Research on Application of Building Energy Saving and Emission Reduction Technology in Civil Engineering

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Abstract. In the context of energy saving and emission reduction concepts, the construction industry can effectively reuse the demolished waste building materials, which can promote the protection of China’s ecological environment, avoid the waste of construction resources and energy, and achieve global warming to reduce emissions, Energy saving and low consumption make a significant contribution, which can promote the improvement of China's economic efficiency. Therefore, energy-saving and emission-reducing measures should be applied in civil engineering construction to promote green and sustainable development of civil engineering construction.

1. Introduction
As the scale of civil engineering construction continues to expand, its role in China's social and economic construction has become increasingly prominent. Civil engineering construction has the characteristics of long construction period and large investment. With the continuous expansion of civil engineering construction projects in recent years, it has also caused many problems while promoting the development of civil engineering construction. The most obvious one is civil engineering construction. Energy saving in the process. The construction of civil engineering buildings needs to aim at energy saving and emission reduction, and increase the utilization rate of resources as much as possible, to promote the green and sustainable development of civil engineering buildings.

2. Establishment of an index system involving energy saving in civil engineering

2.1. System indicators
Based on the principles of scientific, systematises, applicability, universal comparability, and combination with the current domestic and foreign evaluation index systems, based on the evaluation indicators of excellent academic papers at home and abroad, the indexes of domestic and foreign evaluation systems, and the indexes of Chinese laws and regulations, Get the first draft of the comprehensive evaluation index system for energy saving and emission reduction of residential buildings, and comprehensively analyse the characteristics of energy consumption and carbon emissions of residential buildings, and use the expert survey method, the minimum mean square deviation method and the minimum and maximum deviation method to modify and improve it. The final draft of the comprehensive evaluation index system for energy saving and emission reduction of residential buildings is thus obtained, as shown in Figure 1. The index system covers a total of 36 qualitative or
quantitative indicators to ensure the objective, true and reasonable evaluation of the comprehensive evaluation of energy saving and emission reduction of residential buildings.

![Diagram of comprehensive evaluation index system](image)

**Figure 1.** Comprehensive evaluation index system for energy saving and emission reduction of residential buildings

### 2.2. Evaluation method

For the analysis of the advantages and disadvantages of the subjective weighting method and the objective weighting method, this article uses a comprehensive integrated weighting method-the least square method to determine the weight coefficient of the comprehensive evaluation index of energy saving and emission reduction of residential buildings [1]. This method is based on the analytic method of subjective weighting method and the entropy method of objective weighting method to output the index weights, and the least square method is used to construct the weight determination model of the comprehensive evaluation index of energy saving and emission reduction of residential buildings. It is more accurate, objective and credible, providing reference for practical application. It is assumed that the comprehensive weight of each index in the evaluation system of energy saving and emission reduction for residential buildings is:

\[
W = (\omega_1, \omega_2, ..., \omega_n)
\]

(1)

In order to comprehensively consider the subjective willingness of the evaluation subject and the scientific rationality of the decision-making, and achieve the harmonization of the subjective and objective, the deviation of the subjective and objective weighting methods should be reduced as much as possible. The index weight decision model based on the least square method is constructed as follows:
From this, the weight of each evaluation index is:

\[
\omega_j = \frac{w_j}{\sum_{j=1}^{n} w_j}, \quad j = 1, 2, ..., n
\]

After optimization, the basic range of building energy saving and emission reduction is shown in Figure 2 below.

3. Problems in current building energy efficiency

3.1. Not enough knowledge about energy saving and emission reduction

At present, many construction project developers do not fully understand the importance of energy saving and emission reduction, resulting in the inability to effectively use energy saving and emission reduction technologies during the construction of civil engineering. Other construction engineering developers only know to gain economic benefits, and use some styles of construction materials that are more popular with consumers in the market for construction. Although these buildings have good sales capabilities in appearance, they are energy efficient. Not consistent with China's basic national conditions, which restricts the use of energy-saving emission reduction technology. At the same time, some civil engineering buildings do not incorporate local energy, resulting in energy waste.

