many water-saving appliances on the market. In order to maximize the utilization of water resources, the application of water-saving appliances and green pipes can be vigorously promoted in cold rural houses. Increase residents' awareness of water conservation. Enhancing the water-saving awareness of rural residents in cold areas is the root of water-saving links in houses. Only when residents fundamentally recognize the importance of water resources and act spontaneously to save water, supplemented by green water-saving technologies, can water be completely solved. The problem of waste.

2.2 A pplication S ystem of G reen B uilding Technology i n B eautiful r ural H ouses i n c old Regions

While human beings are developing, they have caused severe damage to the natural ecological environment in which they live. People in both cities and villages have been affected by environmental degradation. In China's vast rural areas, resource consumption and environmental pollution are serious problems. To change all of these, we must take the road of green development, especially to promote green building technology in rural residential construction. To effectively promote green building technology, a scientific and rigorous green building evaluation system is needed.

(1) Influencing factors of green building technology choice in beautiful rural houses in cold regions

1) Climate factors

For beautiful rural homes in cold regions, climatic factors are one of the determinants of technology choice. The performance is as follows: the winter is relatively long and cold, and the summer is hot and humid in some areas, the annual temperature varies greatly, and the sun is abundant; it is windy and sandy. When choosing green technology, the beautiful rural houses in the area should take full account of these climatic factors, adapt to local conditions, and choose technologies that are suitable for the climate, such as technologies for sustainable energy use such as cold insulation and solar energy, rather than blindly follow the trend and deviate from reality. Runs counter to the idea of green technology.

2) Economic factors

Environmental protection is one of the main characteristics of green buildings, which includes two parts of conservation and environmental protection. Saving is saving in all aspects and processes, including saving land, water, materials and energy. Environmental protection means that green buildings are environmentally friendly and low in pollution, and reducing pollution is an important part of green buildings.

3) Green buildings will be combined on the Internet to achieve the connection between the two. The Internet is one of the most significant inventions of the 21st century. In today's era, the development of various industries is almost inseparable from the support of the Internet. The docking of green buildings and information networks can guarantee the cutting-edge and advanced nature of green buildings.

4) Pay attention to the use of new energy. Energy-saving design and low pollution are two very important aspects of green buildings. Compared with traditional energy, new energy sources such as solar energy, wind energy, and biomass energy not only have low energy consumption, but also clean and less polluting. It is inevitable for green buildings to use energy. select.

5) Focus on the use of sustainable building materials. During the construction process, the building will not only consume a lot of resources, but also generate a lot of construction waste. If the building materials are degradable, recyclable and recyclable, it will greatly save resources and reduce the ecological environment. harm. Therefore, the use of sustainable materials is also an important advantage of green buildings.

6) Green construction, construction and management. The greenness of green buildings is not only manifested in independent links such as design, but also realizes a full range of greening from design to construction to management.

7) Humane and easy to use. People's living psychology and physiology will change differently in different periods, and their living needs will change accordingly. For example, with the increase of age, the child enters adolescence. At this time, the child will have a privacy requirement and sleep with his parents. If another child starts a family and the elderly lives alone, then there will be some physiological aspects of the elderly. Demand, green buildings can meet the needs of different periods, humane and easy to use.

3. Experiments

3.1 Research Content

The region studied in this article is Henan Province. Henan is located in the central and eastern part of China and the middle and lower reaches of the Yellow River. Zhengzhou, the provincial capital, is located in the middle of Henan. It is a traffic fortress in China with a flat terrain and rapid development. This paper focuses on the rapid development of green residential buildings in and around Zhengzhou.

(1) Investigate and analyze the local climatic characteristics, geomorphological characteristics, lifestyles, and building technology to understand the local building technology.

(2) Based on local green building policies and regulations, research the local green building evaluation standards and summarize the technical strategies corresponding to the standards.

(3) Investigate the specific projects of existing green buildings, fully understand the development of green building technology in the region, and combine the analysis of green building technology strategies to propose a corresponding green building implementation plan.

3.2 Research Methods

(1) Literature research method: By reading relevant literature at home and abroad, analysing and correlating relevant literature, especially focusing on the information about green building evaluation standards and green building technology strategies, after reading, analyzing, and summarizing And summarize, forming the collating thoughts of this thesis.

(2) Investigation and research method: Taking Chongqing's green buildings as the main research object, conduct survey visits to the basic situation of existing green buildings, and sort and sort out and analyze them based on the specific data obtained from the survey.

(3) Comparative analysis method: Take different green building design cases in Xi'an as the object, analyze and study the green building technology of the case, and summarize the scheme of green building technology strategy from different perspectives.

