

## Discussion on BIM technology in energy saving design of green buildings

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**Abstract:** At present, green building energy-saving design has been gradually integrated into the modern architectural design concept. Many urban buildings have high requirements for energy-saving design. Facing this situation, we must pay attention to green energy-saving design in buildings. Green building is a construction project that relies on the energy-saving design concept of green building to carry out development and construction, environmental protection in the whole process and energy conservation and consumption reduction control. Specifically, it refers to taking scientific and reasonable methods to save land resources, building materials, water resources, energy and other resources related to project construction within the whole life cycle of construction project, Make efficient use of renewable, clean and pollution-free natural resources, protect the natural ecological environment and reduce the occurrence of environmental pollution problems. Users can also obtain a satisfactory use experience when using such buildings, and finally the buildings can coexist organically with the natural ecological environment. Applying BIM Technology to green building energy-saving design can help people understand the design structure more intuitively and stereoscopically, and realize the detail control of green building energy-saving design from all aspects, which not only provides more technical convenience for the design, but also realizes a more ideal energy-saving design effect. On this basis, the application of BIM Technology in green building energy efficiency planning is studied for reference.

### 1. Introduction

#### 1.1 BIM Technology concept

BIM Technology is a multi-dimensional model information integration technology developed based on CAD and other information technologies under the rapid development of Internet and computer information technology. It can present the geometry, internal components, material price and construction progress of buildings in the form of digital information three-dimensional model, which is very intuitive, clear and true [1]. At present, BIM Technology has been widely used in the design, construction and other fields of China's construction industry, truly realizing energy conservation and consumption reduction, and promoting the benign development of the construction industry<sup>[1-2]</sup>.

#### 1.2 Main features of BIM Technology

The first is visualization. BIM Technology can collect and sort out all the data information of construction projects, then generate three-dimensional models, and mark the relevant data information in detail and accurately, so as to facilitate the staff to carry out follow-up work.

The second is diversity. The database of BIM Technology can not only process a variety of data information, but also store and export various data information, and output and store data information in a diversified way.

Finally, coordination. The construction of construction projects requires coordination among designers, technicians, constructors and managers. BIM Technology can effectively allocate personnel from all parties, strengthen coordination and communication between them, and enable all parties to jointly complete design, construction and management.



Figure 1 Simulation of 3D digital model of building using BIM Technology

### 1.3 Application value

When BIM Technology is applied to the energy-saving design of green buildings, its application value is reflected in the following two aspects: first, whether the early architectural design and construction or the later construction is put into use, it will consume a lot of resources and energy and produce pollution. For example, the use of various building materials will cause environmental pollution; The use of construction equipment will cause noise pollution and air pollution; The application of various daylighting, lighting and heating equipment will consume power resources and pollute the ecological environment. Therefore, it is necessary to carry out architectural design from the perspective of green energy conservation to reduce the consumption of resources and energy. However, under the traditional design method, it is not only inefficient, but also unable to save energy and reduce consumption. The application of BIM Technology in design can improve the efficiency of design work, ensure the rationality and economy of design scheme, prevent engineering change and reduce the cost of design and construction. Second, with the continuous improvement of the quality of life, people's requirements for housing construction are also improving. To meet people's diversified needs, we need to be scientific, reasonable, accurate and reliable in the preliminary design link, and do a good job in management. Through the application of BIM Technology, it can accurately and comprehensively collect various data information, ensure the order and rationality of design work, realize integrated management, improve construction quality and efficiency, reduce cost and resource consumption, and is conducive to achieving a win-win situation.

