



# Study on the applicable technology of energy saving in rural residential buildings

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**Abstract:** In China, with the continuous development of the economic form and the increasing improvement of people's living standards, more and more people believe that housing research is a necessary way to improve residential happiness<sup>[1]</sup>. Therefore, from the perspective of energy conservation, the research on the applicable technology of energy conservation about rural residential buildings in China mainly includes the current situation of rural residential buildings in China, the existing problems in energy conservation and the insulation of rural residential buildings, as well as the advantages and disadvantages of some applicable technologies and various technologies. This paper also analyzes the climate conditions and architectural features of different regions, and then puts forward relevant suggestions and prospects.

**Key Words:** rural house; energy saving in building ; applicable technology; recommendations

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## 1. Introduction

With the compulsory implementation and promotion of national energy conservation standards<sup>[2]</sup>, the energy conservation design of urban civil buildings, especially residential buildings in hot summer and cold winter areas, has been rapidly and comprehensively carried out and achieved great results in energy conservation<sup>[3]</sup>. It changes from the initial paper energy saving step by step promotion to the implementation of each specific single item. From developers, design institutes, construction units to supervision units, quality inspection and supervision departments have attached great importance to energy conservation work.

However, in the region more than half of the vast rural areas, the implementation and promotion of energy saving standards has fallen into an awkward situation, and the reasons are as follows: First, because the policy of building energy efficiency is not widespread enough in rural areas, some farmers do not have the concept of building energy efficiency at all. When they build their own houses, they still follow the traditional model of the older generation without renovation and innovation<sup>[4]</sup>. Second, even if some farmers have heard of this concept, they will give up building their own houses due to concerns about the cost. Third, villagers generally ask local construction teams to build houses. These construction teams generally lack energy-saving construction technology due to their own limited conditions. All these are the most practical problems that energy conservation work faces in rural areas<sup>[5]</sup>.

Therefore, to actively promote the concept of building energy conservation in rural areas, and to sum up a set of practical and feasible energy-saving technology for rural housing have become the urgent matters of the moment to improve the area of the vast number of rural residential energy conservation issues, which is also the focus of the applicable technology for residential building energy conservation in rural areas.

## 2. Village and town housing development status

The residential area here is divided into two types: hot in summer and cold in winter. That is to say, there is a great difference in the current situation of rural housing development in the two cases respectively. With the continuous improvement of economic conditions, rural residents are constantly improving their living conditions, and the village and town housing has two forms: one is to retain the tradition of the original residence that the residents of a single family to build their own houses to meet the needs of production and living; the other is the residential concentration, which is the product of the new rural construction. Farmers are gathered together and resettled by the government for centralized living and management. In these two ways, except for the energy saving supporting facilities in the resettlement communities built by the government, residents' self-built homes simply follow the traditional building practices, without any concept of energy saving. So the planning and land use of rural residence are generally restricted by the homestead, and there is not much room for adjustment of layout and orientation, but it is relatively reasonable. Before and after the house can be appropriate to plant cash crops or suitable for the local climate conditions of trees and flowers, to reduce the hard ground around and to improve the indoor microclimate by optimizing the surrounding environment of the building.

### **3. Applicable technology for energy conservation of residential buildings in villages and towns**

#### **3.1 Theoretically energy-saving applicable technology**

According to the economic capacity of farmers and the technical level of the existing construction teams, it is suggested that the external wall insulation technology combining the two technologies should be adopted to replace the traditional brick wall as the main wall in the energy saving design of rural residential walls, and the external insulation should be used as the supplement for the local cold bridge. This technology is relatively mature in hot summer and cold winter areas, and a variety of self-insulation wall materials have been produced according to local conditions. For self-insulation wall, cold bridge treatment is difficult. Using the self-insulation wall instead of the traditional brick wall as the main, and using external insulation in the local cold bridge as a supplement, so the combination of the two technologies of external insulation technology can be a good solution to this problem.

The second is the window energy-saving technology, mainly from the reduction of permeability, heat transfer, solar radiation 3 aspects. Reducing the permeability can reduce the direct exchange of cold and hot air inside and outside the room, which can increase the load of the equipment and the air tightness of the window by using sealing materials. Reducing heat transfer is to prevent the existence of indoor and outdoor temperature difference caused by heat transfer, and it ultimately through the selection of different types of glass reduces solar radiation. On the one hand, reducing solar radiation can be achieved by choosing window glass with high shading coefficient. On the other hand, a more feasible method for rural areas is to add external shading to the Windows in the east, south and west directions.

