Research on Application of Environmental Design Concept in Industrial Building Design

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Abstract. With the development of the times and the demands of the broad masses, architectural designers pay more and more attention to the design of small cities. Combined with project design examples, focusing on the theme of green and energy saving in small urban residences, through design concepts, general floor layout, environmental landscape design, new building technology design, sanitary and environmental protection design, and some detailed design, in order to achieve green, healthy, energy-saving, Ecological high-quality living environment.

1. Introduction
Energy-saving and environmentally-friendly design of buildings is a building that uses its best efforts to save resources, protect the environment, and provide people with a healthy environment when in use. With the rapid development of China's urbanization, energy and environmental issues have received more and more attention. In this context of sustainable development, in the process of urban building design, designers need to establish and analyse more building models and fully analyse their performance, while ensuring the quality of the building, it can also improve the energy efficiency of the building.

Traditional integrated environmental protection and energy-saving design methods in urban buildings mainly include: integrated environmental protection and energy-saving optimization design methods in urban buildings based on gay system theory, integrated environmental protection and energy-saving optimization design methods in urban buildings based on improved value engineering methods, and multi-index interval approximation Comprehensive environmental protection and energy-saving optimization design methods, dynamic environmental light-sensitive adjustment-based comprehensive environmental protection and energy-saving optimization design methods, and overall energy demand-based comprehensive environmental protection and energy-saving optimization design methods. However, these traditional methods have varying degrees of poor energy-saving design effects and low efficiency. Severely restricted the development of building energy-saving design. With the continuous progress and development of society, the protection of the ecological environment has gradually become more important, and the concept of environmental protection and energy conservation has gradually risen. Applying this concept to building design can provide people with an environmentally friendly and energy-saving living environment, and this aspect will also gradually become the main trend of future social development.
2. **Principle of integrated environmental protection and energy saving system in urban buildings**

In the process of establishing the principle model of the integrated environmental protection and energy-saving system in urban buildings, the energy-saving principle model $f(x)$, was modelled according to the design plan of the energy-saving and environmentally-friendly building, and expressed by formula (1).

$$f(x) = \frac{\sum_{i=1}^{N_1} \sum_{j=1}^{N_2} y_{ij} \left( \mu(x_i) \mu(x_j) \right)}{\sum_{i=1}^{N_1} \sum_{j=1}^{N_2} \left( \mu(x_i) \mu(x_j) \right)}$$

In the formula, $N$ represents the total parameter amount of the integrated environmental protection and energy saving system, and $\mu$ represents the membership function. The above-mentioned $f(x)$ is introduced into some professional building performance analysis tools for analysis, and a principle block diagram of an integrated environmental protection and energy saving system in urban buildings is established, this is shown in Fig 1 [1].

![Figure 1. Block diagram of integrated environmental protection and energy saving system in urban buildings.](image)

When using the above model for comprehensive environmental protection and energy saving design in urban buildings, the traditional method uses statistical methods to obtain the quantitative relationship between the influence factor of building energy consumption and energy consumption for energy saving design, but ignores the most important parameters in the design. Ventilation situation, sunlight, cannot be effectively analysed, affecting the effect of building environmental protection and energy saving design.

In the process of architectural design, one of the key considerations is the protection of the environment. This is mainly due to the interaction and connection between the ecological environment and the architectural design. This requires relevant design work to be comprehensive when selecting the building address. Considering the natural environment of buildings, roads, greening, etc. Due to the rapid development of society and economy, people carry out various social activities every day. Therefore, there is another important factor in choosing an address: transportation, which requires the construction of transportation roads. Passing through natural areas, this has caused a certain degree of damage to the natural environment. Based on the above, related design work should pay more attention to road damage to the environment when choosing an address. For the internal environment of a building, it can Users make their own choices and constructions, and finally achieve the desired...
use requirements and effects. However, the pursuit of such effects depends on the consumption and use of various home appliances. Although it improves the user's quality of life to a certain extent, as a result, energy consumption is wasted, which further aggravates energy consumption. Regardless of whether the crisis is to build a new building or to transform a building, it will cause a waste of resources to a certain extent, resulting in pollution of the ecological environment and low utilization of various resources. Therefore, when the project is in actual construction, it should be pay attention to the effective coordination between the building design and energy conservation and environmental protection, so that it can maximize the protection of the environment from the perspective of the environment, thereby improving the utilization of resources needed in the construction of the building, and also help the long-term development of society.

