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LETTER TO THE EDITOR

Eco-upgrading Evaluation of Energy Conservation and Emission Reduction Effect of Assembled Green Building with Renewable Energy

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In the future development of architecture, as a new mode of upgrading the construction industry and realizing the sustainable development concept of green environment protection, the assembly green building of renewable energy will become the general trend and the main mode of architecture in the future. This paper mainly elaborates the characteristics and advantages of the assembled green building with renewable energy, and makes an in-depth discussion on its adaptability. It comprehensively studies the advantages and application characteristics of the assembled green building, and constructs the evaluation index system of the ecological upgrading of the assembled green building, so as to provide the corresponding reference for future research.

Renewable energy; Assembled green buildings; Energy saving and emission reduction.

1 Introduction

In recent years, facing the increasingly serious energy crisis, improving energy efficiency and reducing energy consumption level have become a hot issue of common concern around the world. As a major energy consumer, the construction industry has undergone a breakthrough technological change with the development of social economy. The large-scale promotion of assembled green buildings with renewable energy can promote the development of green buildings and effectively deal with energy shortages and global environmental problems. Assembled green buildings with renewable energy have the characteristics of standardization of architectural design, factory construction, mechanization of construction and assembly, scientific organization and management. Compared with traditional extensive cast-in-place buildings, assembling green buildings with renewable energy have high production efficiency, good quality of components, environmental protection and energy saving, and green construction, which are in line with the four sections and one environmental protection concept advocated by residential buildings in China. On the basis of the whole life cycle, green buildings can save water, material, energy and land as much as possible, protect the environment and reduce pollution at the same time (Shazmin S AA et al 2016).

Ziqing Zhang published a paper entitled “Relationship between Regional Economic Development and Ecological Environment Based on Spatial Data Mining” on Ekoloji’s Issue 107 in 2019. This paper uses spatial data mining

method and spatial analysis software to analyze the spatial distribution of GDP in Heilongjiang industrial corridor in 2018. In addition, the spatial correlation of GDP level is also analyzed. The results show that the spatial correlation of GDP of each county in this period is positive, and the correlation coefficient is small. The spatial distribution of GDP shows spatial clustering among similar values. The spatial distribution of GDP is positively correlated with the ecological environment factors, which indicates that the economic development activities of industrial corridors have a greater impact on the ecological environment.(Kiatruangkrai et al., 2017) Through the correlation analysis of GDP and population in Harbin counties, it is found that the spatial impact of GDP on population is also positively correlated. The relationship between GDP of Harbin County and the number of senior high school graduates is further analyzed. The results showed that there was a negative correlation between them. This paper has obtained good research results in this field. On this basis, this paper puts forward the evaluation method of ecological improvement of energy saving and emission reduction effect of assembly green building with renewable energy.

2 Idea Description

2.1 Characteristics of Assembled Green Building with Renewable Energy

The assembled green building with renewable energy has the following characteristics: 1) diversification, can be designed according to housing planning; 2) green environment protection, energy saving, and some new environmental protection materials can be used in construction; industrial production, building accessories can be industrialized production, so that the quality of materials can be guaranteed; 3) construction assembly, reduce labor. Strength, avoid waste of resources; 4) Reduce time, improve construction efficiency and shorten construction period. The main contents of assembly green building of renewable energy are as follows: 1) assembly structure refers to the concrete structure assembled by precast concrete members using stable connection method, which can mainly include assembly integral and full assembly concrete structures; 2) prefabricated assembly rate, which indicates that in the construction process, the prefabricated component concrete volume occupies all the suitable parts. (Heryadi and Hartono, 2016)The volume of concrete components reaches a certain proportion. 3) Prefabricated components refer to concrete components pre-fabricated in factories or on-site, such as beams, slabs, walls, columns, balconies, staircases, canopy, etc. to achieve standardization and industrialization. At present, housing construction is developing industrialization, the transfer cost of land resources has been significantly increased, and the labor cost has been increasing. People have gradually raised their awareness of environmental protection and began to pay extensive attention to green buildings. Under the influence of this background, the construction industry will face tremendous pressure of development. The characteristics and advantages of assembled residential buildings have become a new industry model, which improves the core competitiveness. At the same time, with the renewal of new technology and building materials, the development of assembled residential buildings has become a general trend (Kumar YVP, Ravikumar B 2016).