(4) Inductive summary method: summarize the existing green building design schemes in Chongqing, and propose green residential building designs that meet the characteristics of the area.

3.3 Experimental Data Collection

The LED evaluation system conducts green assessment of construction projects through six aspects, including site design, water resource utilization and indoor environment. In each aspect, LED proposes assessment goals (inte), requirements (requiremnts) and corresponding technologies and strategies and straegis), the scores of the number of assessment terms are shown in Table 1.

Table 1: LED evaluation content

	LEED NC	LEED EB	LEED CI	LEED CS	LEED for school
Sustainable site design	14	14	7	15	16
Effective use of water resources	5	5	2	5	7
Energy and the environment	17	23	12	14	17
Materials and resources	13	16	14	11	13
Indoor environmental quality	15	22	17	11	20
Innovative design	5	5	5	5	6

Buildings undergoing LED evaluation can be divided into three stages according to the progress of the project: design, procurement and construction. The design phase mainly refers to energy-saving, water-saving, and building comfort design. The construction phase mainly refers to the management of site construction waste and indoor air quality control. The procurement phase refers to the procurement of recyclable materials, including recycled materials, Local materials, recyclable materials, etc. The attention of LED evaluation standards to green building design and management during construction is worthy of our study, which provides a good reference for China's green building evaluation standards.

4. Discussion

4.1 Benefit Analysis after Project Green Reconstruction

The green reconstruction design sets up a solar air conditioning system on the roof of the building, and uses green energy solar energy to provide heating and cooling for the building, which not only meets the entire building's summer cooling and winter heating needs, but also saves the traditional energy consumption and effectively reduces The emission of greenhouse gases and

harmful gases can protect the environment and have social benefits. The social benefits are shown in Table 2.

Table 2: Values of social benefits

Serial number	Energy saving comparison of collectors per square meter	Save energy	Benefit value
1	Heat collected annually	4830000kJ	-
2	Annual savings in standard coal	138kg	-
3	Saves natural gas every year	187m^3	360
4	Save electricity every year	1200kWh	1200
5	Reduce CO2 emissions every year	367kg	-

As shown in Table 2 above, after multiple demonstrations, taking into account the cost budget, functional use, architectural image and other factors, and the green performance of the building, the total investment for the project's completion and settlement is approximately 12.5 million . The total investment amount includes an initial investment cost of 250 thousand yuan to achieve the goal of two-star green building, and the annual operating cost saved by green building is about 60 thousand yuan, which is expected to be recovered within 4 years The initial investment cost of Lvjian increased.

This book mainly puts forward requirements for the design of buildings in terms of energy consumption. All aspects of building design must meet the content requirements of control items. It mainly analyzes the technical strategies of the content of the scoring items in the green residential building design stage. The scoring of each item in the scoring items of this research is shown in Figure 1 below.

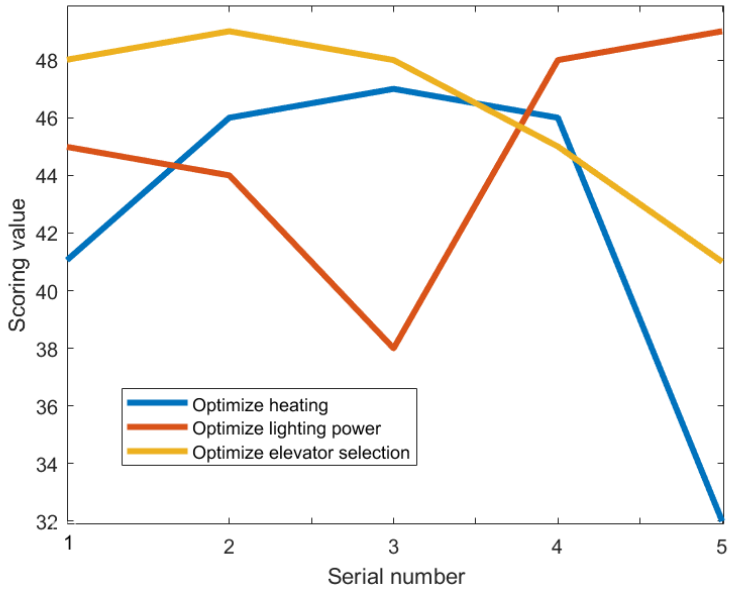

Figure 1: Total score of each project in energy saving and energy utilization

As shown in Figure 1 above, we can know that the requirements for the power consumption and heat transmission ratio of the hot water circulation pump of the heating system, the unit air power consumption of the fans of the ventilation and air conditioning system, and the power consumption cold (heat) ratio of the circulating water pump of the air conditioning cold and hot water system For residential buildings, energy-saving design and selection of heating, ventilation and air-conditioning

systems and equipment are required to reduce the energy consumption of the system in order to meet the scoring requirements. Secondly, the lighting power density value is required. For residential buildings, only the public areas are evaluated. The energy saving of the lighting system and the selection of lamps must be paid attention to in order to meet the target value. A lighting power density calculation book must be provided for this. There are certain difficulties in design requirements.

