

Original Paper

Application of Building Intelligent Design in Energy Saving and Sustainable Development

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Abstract

With the rapid development of social and economic development, people's living standards to a certain extent has been continuously improved, building energy consumption further shows a trend of sustained growth, the apparent contradiction in the supply of energy resources in our country further aggravated. In order to the sustainable development of mankind, we must effectively reduce the energy consumption, and further implement the building energy conservation measures into practice. To a certain extent, effective control of building energy consumption, and further alleviate the contradiction between China's energy supply and economic and social development. Let building energy-saving design in China's energy saving and emission reduction to make the necessary contribution. China is a populous country, per capita resources are poor, people's overall average standard of living is low. With the deepening of China's reform and opening up, the Chinese people are gradually getting richer and richer, the Chinese people began to continuously improve their material life, especially the living environment, so China's construction business is also rapidly developing, with the increase of a large number of new buildings, the building energy consumption is growing rapidly. However, China's large population, the energy situation is not optimistic, reduce building energy consumption is the implementation of the scientific concept of development, to achieve sustainable development of the major strategic initiatives.

Keywords

Building intelligence, Energy saving, Environmental protection, Sustainable development

1. Introduction

With the growth of global energy demand and the increasing prominence of environmental issues, green building design has received widespread attention as a sustainable development solution. Energy saving and sustainable development have importance in green building design. By choosing

energy-saving strategies such as efficient building envelope, optimizing layout and orientation, utilizing renewable energy sources, and improving energy use efficiency, green buildings can reduce energy consumption. At the same time, sustainable development strategies such as selecting environmentally friendly materials, promoting green construction methods, protecting the ecological environment and biodiversity, and improving the durability and service life of buildings can help reduce environmental impacts. Green building design aims to realize the harmonious coexistence of people and the environment and lay the foundation for a sustainable future. Through the analysis of the function and application status of the building intelligence system, it is proposed that the use of building intelligence technology to realize building energy conservation and environmental protection should start from two aspects. One is to explore the potential of energy saving and consumption reduction of the existing building intelligent system and give full play to its energy saving and consumption reduction efficacy; the other is to closely track the development trend of green building and ecological building, and actively develop the application of intelligent technology in environmentally friendly and ecological facilities and systems, so as to realize the goal of energy saving and environmental protection. This paper will discuss the importance of energy saving and sustainable development in green building design and introduce the corresponding strategies and measures.

2. Preliminary Analysis of the Current Situation of Building Energy Efficiency and the Need for Building Energy Efficiency Design

2.1 Lack of Overall Energy-saving Thinking in Building Design

China's construction industry in the process of building design, to a certain extent, the phenomenon of serious waste of energy resources, residential building design is particularly serious. The energy consumption of the building is a long-lasting hidden consumption, and this hiddenness is easy for people to ignore. The reasons for this are initially analyzed as follows: First, developers are overly pursuing huge volume of living communities, which will inevitably cause the urban heat island effect to intensify. Huge communities are bound to have a lot of western sunlight, insufficient sunlight and poor ventilation, which will certainly produce a great waste of energy consumption. Secondly, people are overly concerned about the appearance of the building, and are keen to pursue various architectural styles, such as European, French, English and Spanish styles. But the building itself does not care about the energy consumption. Thus formed from the market influence sales, sales influence design cycle. Leads to the developers would rather spend more money on facade modeling, but also do not want to spend on building energy-saving equipment investment. Third, based on the above two reasons, building designers have not been able to start from the big picture, the design of the overall energy-saving performance of the building, only in the so-called energy-saving details on the discretion, the selection of thermal insulation materials and thickness adjustment and so on. Of course, building designers in the early stages of the program also have the direction of energy saving and emission reduction, due to the developers can not achieve the required benefit maximization, and most of the

program will be aborted. Fourthly, the owner and the operation department, the lack of the whole life cycle of the building operation thinking, only stay in the headache and feet at the primary stage. Building whole life cycle operation thinking, is essential to reduce building energy consumption way of thinking. For example, the purchase of solar energy equipment in the early stages of the first seems to be a huge investment, but in the long run it seems to save a lot of energy costs. If not for the local policy regulations, the average developer will rarely take the initiative to purchase.

2.2 The Goal of Energy-saving Design is Sustainable Development

At present, China's basic strategy is to build a resource-saving and socially friendly society, due to the rapid development of society, to a certain extent, can bring people economic enjoyment and material enjoyment. However, it should be noted that the world's energy is relatively limited or even scarce, the waste of resources will to a certain extent to the future of mankind will bring more problems and dilemmas. At present, we are not rare fast economy, we do not lack of great buildings, we do not lack of various styles of high-grade housing. Only we are scarce comfortable environment. Therefore, building design, we must give full consideration to the impact of the building itself on the surrounding environment, especially in terms of energy consumption, for energy-saving design, it is, to a certain extent, the fundamental ecological development, but also to further drive the society towards a more civilized, friendly and sustainable development. Therefore, only through the continuous improvement of strategies and methods in the process of energy saving can mankind move forward better.