2.2 Advantages of Assembled Green Building with Renewable Energy

(1) Assembled green buildings with renewable energy are green and environmentally friendly. Firstly, the assembly green building of renewable energy embodies the transformation from wet system to dry system. At the present stage, the structure system which integrates cast-in-place and prefabricated assembly is widely used. The main components of assembled green building with renewable energy are manufactured or prefabricated in factories, assembled and installed on site. All the processes can be completed on site, replacing the traditional wet operation mode and adopting dry operation mode, which avoids the excessive dependence on labor force in the

traditional mode and effectively reduces the pollution emission and work intensity (Olubunmi OA 2016).In addition, after demolishing the building, many components can still be reused after recycling. The resources and environment are protected to the maximum extent. During the construction period, excessive sewage, harmful gases and noise can also be avoided, which has a beneficial impact on the surrounding environment, thereby reducing the waste of resources, reducing costs and increasing economic benefits. Secondly, through fine design of strength, thermal and other indicators of prefabricated components, standardized and product-oriented production, all components of green building with renewable energy assemblies can meet the corresponding quality standards, such as external wall design according to the required thermal indicators, factory production, to meet the heat preservation and insulation in winter and summer, effectively reduce energy consumption; such as wall, floor, doors and windows to meet the sound insulation and other work. It can effectively avoid external noise and mutual interference, and ensure the green building of renewable energy assembly to meet the requirements of energy-saving green building through serialized assembly and assembly (Li Z 2016).

(2) Improvement of performance of assembly green buildings with renewable energy. The assembly green building of renewable energy mainly solves the high-strength concrete technology and prestressing technology of prefabricated components, the key technology of prefabricated building structure system, forms the pre-stressed frame structure system and the prefabricated and pre-stressed frame shear wall structure system, forms a series and diversified technical system, uses light-weight high-strength materials, flexible connections, and achieves good resistance. Seismic performance, with better adaptability. From the aspect of structure system, the seismic performance of green building with renewable energy assembly is higher than that of cast-in-situ concrete building of the same type. It has also been confirmed in many earthquakes, such as high-rise steel structure buildings and foreign low-rise residential wooden structures, which belong to the assembly green building of renewable energy, and have shown superior seismic performance in previous high-magnitude earthquakes(Flacke J, De Boer C 2016).At the same time, the structural components of the assembly green building with renewable energy are prefabricated in the factory, the quality is guaranteed, the quality system is more perfect, and the strength of the prefabricated components is high. The structural calculation is mainly carried out according to the bearing capacity of each component itself, and connected into a whole through appropriate ways. The force of structural members is transferred through post-poured concrete, connecting bar and welded parts of embedded parts. When the connection structure of prefabricated concrete is reliable and the strength of the joints is higher than the tensile and shear strength of the concrete itself, it can be regarded as equivalent to cast-in-place concrete. The connecting part can be made into sliding, articulating or fixing according to the direction and size of deformation. When natural disasters such as earthquakes occur, under the action of prefabricated component structures, stress can be reduced by using the strain at the joints, so as to avoid its continuous transmission within the structure and reduce the damage of structural components. In the aspect of building fire prevention, it ensures that the materials of prefabricated components reach non-flammable or non-flammable, prevents the spread or spread of fire, and improves the fire prevention performance of assembly green buildings with renewable energy.