4.2 Water Saving and Water Resources Utilization Technology Analysis

The water saving and water resource utilization of this project mainly includes: update of water supply and drainage system, collection of water system, rainwater and installation of water-saving appliances. In the renovation of outdoor sites, most of the pedestrian walkways use water-permeable pavements, and parking spaces are laid with grass planting bricks to enhance the ground's water permeability and effectively reduce the pressure on the municipal drainage pipe network.

Table 3: Self-assessment form of rural water saving and water resource utilization technology

Category	Standard provisions	Score setting	Self-rating score	Weights
Grading items	Water supply system has no over-pressure outflow	8	6	0.18
	Greening irrigation uses water-saving irrigation	10	4	0.18
	Reasonable use of non-traditional water sources	15	10	0.18
	Cooling water supplementary water uses non-traditional water sources	8	4	0.18

As shown in Table 3 above, the requirements involved in the water conservation and water resource utilization chapters of this article are: avoiding leakage of the pipe network, no overpressure outflow of the water supply system, water metering, high-level sanitary appliances, water-saving irrigation, air-conditioning equipment or System water-saving cooling technology, other water-saving measures, reasonable use of non-traditional water sources, cooling water replenishment of non-traditional water sources, rainwater utilization and landscape water bodies.

In this paper, the water-saving design of the building is required, and all aspects of the building design must meet the content requirements of the control items. This article analyzes the technical strategies of the content of the grading items in the green residential building design phase. The scoring of each item in the scoring items of this research is shown in Figure 2 below.

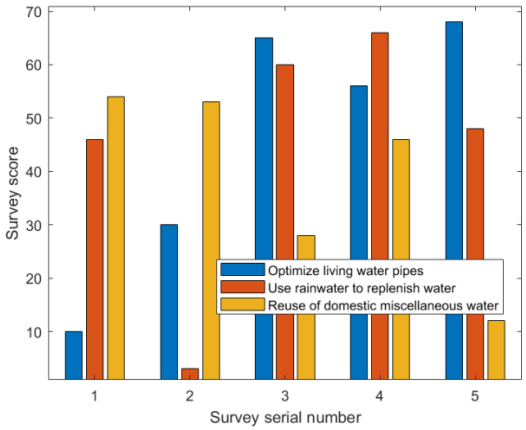

Figure 2: Total scores of each project in water conservation and water use

As shown in Figure 2 above, 80% of users said that saving water is necessary. Starting from the use of non-traditional water sources, non-traditional water sources are mainly miscellaneous domestic water, including non-potable water used for green irrigation, toilet flushing, etc. For example, in the design, the same-layer drainage indoor reuse technology can be used for indoor flushing. Because flushing water accounts for a large proportion of the total water consumption, the utilization rate of the water source is relatively high. A rainwater collection system can also be designed to use rainwater as for green land irrigation, road paving, underground garage cleaning, and car washing. In general, this evaluation item is mostly used for high-star green residential buildings.

4.3 Analysis of Materials and Materials Resource Utilization Technology and Indoor Environmental Quality technology

According to the selection principles of green building technology strategies, and referring to the specific scores of each item in the scoring items, analyze each clause and the corresponding technology strategy, as shown in Figure 3 below.