Finally, roofing energy saving technology is suitable for the building. Because the roof contact rises hot pressure airflow, heat dissipation is larger. Therefore, winter insulation performance is poor in summer because of strong solar radiation roof absorption of a large number of radiant heat caused by the roof overheating, and the design should carefully be chosen to adopt to the appropriate roof structure. For sloping roof, laying nail insulation material along the slope direction, and using attic ventilation and heat dissipation can meet the requirements of related energy saving design standards. For the flat roof part, the village house should increase the thickness of thermal insulation layer or set up an air ventilation layer. The roof quality can alleviate the temperature difference of the building surface caused by the exposure to the sun and the shower, so that most of the radiant heat will not enter the envelope and transfer to the interior, thus improving the ecological and indoor environment. If we plant a few economic kind plant or vegetable, it still have certain economic gain.

#### **3.2 Life-based energy-saving technology**

Solar energy is the first technology. As the use of solar energy has become more and more common, so solar electric water heater for villages and towns generally have more favorable conditions. Compared with the city, the rural building density is low and the number of building layers is small. Because the solar radiation is strong, so the solar water heater can play a better role. If the combination of electric heating can sometimes make up for the lack of climate conditions, it should be a very worthy of promoting the rural energy conservation project.

Air conditioner is the second technology. Energy-saving air conditioners are selected for household use, that is: High efficiency refrigeration compressor, heat exchanging and fan adopt frequency conversion speed regulation and good match; the installation position of the air conditioner should not be exposed to direct sunlight. It will require that do not set the room temperature too low, and remember to often clean. At the same time, heat pump technology is adopted to meet the needs of cooling in summer and heating in winter.

The popularization of energy saving knowledge and the depth of energy saving concept is the third technology. Most citizens in developed countries have a higher awareness of energy conservation, which is inseparable from the government's regular publicity, education and training. But most of China's citizens have insufficient awareness of energy conservation, such as not being clear for the concept of building energy consumption, having no awareness of building energy conservation among building developers, and the lack of understanding for building design, supervision, construction and other units of the existing building energy conservation laws and policies and mandatory standards, which directly lead to China's long-term stagnation in building energy conservation.

Therefore, the state and local governments at all levels should strengthen the publicity of energy conservation and carry out related training work to enhance the public's awareness of energy conservation.

## 4. Conclusion

With the continuous deepening of the construction of new socialist countryside, the construction of rural houses will be one of the hot spots in China, which is very important for the energy saving work of the whole building in China to concentrate the rural residence. To sum up, combined with the actual situation in rural areas and practical engineering experience, the differences between urban houses and village houses must be requested to find a balance point among various elements. Careful conception, design, selection of materials, reasonable construction are all important for ensuring the smooth implementation of the construction of energy-saving residential buildings in concentrated rural areas, so as to ensure the effectiveness and practicability of the applicable technology for residential buildings in villages and towns.

## Reference:

- [1] Zheng Z, Li Y, Yang X. Study on Energy Efficiency of Rural Residential Building in Beijing. Building Science, 2008.
- [2] Dong H, Qi S, Han C. STUDY ON ENERGY-SAVING OF RURAL RESIDENTIAL BUILDINGS IN THE NORTH OF HEBEI IN THE COLD DISTRICT. Low Temperature Architecture Technology 2009; 31(8): 116–118.
- [3] Liu Y, Fang X, Dan M, et al. Analysis of Energy Consumption and Research on Energy-Saving Technology of Rural Residential Buildings in Southern Shaanxi. IEEE Computer Society, 2011.
- [4] Li Z, Huang X, Yuan D, et al. Study on Characters of Rural Residential Buildings Based on the Investigation in Shaanxi, Guangxi and Jiangsu in China[J]. E3S Web of Conferences 2021; 237.
- [5] Shi Z, Ju J. Research on Technology Optimization of Energy-Saving for Rural Residential Buildings in Harbin. International Conference on Construction & Real Estate Management 2009: 854–857.