3.2. The overall level of energy saving and emission reduction is low

With the development of economy, people pay more and more attention to environmental protection and sustainable use of resources. The energy conservation and emission reduction of civil engineering buildings in China also gradually proceed in response to the call of the times. However, in the actual process, the energy conservation and emission reduction of civil engineering buildings The work is more
in a form than reality, and when it is actually implemented, it has not achieved any significant results; although some construction projects have also used energy-saving and emission reduction technologies, they have not achieved the expected goals. The work of energy saving and emission reduction has not been effectively implemented. The reason is that the technical level of energy saving and emission reduction is too low, and the energy saving and emission reduction effects required for construction projects cannot be implemented. Civil engineering building energy saving and emission reduction is a systematic project with strong comprehensiveness, high professionalism, and extensive disciplines. It is a long-term process that runs through the entire building implementation process, and it penetrates every link and corner of building implementation. China's construction industry is gradually emerging with the improvement of construction technology, but the development of building energy-saving technology cannot meet the development of the construction industry, and has always been in a relatively backward state. It has not achieved much results in the implementation of energy conservation and emission reduction in civil engineering buildings. It cannot adapt to the current social environment that seeks environmental protection and resource conservation [2].

3.3. There are deficiencies in the energy saving and emission reduction system and management

The most important thing before building construction is the engineering design link. In engineering design, the concept of building energy saving and emission reduction needs to be fully applied to the design. However, in view of most of the current design units in China, many construction engineering design units There are deficiencies in the energy saving and emission reduction system and management. The construction of energy-efficient residential buildings is a project that integrates comprehensiveness and professionalism. It involves many aspects. Many majors collaborate with each other, but many architectural design units are independent in design. The majors are completed separately, and the energy-saving drainage of buildings is done separately by the majors of drainage. The lack of communication and coordination among the majors directly affects the systematic nature of energy-saving buildings [3]. The energy-saving requirements of different professions are different. If there is a lack of communication and cooperation, it is likely that the energy-saving of the building will stay in theory and cannot really play its advantages.

4. Research on building energy saving and emission reduction measures

4.1. Waste utilization

Modern society buildings are renewed faster and faster, resulting in many waste building materials due to building demolition, because the recycling of these waste building materials is necessary. The accumulation and non-use of waste building materials not only affect people's normal lives, but also bring undesirable consequences to human living environment, but also cause waste of energy in our country. Therefore, we should effectively recycle and reuse the waste building concrete materials. First, the use of cementitious materials, effectively differentiated from used building cementitious materials, can be made into new aggregates, and the use of the remaining concrete to improve materials can effectively reduce the production cost of aggregates, which can improve Economic benefits of aggregate production. According to the relevant data, the use of gel to make aggregates has a relatively stable content and high density, which can achieve the purpose of energy saving and emission reduction; second, the collection of raw materials, effective crushing and burning of waste building concrete raw materials It can be used again, the production method is relatively simple, and the production cost is relatively low, which is more in line with the current adaptability of China's concrete materials, which can improve social and economic benefits. Under the concept of energy saving and emission reduction, the use of waste building glass materials can reduce ecological problems and improve economic efficiency. It can promote the protection of China's ecological environment and avoid the waste of construction resources and energy, and promote the improvement of China's economic benefits. Can save energy for social and economic development. First, glass tiles, using waste building glass materials,
waste ceramic materials, and clay materials as raw materials, fired to 1100 degrees Celsius, can be made into glass tiles, which can realize the reuse of waste building materials [4].

4.2. Establish and improve energy-saving technology management
At present, China has relatively comprehensive building energy-saving laws and regulations and specific clear regulations on energy-saving indicators. However, because the ideology of energy-saving and emission-reduction in China is relatively late, therefore, there are implementation and supervision of relevant laws and regulations Insufficient, so that energy conservation and emission reduction stay more in words or in theory, did not really fall into specific practice. In addition, the technical management system on energy saving and emission reduction is not perfect, and the supervision and monitoring measures are not effective, making the development of energy saving and emission reduction in civil engineering construction relatively slow. Therefore, it is necessary to clarify the corresponding supervision procedures and systems, further strengthen supervision, and urge the application of energy-saving and emission reduction technologies during construction. At the same time, construction companies should increase institutional innovation in the management of building energy-saving and emission-reducing technologies, and promote the implementation of energy-saving and emission-reducing efforts.