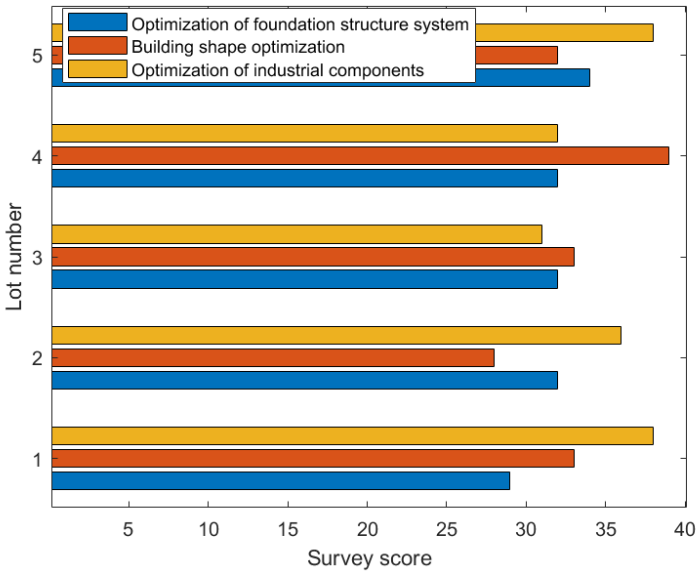

Figure 3: The total score of each project in the use of materials and resources

As shown in Figure 3 above, according to the selection principles of green building technology strategies, and referring to the specific scores of each item in the scoring items, the analysis of each clause and the corresponding technology strategy can be known. It is required to optimize the foundation, structural system and components during the design. For residential buildings, the raft foundation can be used as the foundation type, which can give full play to the bearing capacity of the foundation and adjust the uneven settlement. The foundation treatment is optimized by CFG composite foundation in accordance with the shear force. The stress characteristics of the wall frame, the structural system can use the shear wall structure. From the perspective of the usability and functionality of the residential building, other structural systems are not as reasonable as the shear wall structure system. As for the arrangement of the components, In the case of the axial compression ratio, it is necessary to use a smaller concrete grade and cross-sectional size, vertical

component size and concrete strength, which are gradually reduced along the height to achieve the optimal design.

This article puts forward requirements for the design of the building in terms of environmental quality. All aspects of the building design must meet the requirements of the control items. The technical strategy of the content of the scoring items in the green residential building design stage must be analyzed. The survey results are shown in Figure 4 below.

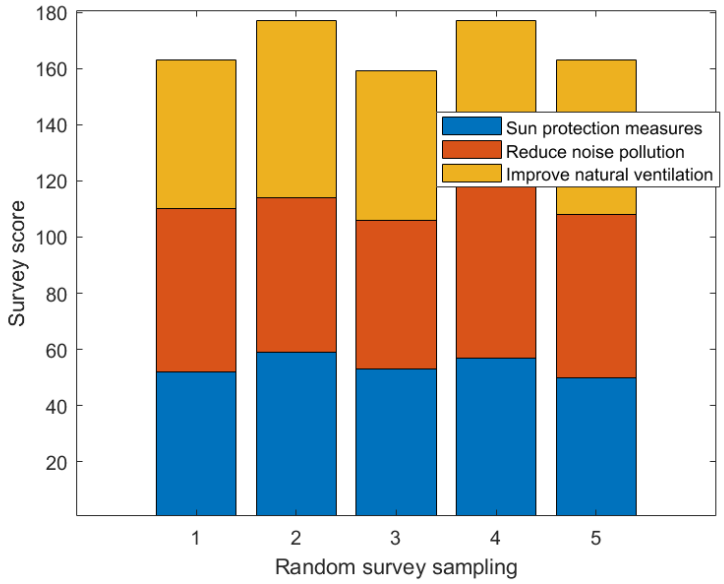

Figure 4: Total score of each item in indoor environmental quality

As shown in Figure 4 above, the room sound is required. When designing, ensure that the sound insulation performance of external walls, windows, doors, and partitions must meet the high standards of relevant standards in order to score. The external wall can be sheared. The wall is partially filled with autoclaved aerated concrete self-insulation blocks, the outer window can be made of insulated aluminum alloy insulating glass, the entrance door is sound-insulated thermal insulation anti-theft door, and the partition wall is made of aerated concrete blocks. In addition, it is required that the sound insulation performance of the floor impact sound reaches the high required standard limit. Sound insulation mats can be added to the floor to meet the requirements.

5. Conclusions

This paper systematically analyzes the construction characteristics and current situation of rural houses in cold areas, summarizes the problems that occur in rural houses in cold areas, and studies feasible green building solutions. The systematic research summarizes the green building technologies suitable for the construction of beautiful rural houses in cold areas, and forms a relatively complete green building technology system for rural houses. It focuses on the research and analysis of the characteristics and advantages of various suitable green building technologies. It also analyzes and elaborates with examples and practices. Reasonably judge the application trend and development direction of green building technology in beautiful rural houses, and make reasonable expectations for its development prospects.

The application strategy of green building technology in public building reconstruction can be

summarized as: the reconstruction and renovation of building envelopes, including the renovation and updating of exterior walls, windows and roofs; the rational use of resources, mainly including the use of renewable energy solar energy and water Utilization of resources and water saving; renovation and renovation of building space, mainly including the transformation of physical space and the implantation of functional cavities, to improve indoor natural ventilation and natural lighting effects.

This article starts from the concept of green building, based on the theory of green building and green building technology, studies the related applications of green building technology in public building reconstruction, explores some strategies and methods for green building public buildings, and then transforms green building methods. Apply to actual cases to analyze the benefits before and after the transformation

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