Research on Key Technologies of Environmentally Friendly Modern Building Science

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Abstract. The continuous development of China's economic level and the increasing improvement of people's living standards have directly promoted the development of China's construction industry. However, in the construction of buildings, people often ignore the problem of waste of resources. To a certain extent, it also caused a lot of waste. Therefore, I believe that it is necessary to construct a scientific view of building energy conservation and apply it to actual building construction. Therefore, this paper addresses the problems of unclear scientific understanding of building energy efficiency and weak theoretical basis of engineering practice, and puts forward the necessity of the construction of a scientific view of building energy conservation and its application research. From the concept of energy, the development of building science, the development of building disciplines, and the connection between science, engineering, technology and industry, it reveals the inherent connection of building energy conservation science, building energy conservation engineering, building energy conservation technology and building energy conservation industry. Aiming at the characteristics of building energy as a social activity, the practice activity is constructed from the perspectives of the subject, object, content, and goals to form a multi-angle and multi-level understanding system of building energy efficiency. Form an epistemological system for building energy efficiency.

1. Introduction
In the 21st century, China's building energy efficiency is facing a better development situation. At the same time, there are many letters in the field of building energy efficiency that need to be studied and resolved. For example, in the current practice of China's building energy efficiency engineering, the introduction of foreign high-tech and methods has been blindly introduced, and a large number of demonstration projects Stacking the current status of building energy-saving technologies, measures, and products has the adverse effect of improper use of building energy-saving technologies, leading to abnormal phenomena such as inefficient energy-saving buildings. Building energy efficiency is still "praising or not" and has not achieved the expected development. The total energy consumption and energy consumption level of public buildings have risen without falling; in the promotion of building energy conservation, the concept of "emphasis on technology, capital and management" There are all kinds of "non-technical problems" such as the failure to implement good energy-saving technologies, the unsatisfactory effects of energy-saving technologies after use, the simple and feasible low-cost or even no-cost measures unwilling to be implemented, etc [1]. To confuse the essential difference
between building energy saving targets and building energy saving goals, and to pursue digital energy saving; the construction department has not yet smoothed the internal driving mechanism of building energy saving and only pushed for energy saving from external technical means.

The methodology of building energy saving is a general term for the methods of understanding building energy saving and the practice methods of building energy saving. It is an important part of the scientific concept of building energy saving. In summary, answer the basic question of "How to save energy in buildings?" The dissertation analyses the building energy conservation methodologies and theories, and reflects the consistency of the building energy conservation methodologies and epistemology, thus forming a scientific thinking system for building energy conservation. Combining modern scientific thinking methods with building energy saving to form the theoretical basis of building energy saving evaluation system and an important content of building energy-saving method theory.

2. Theoretical basis of building energy efficiency

According to the basic point of view of the dialectical materialist scientific view: Science is a practical activity that enables subjective cognition and objective reality to achieve a specific unity. Scientific thinking refers to thinking in accordance with the actual connection between objective things and objective laws. The use of scientific thinking to analyse things and problems is scientific analysis; the decisions based on scientific analysis that can achieve the expected goals are scientific decisions; whether it is possible to create subjective cognitions through repeated or universal practice tests and scientific thinking objectively, this is a scientific attitude. Only by using scientific thinking and scientific attitude to guide social practice can we form scientific understanding [2].

2.1. Energy

"Energy" in physics refers to the ability of an object to do work. Energy is the unity of the quantity and quality of energy, which characterizes the amount of energy and the level of function. The interpretation of energy currently has about 20 different definitions. The World Energy Congress (WEC) believes that "energy is the ability to enable a system to generate external activities". Energy in this definition refers to energy, because the English word for energy and energy use the same word. The basic attributes of energy include both natural and social attributes. The natural attributes or physical attributes or resource attributes described in the above definition are manifested as objectivity and scarcity as material resources in nature; form diversity and convertibility; from open source, conversion, transmission and distribution to utilization of the entire process of diversity and Complexity. The social attributes of energy are manifested as energy as an important material basis for the development of the national economy [3]. The supply of energy is considered as a public service in many countries, reflecting the socio-economic nature of energy; the wide range of energy use subjects and energy service objects, and energy resources Fairness as social wealth, etc.

2.2. Environmental concept of energy consumption

Environmental issues caused by energy activities are often referred to as energy environmental issues. China's energy and environmental problems are mainly caused by the severe acid rain pollution caused by sulphur dioxide emitted during coal combustion; global climate change caused by carbon dioxide emissions from fossil fuel combustion. Global climate change is seriously threatening human survival and development, and the world's energy resources will be increasingly depleted. From the perspective of the environmental impact of energy consumption, China has made building energy conservation a key area for low-carbon emissions. The related environmental impact of energy consumption is shown in Figure 1.
Figure 1. Environmental issues related to energy consumption.