3. Thermal analysis calculation of energy-saving filled floor and ordinary building floor

3.1. Thermal analysis calculation model

Studying the energy-saving effect of environmentally-friendly and energy-saving filled floor slabs is the most realistic and effective way to adopt experimental verification, but the experimental cost is high, and accurate and complete experimental schemes are needed before the experiment to make the experimental test smoother and the results more reliable. For this reason, thermal analysis and numerical simulation calculations are performed on the environmentally-friendly and energy-saving infill floor slabs, and the results are compared and analysed with conventional common building slabs with the same geometric parameters.

The schematic diagram of the partial three-dimensional layout of the energy-saving filling floor is shown in Figure 2. Because the geometry of the filling block is a torus and the surfaces are a curved surface, it must conform to the topological relationship between the elements when meshing in the finite element. The meshing of the finite element model based on the actual model shown in Figure 2 can only be tetrahedral mesh. Ordinary building slabs can be divided into hexahedral meshes due to their regular geometric shapes [2]. When using finite element calculations, the accuracy of tetrahedral meshes and hexahedral meshes is different. In order to compare the two types of floor slabs more effectively, energy-saving filled floor slabs are now converted (the conversion principle is to keep the cross-sectional area and the moment of inertia consistent) For the finite element modelling of the model shown in Figure 4, it can be easily divided into a hexahedral mesh, and a part of the finite element model is intercepted as shown in Figure 3. To distinguish it from ordinary building floors, the finite element of the environmental protection and energy saving filling block is not shown in the figure.

![Figure 2](image-url)

**Figure 2.** Schematic diagram of partial three-dimensional layout of energy-saving filling floor.
Design and implementation of energy-saving and environmental protection simulation experiments

Analyse the lighting performance of an international conference centre through BIM, and select Uniform sky conditions to simulate weather conditions. The daylighting performance is mainly affected by the latitude of the building, so the software calculates the sky illumination at different latitudes according to the daylighting coefficient, obtains the daylighting situation of the buildings and houses throughout the year, and uses probability statistics to obtain the result. Graph of overall daylighting coefficient and daylighting percentage of the conference centre [3].

Analysis of Figure 4 shows that the visor design of the International Conference Centre is unreasonable, resulting in poor lighting effects from 9 am to 11 am. Therefore, the building orientation can be improved by continuously adjusting the BIM model. Re-export and use ECOTECT2010 software for analysis to improve the lighting effect of the International Convention Centre and complete the energy-saving and environmental-friendly building lighting design.
4.2. Simulation of Building Energy Consumption

This article takes the International Conference Centre as the research object. The International Exhibition Centre is a large-scale exhibition venue constructed in accordance with the functions of contemporary international exhibitions. The organic combination of the hall makes the whole building magnificent and integrated. The International Convention Centre uses chiller units and cooling towers as air conditioning cold sources and gas vacuum boilers as heat sources for air conditioning and domestic hot water. During the analysis of energy consumption, design parameters and equipment performance parameters are obtained through national standards. The energy consumption for the entire year is obtained by meeting the initial conditions for energy conservation. The results of the annual energy consumption analysis of each project are used as the basis for evaluating the credibility of the model in this paper, as shown in table 1.

| Window ratio | Shading factor | Energy consumption per area / J | Total energy consumption / J |
|--------------|----------------|---------------------------------|-------------------------------|
|             | 0.69           | 0.201                           | 0.69                          | 0.169                         |
| 20%          |                |                                 |                               |
|              |                | 246                            | 405.4                         | 564.5                         | 402.5                         |
| 30%          |                |                                 |                               |
|              |                | 244.8                          | 175.4                         | 224.8                         | 1752                          |
| 40%          |                |                                 |                               |
|              | 348            | 216.5                          | 336.2                         | 214.6                         |