3. Energy Saving Strategies in Green Building Design

3.1 Selecting an Efficient Building Envelope

In green building design, an efficient building envelope includes components such as walls, roofs, floors, and windows, and their performance directly affects the heat loss and gain of the building. In order to improve the efficiency of the envelope, designers need to use high thermal insulation materials, such as new materials with good thermal insulation or composite materials, to reduce the heat transfer coefficient. In addition, reasonable design of the thickness and level of the building envelope can effectively resist the adverse effects of the external climate, thus reducing the operating load of heating and cooling equipment. By using green vegetation in the walls and roofs, the ecological benefits can be further enhanced and natural temperature regulation can be realized. At the same time, high-efficiency windows, such as low-radiation coated windows or double-layer insulating glass, can significantly reduce heat loss and ultraviolet ray intrusion, ensuring indoor comfort and reducing energy consumption at the same time.

3.2 Optimize Building Layout and Orientation

Green building design requires careful planning of building layout and orientation to achieve the purpose of energy saving. Building orientation has a significant impact on lighting, ventilation, solar energy acquisition, etc. Therefore, the local climate characteristics should be fully considered to optimize the orientation of the building. For example, in cold regions, the main living space of a

building should be oriented towards the south to maximize the absorption of solar radiant heat and reduce the heating demand in winter, while in tropical regions, the cooling load should be reduced by reducing the area of direct sunlight through rational layout. In addition, the relative position between buildings should also take into account the ventilation path and natural lighting. Appropriate building spacing and height ratios can effectively utilize the natural wind and reduce the heat load and lighting demand inside the building.

3.3 Utilization of Renewable Energy

Incorporating the use of clean energy such as solar, wind and geothermal energy in the design can significantly reduce the building's dependence on traditional fossil energy. Solar energy, as the most common renewable energy source, can be converted into electricity through solar photovoltaic panels or provide hot water through solar water heaters. Under favorable conditions, buildings can also be designed as zero-energy buildings or positive-energy buildings, which means that the total sum of energy consumption throughout the year is zero or excess energy can be generated. Wind energy can be utilized in suitable areas through wind turbines outside the building, while the use of geothermal energy needs to be combined with the more stable underground temperature to provide cooling and heating for the building through a geothermal heat pump system. With the progress of technology, the integration and application of these renewable energy technologies are becoming more and more convenient and economical, becoming a powerful means to promote the sustainable development of the construction industry.

3.4 Improve the Energy Utilization Efficiency of Buildings

Improving the energy use efficiency of buildings not only includes the use of energy-efficient building materials and systems, but also involves the optimization of overall energy management strategies. For example, intelligent building management systems can monitor and regulate indoor and outdoor temperature, humidity, light and other environmental parameters, and automatically adjust the operation of air conditioning, lighting, ventilation and other systems based on real-time data, thereby reducing unnecessary energy waste. In addition, efficient heating, cooling and lighting systems, such as air-conditioning systems using inverter technology and LED lighting, can greatly improve energy utilization. The distribution of heat loads within the building should also be considered, and the functional areas of the space should be rationally arranged to reduce internal energy transmission losses.

4. Application and Practice of Intelligent Technology in Energy-saving Design

Intelligent technology, as the forefront of today's science and technology, provides unlimited possibilities for energy-saving design. In intelligent buildings, intelligent technology runs through all aspects of the design, from the selection of building materials to the use of energy, to the control of energy consumption in the process of building operation, all of which cannot be separated from the support of intelligent technology.

4.1 Intelligent Technology Provides Accurate Data Support for Energy-saving Design

Through the Internet of Things (IoT) technology, various data inside and outside the building can be collected in real time, such as temperature, humidity, light, wind speed, etc., providing designers with a detailed and accurate data base. Designers can accurately calculate and analyze the energy consumption of the building based on these data, so as to develop a more reasonable energy-saving design scheme.

4.2 Intelligent Technology Provides Efficient Energy Management Means for Energy-saving Design

Through big data and artificial intelligence technology, real-time monitoring and intelligent regulation of energy use in buildings can be carried out. For example, the intelligent air conditioning system can automatically adjust the supply of cold and warm air according to changes in indoor and outdoor temperatures, ensuring a comfortable indoor environment and avoiding unnecessary energy waste. At the same time, through the intelligent energy management system, it can carry out unified scheduling of all kinds of energy use in the building to realize the optimal allocation and efficient use of energy.