## 2. Specific strategies for applying BIM Technology to energy-saving design of green buildings

The application process of BIM Technology in the energy-saving design of green buildings is as follows: the first step is to do a good job of investigation and analysis according to the actual situation of the project, including terrain, climate, hydrology and other factors, and then input all data information into BIM software to simulate the best orientation of buildings. The second step, according to the land use plan, strictly follow the corresponding specifications and standards, set the building spacing to meet the daily lighting needs, and make reasonable planning for greening plants to improve the utilization efficiency of land resources. The third step is to simulate indoor thermal insulation, sound insulation, moisture-proof, lighting and other links according to building materials, components and structures, timely find out problems, carry out corresponding optimization and adjustment, and strictly follow corresponding specifications and standards. In the fourth step, the calculation and analysis are carried out again, and finally compared with the standard value to complete the design work.

Table 1 Application process of BIM Technology in energy efficiency design of green buildings

step	content
First step	Research and analysis
Step 2	Set building spacing
Step 3	Simulation of indoor links
Step 4	Calculation, analysis and comparison

## **2.1 Apply BIM Technology to simulate building sunshine**

In the energy-saving design of green buildings, in order to effectively control the energy consumption of buildings within a reasonable range and reduce the amount of greenhouse gases emitted by buildings, it is necessary to ensure that buildings have a certain role of heat insulation and thermal insulation. Therefore, when planning the energy-saving design of green buildings, we must carefully analyze the solar radiation of buildings, which can be completed with the help of BIM Technology. During the simulation analysis, BIM Technology is applied to build the three digit digital model of the target building, combined with the actual local solar illumination, input various information and data, and rely on the powerful computing power of the computer to make a detailed analysis of the solar radiation received by the building surface in different time periods, and then make further correction and improvement, Draw the final conclusion and take the conclusion as an important basis for selecting building construction materials, designing building shape and planning building orientation, so as to implement the energy-saving design concept of green building into the building construction process, effectively reduce the energy consumption of the building itself, and control the solar radiation received by the building within a reasonable range, It can not only ensure that the buildings get enough sunlight, but also effectively avoid too strong solar radiation.

## **2.2 Apply BIM Technology to simulate the outdoor environment of buildings**

The energy-saving design of green buildings must strictly follow the principle of adjusting measures to local conditions, That is, combined with the local situation (mainly referring to geographical environment conditions) to realize the harmonious development between man and nature. In order to effectively implement this requirement, BIM Technology can be applied to simulate the outdoor environment of the building, effectively restore the surrounding environment of the building, and then scientifically analyze the changes of wind direction and ventilation conditions around the building, so as to effectively optimize based on the analysis results Green building energy saving design scheme. For example, since the analysis of wind pressure difference involves hydrodynamics, it is difficult to complete it by manpower. With the help of BIM Technology, it can easily obtain the information of natural ventilation around the building and comprehensively grasp the ventilation conditions of the building, so as to lay a good foundation for controlling the spacing of buildings and designing the doors and windows of buildings. Through the effective application of natural wind, architects can skillfully achieve the effect of "warm in winter and cool in summer", so as to reduce the use of electric fans, air conditioners and other electrical equipment, and effectively achieve the purpose of energy conservation and environmental protection.

## **2.3 Apply BIM Technology to simulate indoor lighting**

The application of BIM Technology can also scientifically analyze the indoor lighting of buildings. By inputting the relevant values of buildings and constructing the corresponding three-dimensional digital model, the computer can analyze the lighting of buildings with different shapes in the same environment from different angles, so as to help the architectural designer optimize the design scheme and select the most appropriate materials for the buildings, Make the building have the best daylighting conditions, effectively improve the natural daylighting effect inside the building, and achieve the purpose of saving electric energy. For example, BIM Technology can be applied to simulate the daylighting performance of different glass materials to obtain the glass materials that best meet the actual daylighting needs of buildings, save the time of selecting materials, and reduce the construction cost while improving the construction quality.