4.3. Promote energy-saving technology innovation
Science and technology are the driving force behind development. Energy-saving and emission-reduction technologies for civil engineering buildings also require strong technical support to help it achieve the goal of energy-saving and emission-reduction. Relevant technical personnel should study the degree of integration with the construction project according to the characteristics of the existing energy-saving technology, and will fully utilize the energy-saving technologies that can be applied to the energy conservation and emission reduction of civil engineering buildings. It is necessary to innovate the existing building energy-saving technologies and make a full understanding of the energy-saving properties of building materials. During the construction, the performance of the materials should be considered horizontally and vertically to ensure that the building materials are warm and thermally insulated. Reduce the heating consumption of the building, and at the same time control its price to meet the building cost standard. In construction, materials with low energy consumption should be selected as much as possible, and renewable resources should be used as much as possible to ensure that the construction materials can be effectively used in the construction process. Incorporating some advanced technologies into the building's energy-saving and emission-reducing construction process, it enhances the overall cost-effectiveness of the building, and improves the building's waterproof, soundproofing, and thermal protection in various ways. To prevent polluting materials and toxic materials, and to ensure the greening of building energy, relevant regulatory authorities should also timely monitor the waste discharge during the construction process to ensure the green and energy-saving progress of construction projects [5].

5. Empirical research

5.1. Research background
According to the annual development research report of China's building energy efficiency, China is divided into five climatic regions, namely hot summer and warm winter region, hot summer and cold winter region, mild region, cold region and severe cold region. Statistics on residential building energy consumption in different climate regions the survey questionnaires are slightly different, there are differences in emphasis, and the determination of the weighting coefficients of the comprehensive evaluation indicators is also different. Therefore, the empirical study of this paper selects the severe cold climate area as the research object as the object of the residential building energy consumption survey statistics, quantitatively evaluates the energy consumption statistical data, and analyses the evaluation results. According to the data of residential building energy consumption statistics, the total number of
samples is 100. In order to reduce the workload, shorten the cycle, and improve the efficiency, this article adopts the classification sampling method to randomly select 4 survey samples, and takes the construction technical index B1 of the technical index B as the research object. Covering the three indicators of B11, B12, B13, the first two are quantitative indicators, the latter are qualitative indicators, using statistical quantitative theory III to give qualitative and quantitative indicators score points (percentage system), and through comprehensive integration Weight method-least square method to determine the weight of each index, overcome subjective and objective influencing factors, and achieve the authenticity, accuracy and credibility of the evaluation results. Has formula [6]

\[
R = W \ast B = \left( w_1, w_2, ..., w_n \right) \left[ b_1, b_2, ..., b_n \right]^T = 75.524
\]  

Comprehensive evaluation of energy-saving and emission-reduction levels in common at home and abroad, the evaluation object of this article is "silver certification".

5.2. Policy recommendations

Based on the statistical results of the above survey, the key to the energy-saving and emission-reduction strategies for residential buildings is to control the architectural characteristics of the residence, such as a reasonable building layout, proper orientation, and suitable area. At the same time, in terms of heating methods and types of water heaters, clean energy and renewable energy are used as much as possible, such as solar energy, wind energy, nuclear energy, geothermal and tidal energy, etc. The heating method uses central heating or central air conditioning. In addition, the building decoration uses energy-saving and environmentally friendly materials and equipment, uses the reclaimed water reuse system to realize the secondary use of domestic sewage, and increases the coverage and diversity of green plants in the residential area. In the end, the residents’ awareness of responsibility for energy conservation and emission reduction will be improved. Energy conservation and emission reduction will start from every bit. Properly carry out activities such as publicity lectures, knowledge contests, on-site simulations, and invention recognition of residential building energy conservation and emission reduction, to correct the owners’ wrong awareness, energy conservation and emission reduction The job is to invest less, maximize economic benefits, optimize social benefits and sustain environmental benefits. Only by achieving vertical energy conservation and emission reduction of structural genes such as countries, regions, cities, residential communities, residential units and owners Promote the promotion and popularization of energy-saving and emission-reduction work in China's buildings, and then improve the international competitiveness of China's low-carbon economy [7].

6. Conclusion

With the continuous enhancement of people's environmental awareness, the issue of energy conservation and emission reduction in civil engineering buildings is more and more valued, and the architectural concept is further updated. Energy conservation and environmental protection, as an important indicator to measure economical residential buildings, have an important direction for the construction of construction projects. effect. As far as the current application of energy-saving technologies in construction engineering in China is concerned, there are still certain problems in energy-saving measures for civil engineering construction. This requires that construction units can optimize the construction plan according to the actual situation and fully apply energy-saving and emission reduction technologies. To promote the sustainable development of green buildings in all aspects of construction.

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