4.3 Intelligent Technology also Provides Innovative Building Materials and Construction Methods for Energy-saving Design

For example, intelligent windows can automatically adjust the light transmittance and heat insulation performance according to the external light and temperature changes, thus reducing the building's cooling and heating energy consumption; intelligent wall materials can automatically adjust their heat transfer performance according to the environmental conditions, improving the building's heat preservation and insulation performance. The application of these innovative design concepts and materials cannot be separated from the support of intelligent technology.

4.4 In Practice, the Application of Intelligent Technology in Energy-saving Design has Achieved Remarkable Results

Many advanced intelligent buildings have been built or are under construction around the world, and they are characterized by high efficiency, energy saving and environmental protection, making positive contributions to the sustainable development of cities. Meanwhile, the application of intelligent technology in energy-saving design will be more extensive and in-depth with the continuous progress of technology and the expansion of application scope.

In summary, the application and practice of intelligent technology in energy-saving design is of great significance. It not only improves the energy efficiency and comfort of buildings, but also provides strong support for the sustainable development of cities. In the future, with the continuous development and improvement of intelligent technology, it is believed that its application in energy-saving design will be more extensive and in-depth, and make greater contributions to the creation of a better human environment and social development.

5. Analysis of Countermeasures for Sustainable Development

5.1 Promote the Development of Energy-saving Technology

In the specific work of promoting the development of energy-saving technology, it is necessary to strictly implement the various new building energy-saving standards in China, use energy-saving materials and products in the construction process, improve the application efficiency of various energy systems, and reduce consumption. For example, in the structural design of housing construction projects, you can use new environmentally friendly skills technology in lighting, heating and air-conditioning systems, and more use of natural light sources, and use new materials and processes in the construction of the external wall to improve the thermal insulation of the external wall body. Commonly used exterior wall insulation materials mainly include silicate bricks, porous bricks, glass wool products, and building panels. In order to realize the sustainable development of modern building intelligent technology, it is also necessary to increase the use of renewable energy and strengthen the management of the operation of each system to further improve the quality of the indoor thermal environment of the building, enhance the energy-saving, environmental protection and greenness of intelligent technology, and promote its sustainable development.

5.2 Control the Technical Points of Green Building

The development of modern building intelligent technology requires a comprehensive grasp of the relevant technical points of green building, which will be integrated into the modern building intelligent technology to add impetus to the realization of the purpose of sustainable development. In modern intelligent buildings, in order to further extend the use of the building time, it is necessary to minimize the pollution of the surrounding environment during the construction and use of the building, so as to create a harmonious living place for people. Secondly, in the use of intelligent technology, should be integrated into the relevant recycling concept, as far as possible to save energy, land, water resources, raw materials and other inputs. For example, when designing the doors and windows of buildings, in order to enhance the airtightness and heat preservation of the doors and windows and reduce their heat transfer coefficient, we can use some elastic sealing strips and sealing pastes, and use metal windows or rigid-plastic composite windows, or coated glass and empty glass. Then, it is also necessary to further increase the innovation of related technologies, improve the scientific and technological content of various technical resources, and in this process, effectively consider the market demand, in order to make the sustainable development of modern building intelligence technology compatible with the local economic development situation. In addition, also based on regional reality, enhance the characteristics of intelligent technology, and this green technology used in sustainable development.

5.3 Work Together to Promote Green Construction in the Whole Process

Systematically promote green construction, mainly from the following aspects: (1) policy guidance, the government based on the effective means of macro-control and policy, the system launched green construction management methods, implementation rules, incentives and code of conduct, incentives

and standards for all parties to participate in green construction activities. (2) market tilt, gradually eliminating the schedule-oriented low bidding, cultivate green construction as the advantage of the core competitiveness of the construction industry. (3) Owner-led, project construction investors in the project implementation of the leading position, green construction needs to obtain the owner's full support and financial investment in order to effectively implement. (4) The whole process to promote, construction companies to promote green construction must establish a complete organizational system to achieve clear goals, responsibilities, sound management system, technical measures in place, the establishment of traceability of the witness information, so that green construction to achieve practical results.

6. The Development of Building Intelligence and the Direction of Sustainable Development

6.1 Healthy and Sustainable Development

Scientific and sustainable development is the main trend of today's society, and the construction of building intelligence is also a requirement for healthy living. Building intelligence has inherent hardware superiority for saving energy and environmental resources, which can protect the production safety and reduce the consumption of resources by the building. It is also able to provide a living environment that is more suitable for people to live and survive. Building intelligence reduces the resource consumption of buildings by using intelligent technology, and the use of non-polluting clean resources can reduce the use of fossil materials in buildings. Therefore, building intelligence also increases the use of natural, renewable resources. Sunlight is a very well-sourced renewable energy source, so green building intelligence also improves the use of sunlight resources by using solar photovoltaic buildings, solar photovoltaic glass, and various other means of utilizing resources to convert sunlight into electricity and subsequent energy for green building intelligence. Green building intelligence also combines the ventilation equipment of traditional buildings with wind power generation and wind heating technology, and applies nature's renewable resources to green building intelligence, maximizing the use of natural renewable resources, thus effectively reducing the consumption of fossil and chemical material resources, and in this way, also contributing to the better protection of nature.