## **2.4 Scientific inspection of building energy conservation design scheme**

There are many elements and aspects in the energy-saving design of green buildings. If we only compare the paper data with the data, we can not accurately and quickly find the problems in the design scheme. If these problems are not well solved in the design link, and it is found that the

design scheme deviates from the actual situation in the specific construction link, it will not only increase the difficulty of the construction project, At the same time, there will be serious rework problems, which will increase the construction cost of the construction project, which will not only affect the construction progress, but also cause serious losses to the development of construction enterprises. The rational application of BIM Technology in construction engineering can effectively improve this problem. Based on BIM Technology, designers can input corresponding data to build a three-dimensional model, effectively simulate the actual situation, use software to evaluate the design scheme, timely find conflicts and errors in the design scheme, and accurately display the corresponding report.

## **2.5 Application in green building construction activities**

At present, the importance of BIM Technology in green building construction is increasing. It can view the building model in time, reduce the difficulty of reading drawings in the construction process, help the staff fully understand the building scheme, estimate the possible problems in project construction in advance, and then apply effective measures to deal with them. Use BIM Technology to systematically test the building model, confirm the spatial overlap and energy consumption of the building, and fully reflect it in three-dimensional form. At present, the number of equipment in green building construction is increasing, which makes the electromechanical pipeline construction of green building engineering face great challenges. At this time, BIM model can be used to analyze the electromechanical pipeline to help staff formulate scientific and reasonable construction scheme. In addition, the use of BIM Technology can establish an intuitive 4D model to dynamically simulate the project construction, and then effectively control the project construction, so that the green building construction can be completed on time and quality

## **3. Application mode and Prospect**

### **3.1 Application mode**

With regard to the application of BIM Technology, it can improve the use of architectural models, so as to help architects optimize architectural design. Using BIM model, the design scheme can be transformed into three-dimensional model, which is convenient for observation and analysis, improves the overall communication efficiency of professionals, significantly reduces possible errors and omissions in planning, and effectively controls the construction cost of the project. For example, pipeline collision, problems between buildings and structures, structures and pipelines, electromechanical equipment, etc. BIM Technology helps to more effectively solve the pipeline problem, realize the accurately positioned wiring path, and solve the problems between buildings, buildings and structures, structures and pipelines, and electromechanical equipment. In the whole design process, you can also preview the design at any time, correct the design in time, and ensure the optimization of the design.

### **3.2 Prospects**

Nowadays, the rapid development and progress of China's social economy and science and technology have promoted the development of design concept in the green direction. At the same time, it has gradually begun to popularize the awareness of green energy-saving design on a large scale. Under this situation, BIM Technology has been born, which can effectively make up for the disadvantages and deficiencies in architectural design, and has a broad development prospect. In the process of efficient building design, we should deeply analyze the constructive and collaborative development trend of the design team, contracting methods and other participants. In addition, we should also analyze the impact of the project itself on the local formation. In short, if BIM Technology is effectively applied in the energy-saving design of green buildings, we can perfectly achieve the established objectives and improve the quality of the surrounding environment, Achieve the purpose of effective cost saving. With the help of BIM Technology, strengthen the depth and breadth of research in the design process. Through the analysis of solar radiation in hot summer, the

solar utilization effects of different design schemes can be mastered. With the help of BIM Technology, the effect of spatial planning can be enhanced. On this basis, the benefit of green energy is analyzed and evaluated. It is worth noting that BIM Technology can help architectural designers effectively control the progress of material use, fundamentally ensure the saving of production cost, and then realize the double improvement of production and economic benefits.

#### 4. Conclusion

At present, although China's green building design has been applied and popularized in a large range, the control effect on cost control, resource conservation and environmental protection is still not ideal. The application of BIM Technology in green building design can provide effective reference and guidance for green building design through the simulation of information management and design, construction and management. By building BIM building information model, we can effectively reflect all kinds of information in the building, clarify the relationship of topological connectors through a comprehensive information model data system, and provide designers with equipment, materials, components, space and other data, so as to provide a reliable reference for the development of its calculation and evaluation. It can be seen that in-depth analysis of the basic theory of BIM Technology and detailed analysis of the specific application evaluation of BIM Technology in each stage are of great practical significance to improve the construction quality of green building engineering<sup>[3-4]</sup>.

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