(3) Promote the refinement of design and construction, and improve the overall quality and functional diversity of the building. Modern architecture presents the trend of diversification of forms and functions, especially residential buildings put forward higher requirements for flexibility and variability of functions. This requires that the structural system of the building should be more adaptable. The movable interior partition system of the green building assembled with renewable energy has flexible combination mode to avoid damage to the building structure during decoration. It also reflects a high degree of freedom when it is renovated. It can be personalized according to the actual needs, and can show a variety of functions. The single space becomes rich and colorful,

which provides the possibility for people's life and living function, as well as the diversity of space. Renewable energy assembly green building has flexibility, kitchen and toilet equipped with a variety of facilities are interchangeable and changeable, creating possibilities for the transformation and addition of new electrical or communication equipment. (Tsai et al., 2019)Assembled residential design, through standardized design of kitchen, bathroom, window, staircase and other components of the house, standardized production through factory customization, forming uniform components and finished products, can effectively improve the accuracy of components, transport to the construction site assembly, in the process of project construction, components modularization and other methods can be used to install the system thoroughly. Information and water supply and drainage systems meet various needs, thus achieving standardization and systematization of prefabricated structure system, improving project efficiency and adaptability.

3 Construction of Assessment Index System for Ecological Improvement of Assembled Green Buildings

At present, many scholars at home and abroad have studied and made great progress on the assembly green building of renewable energy. Based on the life cycle theory, the evaluation index system is divided into five stages: design, production, construction, use and maintenance, scrap and recycle.

3.1Construction Principles

(1) The principle of scientific conciseness. Each index must establish scientific guidelines and reflect the evaluation indexes in the process of construction. Specific indexes should be moderately complex and operable.

(2) The principle of attaching equal importance to independence and integrity. Indicators of each group exist independently and interact with each other, forming a perfect organic whole.

(3) The principle of combining systematicness with hierarchy. There is a close logical relationship among the target layers of the evaluation system, which has a clear structure and a complete system.

(4) The life cycle theory evaluation of life cycle principle reflects the idea of comprehensive evaluation, which is helpful to find out the link of the problem and improve it in time.

3.2 Evaluating indicator

The whole construction cycle is divided into design stage, production stage, construction stage, use and maintenance stage and scrap and recycle stage. In the process of index evaluation system construction, material saving, energy saving, water saving, environmental protection and other indicators have an impact on many stages of renewable energy assembly green building construction. According to the significance of each index in each stage, the impact of the index in other stages is neglected in order to calculate concisely.

(1) Design stage. At this stage, the focus is on the context factors (respecting local culture, providing community residents with public places of activity, protecting local cultural heritage) and technical factors (technical strategy adaptability).

(2) Production stage. In this stage, we focus on the material saving factors (material saving and low energy storage material use) energy saving factors (envelope structure energy saving, improving resource utilization efficiency, using renewable resources) environmental protection factors (reducing CO_2 emissions, reducing SO2 emissions, reducing dust pollution).

(3) Construction stage. At this stage, the focus is on water-saving factors (water and rainwater recovery in water-saving appliances, ecological sewage treatment), outdoor environmental factors (green space rate, roof greening) construction civilization (construction method of waste discharge from noise construction).

(4) Use and maintenance stage. In this stage, the focus is on the factors of indoor environment (improving ventilation, temperature comfort, lighting and sunshine) operation management (waste collection and disposal,

energy saving and water saving management, greening management) evaluation management factors (residents' satisfaction around the site, self-evaluation of construction enterprises).

(5) Scrap and recovery stage. This stage focuses on the service life factor (life) and the recovery difficulty factor (degree of difficulty).

4 Conclusion

In the current social development, the national construction industry has moved towards a new development process, and housing industrialization will also become the general trend. At the present stage, the construction industry is still in a period of extensive development. The construction mode is too simplified and the work efficiency is seriously low. With the rapid development of market economy, the traditional construction mode has long been unable to meet the development needs of the current society. Assembled building meets the requirements of national green building and modernization of construction industry. It is the development direction of upgrading and upgrading of construction industry. Assembled sustainable building will be the inevitable trend of housing construction development and has broad application prospects.

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