6.2 The Government Continuously Improves the Relevant Standards of Building Intelligence

Government departments should strengthen the supervision of several aspects such as project construction and evaluation of building intelligence, and should not approve or even disagree with the construction of certain projects that do not meet the construction requirements, so as to fundamentally avoid the emergence of these non-compliant projects, and to increase the evaluation and supervision of the completed building intelligence, so that it can meet the corresponding standards and requirements. To further improve the management specification of building intelligence materials, in order to realize the effective saving of natural resources, and advocate the use of local materials, reasonably regulate the scope of material delivery, and reduce the resource expenditure in material delivery activities.

Further strengthen the government's policy support for building intelligence and vigorously promote the use of building intelligence.

6.3 Reduce Energy Consumption and Protect the Natural Environment

At present, due to the irrationality of some urban planning and building management in China, the consumption of natural resources and building materials is very huge, and the unit energy consumption of some buildings is 2-3 times higher than that of the national and local governments, and there are also some urban heating facilities that produce very large atmospheric pollution. According to relevant statistics, about half of the world's energy is used in the construction industry, so it can be seen that the resources and energy consumed by the construction industry is very huge, and the emergence of intelligent buildings can greatly reduce the harm of the building on the natural environment, during which the use of non-toxic, harmless building materials can greatly reduce the environmental pollution of nature and waste. At the same time, building intelligence can also make use of clean renewable energy technology to control the temperature inside the building, which can also reduce the pollution of greenhouse gases, thus promoting the sustainable development of human society. At the same time, building intelligence can also use intelligent systems to monitor the use of different resources within the situation, to give residents the appropriate reference advice, thereby reducing the loss of internal energy.

6.4 Multiple Information Integration Modes

In intelligent buildings, the local area network is the basis for the mutual integration of various information within the system. In the network, not only data information can be transmitted, but also data such as sound, image and control can be transmitted. For example, different intelligent devices are connected through LAN to realize the integration of information and sound data; LAN is integrated with digital camera devices to realize the integration of digital and image data; and LAN is integrated with controller devices to realize the integration of information and control data. During the design of building intelligent area network, the integration of various data is required is also an important goal. Take Shanghai Pudong International Airport as an example. The airport has adjusted the central air-conditioning system, lighting facilities and publicity light box facilities in the terminal building according to the operation data of the aircraft by connecting the flight information and terminal operation data to the BA network, so that these facilities are all located in the same terminal building. The best whole process dynamic control before the first flight and before the last flight was implemented. At the same time, the central air-conditioning equipment in the terminal building is also controlled in advance, which improves the comfort and hygiene of the terminal building environment and at the same time achieves the efficacy of power saving and energy saving. According to statistics, the annual power saving benefit is up to 100 billion yuan.

7. Conclusion

With the progress of science and technology, building intelligence will meet the actual needs of residents as the main direction of development, so that residential construction can be more environmentally friendly and more intelligent, thus greatly facilitating people's daily life, at present, the sustainable development of building intelligence has become an inevitable trend for the development of China's construction industry in the future. Through the calculation of intelligent systems, building intelligence can enhance the satisfaction of residents during the period of residence, and provide humanized customized services for residents, thus enhancing the comfort of residents, and at the same time, further reducing the pollution of building intelligence on the surrounding environment. Energy-saving technology in the construction industry is an important aspect of realizing the sustainable development of China's economy and the transformation of the national economic growth mode, and it is a major initiative to implement the scientific outlook on development, conserve energy, protect the environment, pay attention to people's livelihoods, and ensure the sustainable economic and social development, and it is a long-term strategic guideline for the country to vigorously develop its economy. With the continuous improvement of relevant legislation, law enforcement and policy management, we will be able to push the design of energy-saving buildings and energy-saving technologies to a new stage of development, so as to realize the long-term goal of sustainable use of energy in China. The implementation of building energy efficiency but sustainable development as an established policy cannot be accomplished overnight, it is important to establish the concept of comprehensive, coordinated and sustainable development and make active efforts in this direction, to put energy efficiency into practice, to improve the relevant legislation, law enforcement, policies and management systems, and to ensure, through the full cooperation of architects, engineers, designers, municipal planners and product manufacturers, that the realization of the ambitious goal of sustainable energy development in China.

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