5. Recommendations for the application of energy saving and environmental protection in industrial buildings

5.1. Design of thermal insulation and thermal insulation performance of building envelope

In the actual construction of the building, the consumption of the external wall is a relatively large part of it. Therefore, reasonable thermal insulation of the building envelope in the building can effectively improve the indoor heat environment, and thus achieve environmental protection and energy saving effects. There are some differences in the use of construction projects, and other factors such as the climate of the region will also affect the effectiveness of the construction to a certain extent. Therefore, it is necessary for the designer to formulate the corresponding envelope structure plan in accordance with the actual conditions of the area so that it can be used. Maximize the effectiveness of thermal insulation [4]. For example, by strengthening the heat storage performance of the building wall, this can extend the process of the insulation of the envelope structure to the room to a certain extent, so as to avoid the maximum temperature of the building surface and the time of use of the building; The
effectiveness of the use of the ventilation layer can also be applied to the design of the wall of the building. The main principle for doing this is to use the principle of wind pressure and heat pressure to take away the heat in the building, thereby reducing the introduction of indoor heat; You can also use the current new materials to reflect the sun's rays, or use materials to reduce the absorption of light and heat energy.

5.2. Improve the design of the envelope structure to achieve energy conservation and environmental protection

As an important part of the design system, the building envelope is also an important embodiment of energy-saving design. In the design of the actual building envelope structure, it is necessary to improve the design from the aspects of floor, internal and external walls, doors, windows and so on. For example, in actual design, the external wall design can use special thermal insulation materials to ensure the building's specific thermal insulation performance while achieving energy saving. Many practices have proved that the use of thermal insulation materials not only ensures the flatness of the external wall, makes the building more beautiful, but also effectively saves the actual use of external wall materials. In addition, in the environmental protection and energy saving design of building doors and windows, doors and windows are the main thermal insulation materials. In the actual energy saving design, the ratio of doors and windows to the wall is optimized. Reduce the number of replacements and strengthen the thermal insulation performance, to achieve building energy saving. In building design, in order to verify whether the design of the envelope is in line with the concept of energy conservation and environmental protection, it can be simulated and analysed with the help of information technology software, and the final data analysis can be used to obtain the results and provide data support for subsequent continuous improvement [5].

5.3. Optimize the use of water resources to achieve energy conservation and environmental protection

At present, the entire process of building construction consumes a large amount of water resources. When implementing the concept of energy conservation, it is also necessary to pay attention to energy conservation and water conservation. In the actual building design, the engineering designer should be able to accurately estimate the water consumption of the construction project, to achieve the minimum compression control, and to obtain a reasonable allocation of water resources through quantitative analysis based on the overall use data. In the statistical use of water resources, engineering designers need to consider the use of water resources by mechanical equipment and some material mixing. In addition, the design should try to choose water-saving building materials, cooperate with the latest construction technology, and strengthen construction management to achieve the goal of saving water resources throughout the process. Based on project water-saving, water-saving pipes can be introduced and used. Through scientific planning and design of pipes and the use of water treatment equipment, water resources can be recycled and the building's life can be saved.

5.4. Reasonably design the external structure of the building and the curtain wall system

In the architectural design, the application of windows and glass curtain walls also requires a certain amount of energy, but with the current vigorous development of science and technology [6], the performance of windows and glass curtain walls has also improved to a certain extent. One of the glass curtains walls, not only is there a certain improvement in use performance, but also a certain improvement in building insulation and radiation protection. Second, after the new structure and new materials are applied in the building, the windows and glass curtain walls of the entire building are thermally and densely packed. According to the principles of green building design, the curtain wall is an important system in the entire building periphery. In order to effectively ensure the quality of the indoor environment, it is necessary to make the curtain wall structure act as a filter between the building and the environment. Devices, etc., in order to achieve the concept of environmental protection and energy saving in building design.
5.5. Scientific use of renewable energy resources
At present, the renewable energy resources we are familiar with are mainly solar energy, wind energy, and thermal energy. For the use of solar energy in buildings, it is mainly used for photovoltaic power generation and heat collection in people's lives, and this technology equipment and related materials are more in line with people's consumption ability, and in the future, the development of various renewable energy sources will gradually develop towards the consumption direction that people can afford, so as to further meet the requirements of building design under the concept of environmental protection and energy saving [7].

6. Conclusion
The implementation of building environmental protection design under the concept of energy saving needs to be implemented from the aspects of building layout, water saving and energy saving, and reducing environmental damage based on the principles of integration, practicality, and energy conservation and environmental protection of building structures. There are problems with environmental protection design of energy saving concept. From weighing the contradiction between energy saving concept and energy saving design and strengthening the improvement of new technology research and development, it really promotes the implementation of energy saving concept in building environmental protection design.

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