2.3. Concepts and Knowledge of Building Energy Efficiency

From the perspective of the development of building energy-saving concepts, initially "building energy saving" refers to saving energy consumption and reducing energy input; later "maintaining energy in buildings" means maintaining energy in buildings and reducing thermal dissipation of buildings; "Improving the efficiency of energy use in buildings" is not to passively save energy, but to improve utilization efficiency in a positive sense and efficiently meet comfort requirements. "Energy efficiency" refers to the ratio of the amount of energy that is used to the actual consumption of energy in the use of energy, that is, the ratio of the services provided to end users and the total amount of energy consumed. In the "Application of High Technology to Improve Energy Efficiency" published by the World Energy Council in 1995, "energy efficiency" was defined as: reducing energy input to provide equivalent energy services. As shown in Figure 2, this is the area where building energy efficiency is reflected [4].
The above table shows that the specific characteristics of building energy consumption are as follows: users of the building and the service target of the building energy system are people in the whole society, and all people living in the building can participate in the manipulation of building equipment and the adjustment of building environmental parameters. However, most people do not understand the performance and correct operation methods of building equipment, and do not understand the principles of building energy conservation. There are no mandatory energy-saving usage guidelines to guide them. Their operation methods and environmental control methods are subjective, casually, the behaviours and living habits of building users have a great impact on building energy consumption, which reflects the particularity and breadth of the subject of building energy efficiency. The hierarchical nature of building energy demand and the diversity of energy service levels originate from the characteristics of the building itself; the basic attributes of the building determine that the building environment must be built based on liability, and there are individual differences in human needs. It varies from person to person.

3. Related concepts and technologies of wall heat transfer

3.1. Wall insulation arrangement
Considering that the construction methods of external and internal thermal insulation will affect the durability of the thermal insulation layer, and most organic thermal insulation materials are flammable. Coupled with the characteristics of bamboo structure, the original bamboo keel composite structure wall developed in this paper is supported by bamboo poles, filled with insulation boards, and covered with thermal insulation mortar on both sides, which is a typical sandwich insulation wall.

3.2. Selection of insulation materials
The original bamboo keel composite structure wall is popularized and applied in the rural areas in the northern cold regions. It is suitable for low-rise and multi-storey buildings. The thermal insulation
material is built into the wall structure and is supported by the original bamboo rods. Therefore, the built-in insulation materials have lower requirements on strength and construction technology, and they also have low requirements on environmental protection and weather resistance. They are mainly considered in terms of insulation performance and cost. Therefore, EPS gravy board, EPS white board and XPS board with better comprehensive performance and lower cost are selected as the internal filler [5].

In this study, the thickness of the solid protective material to be sprayed on both sides of the original bamboo keel structure wall of the original bamboo keel structure was 30mm. The measured thermal conductivity of the protective material used in this test was 0.158W/(m²·K). The net distance between the inner walls of the two bamboo rods was set to 400mm, and the outer wall of the two bamboo rods to the edge of the test piece were 200mm. The following three thermal insulation materials were selected as filling materials for the interior of the wall. The calculation parameters of the thermo physical properties are shown in table 1.

Table 1. Calculation parameters of thermal physical properties of insulation materials

| Material name                              | Dry density $\rho$ (kg/m³) | Calculation parameters | Calculation parameters |
|-------------------------------------------|---------------------------|------------------------|------------------------|
| Styrofoam board (EPS white board)         | 20                        | Thermal Conductivity $\lambda$ (W/(m·K)) | 0.039                  |
|                                            |                           | Thermal storage coefficient $S$ (W/(m²·K)) | 0.28                   |
|                                            |                           | Specific heat capacity $C$ (kJ/(kg·K)) | 1.38                   |
|                                            |                           | Steam permeability coefficient $\mu$ (k/(m·h·Pa)) | 0.162                 |
| Graphite polystyrene board (EPS gravy board) | 20                       | Thermal Conductivity $\lambda$ (W/(m·K)) | 0.033                  |
|                                            |                           | Thermal storage coefficient $S$ (W/(m²·K)) | 0.28                   |
|                                            |                           | Specific heat capacity $C$ (kJ/(kg·K)) | 1.38                   |
|                                            |                           | Steam permeability coefficient $\mu$ (k/(m·h·Pa)) | 0.162                 |
| Extruded polystyrene foam board (XPS board) | 35                       | Thermal Conductivity $\lambda$ (W/(m·K)) | 0.03                   |
|                                            |                           | Thermal storage coefficient $S$ (W/(m²·K)) | 0.34                   |
|                                            |                           | Specific heat capacity $C$ (kJ/(kg·K)) | 1.38                   |
|                                            |                           | Steam permeability coefficient $\mu$ (k/(m·h·Pa)) | -                     |

According to Table 1, the limit value of the heat transfer coefficient of the outer walls of residential buildings in urban areas in cold areas is 0.45W/(m²·K). The heat transfer resistance of the envelope structure that meets this energy-saving standard $R = 2.072$ m²·K/W can be derived the relationship between the thickness $d$ of different insulation boards and their thermal conductivity is:

$$\lambda = \frac{0.8d - 4.163d^2}{1.478 + 2.206d}$$ (1)

According to this, the thickness of the wall filled with different insulation materials can be obtained. The thickness of the required EPS white board is about 100mm, and the total thickness of the wall specimen is 180mm. The thickness of the required EPS gravy board is about 75mm. The total thickness of the wall is 155mm; the thickness of the required XPS board is about 65mm, and the total thickness of the wall currently is 145mm [6].
4. Analysis of ways to reduce building energy consumption and achieve building energy efficiency goals

4.1. Reduction of air-conditioning energy consumption
In order to make the building bring a better user experience, in some cases it is necessary to apply air conditioning to adjust the temperature and humidity of the building's internal environment. In areas where air conditioning is used more, the reduction in load during peak power hours can be considered as one of the building energy-saving goals is that air-conditioning applications are intermittent and seasonal, which results in a huge gap between power supply peaks and valleys, which causes a large burden on the power grid. Based on this, people deal with them through ice-storage air-conditioning technology to a certain extent, the difference between the peak and valley of the power supply is reduced, and the efficiency of power generation is improved, so it can be classified into the energy-saving range of the building. It will be compensated with certain policies to promote the realization of building energy conservation goals.

4.2. Achievement of Energy Efficiency in Buildings with Steel
Materials such as concrete and steel bars are widely used in the construction of our country, and the consumption of steel accounts for a considerable proportion. In order to promote the reduction of China's building energy consumption ratio and achieve the building energy conservation goals, more attention must be paid to the efficient and economical use of steel in buildings, in-depth research on related projects, and applying excellent research results to actual building energy conservation.

The application of this method has more positive effects on the construction industry. On the one hand, it can reduce the consumption of energy resources, promote the stability of the building itself, and promote the development of environmental protection in China. A need for the development of the industry is in line with the development needs of the construction industry, alleviating the problems of excessive consumption of steel resources, improving the corresponding standard requirements and technical levels, and promoting the construction of our country to high floors, large loads and large The direction of the span changes, and related researchers need to conduct in-depth research and popularization of this method to promote the reduction of the energy consumption ratio of buildings and the realization of energy conservation goals [7].

4.3. Application of new wall materials and thermal insulation materials
The reduction in the proportion of building energy consumption and the realization of energy-saving goals have a greater relationship with wall materials. People need to combine the development goals of green building materials and apply local wall materials to new wall materials in the area to achieve building energy-saving goals. To reduce the contradictions in energy and resources in China, consider environmental and land protection issues, and then achieve the purpose of building energy conservation. If you want to reduce the energy consumption of buildings, you need to consider the issues of heat transfer on the external wall. This part of the heat transfer cannot be underestimated in the overall heat transfer, so it can be regarded as one of the important ways to reduce the building energy consumption and achieve the building energy saving goals: 1. Pay more attention to the research work on the development of three waste thermal insulation coatings. The research results will be promoted and applied to actual work to promote the environmental protection level and water level of coatings. 2. In-depth development of product performance, improvement and improvement of existing deficiencies in current work. 3. Research and development of composite thermal insulation coatings, people can take high bonding strength, low cost as research goals, improve the original thermal insulation performance, and promote the realization of building energy conservation goals.

4.4. Use of renewable energy
In buildings, people can make full use of renewable energy, and then reduce the proportion of building energy consumption, and promote the realization of building energy conservation goals. For example,
people can make full use of solar energy, such as clean energy, and use technologies such as photoelectric conversion. In-depth research and apply excellent scientific research results to buildings, reduce the consumption of non-renewable energy, now people have applied it to the construction work of external walls, roofs and other structures, and can carry out the electrical energy demand inside the building. To a certain degree of satisfaction, even in some energy-saving buildings, not only can they meet their own electrical energy requirements, but there is also excess electrical energy.

4.5. Application of Intelligent Lighting System

In order to improve the experience of people inside the building, people need to meet the needs of light conditions. There are many lighting equipment’s in our country's buildings, so the intelligent construction of the lighting system can be regarded as one of the important ways to achieve the building energy saving goals. People in the building use lighting fixtures. If they forget to turn them off when they leave, they will increase the energy consumption of the building. Based on this, people have researched and applied intelligent lighting systems. Perform detection, turn off the lighting fixtures when everyone leaves, and with the continuous improvement of the intelligence level of the lighting system, its functions have become more abundant. The left side of the lighting fixture is turned off. For example, when there is enough sunlight, the system can automatically adjust the brightness of the light. It can reduce the energy consumption of the building while meeting the lighting needs of people.

5. Conclusion

At present, the application of the scientific concept of building energy conservation in China is not optimistic. However, with less and less resources available to mankind, environmental protection and energy saving are a basic policy in China, and it is very meaningful for various industries to respond to this call. As an industry with the worst energy consumption in China, it is necessary to focus on building energy efficiency. In particular, the discharge of construction waste has caused a great waste of resources. Therefore, through the recycling and utilization of construction waste, it is necessary to apply the most advanced technology to achieve the maximum application of construction waste. This will not only bring a certain degree of impact on China's energy conservation and environmental protection, but also directly affect people's living standards and living environment.

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