Application analysis of green ecological building theory based on residential architectural design

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Abstract. At this stage, with the proposal of green, ecological and environmental protection concepts, higher requirements have been put forward for the current residential architectural design. Applying the concept of green ecological architecture to residential architectural design can not only reduce the consumption of resources and pollution to the environment, but also achieve the construction of green houses and green cities. At the same time, it is also the key that promotes the sustainable development of the construction industry. In this article, it first analyzes the significance of green ecological residential architectural design; it then focuses on the specific application of green ecological architectural concepts in residential building design.

1. Introduction
In the past, there was a time when the traditional residential building design model could not only easily cause resource waste, but also result in certain pollution to the environment. In the new era, the application of green ecological building concepts in residential architectural design has become an inevitable trend of development, therefore, it should be given sufficient attention.

2. Significance
Nowadays, the country is paying more and more attention to environmental protection work, and has issued a series of environmental protection policies, which put forward higher requirements for residential architectural design. Green ecological residential building design is not only an inevitable trend of development, but also a significant task to promote the sustainable development of the architectural industry. At this stage, government departments strongly support the design of green ecological residential buildings. Through green ecological design, it can not only get help from government departments, but also improve the core competitiveness of enterprises in the market and bring good economic benefits to construction enterprises. Not only that, the strengthening of green ecological residential building design is a key measure to promote the construction of green and ecological cities. In the design and construction, the application of green energy-saving materials, facilities and equipment can not only avoid waste of resources and reduce environmental pollution, but also achieve effective control of construction costs, providing important support for urban green development construction.
3. Discussion on specific application

3.1 Reasonable planning of architectural location
Before residential building design, it is necessary to carefully select the location of the building, go deep into the construction site to carry out a comprehensive survey, and scientifically select the location to meet the residents' living quality. In addition, it is necessary to fully consider the impression may brought by the residential construction, and estimate the energy consumption generated by the residential building design and construction, and then combine the influence of the surrounding climate and environment as well as other factors to rationally plan the construction site selection, laying a good foundation for the next construction [1].

In addition, it should reasonably plan the internal space and structure of the building in conjunction with various survey data, minimize the consumption of energy, and reasonably control the construction process to ensure the design and construction effect of residential architecture.

3.2 Space combination design emphasizing ecological environment and residential architectural design
In the process of green ecological residential building design, it should think highly of space combination work and reasonable division of functional spaces, so as to ensure good energy saving effect. At the same time, a high level of comfort should also be ensured. There are certain differences in the total requirements of different functional divisions. Take the main body of a residential building as an example: the function and landscape requirements of each area are different in the process of area division. While in the road design of residential buildings, it is necessary to consider the convenience of passing and the harmony of the environment to reduce the problem of noise pollution. In addition, it is necessary to think highly of the ecological design of residential building space and fully consider the ecological design of auxiliary space, especially when designing space such as stairs and elevators, to ensure that they have good ventilation.

3.3 Do a good job of "surface" ecological design of residential buildings
Residential building surface refers to the structure that can protect the living environment inside and outside the building, such as: building exterior walls, etc.. The perfection of the green ecological design of the exterior wall of the building can greatly improve the comfort of the living environment at the same time of improving the aesthetics of the building. In the past period of time, the "surface" design of residential buildings was mainly decorative. While under the concept of green ecology and environmental protection, in the process of surface design of residential buildings, it must pay attention to the organic integration with the natural ecological environment and strengthen the support and control effect of surface design. At the same time, it is also necessary to ensure the environmental protection of the materials used in surface design and construction, reduce the release of toxic substances, and avoid causing pollution. Besides, factors such as natural light, temperature, and ventilation should be fully considered in the green ecological design of residential building surface to make the living environment more comfortable [2]. (As shown in figure 1, 2)
3.4 Other green ecological design technologies

3.4.1 Space layout design.
In the process of the layout of residential building sites, environmental, climatic and geographical factors should be fully considered, and the North-South layout standard should be followed, and the sunlight and ventilation are simulated with the help of computer technology, so as to improve the daylighting effect and ventilation effect of residential buildings. At the same time, it should pay attention to the rational design of heating and ventilation systems as well as lighting systems, apply energy-saving technology, achieve effective control of system energy consumption, and create a comfortable indoor environment.

3.4.2 Architectural heat preservation design.
Heat preservation design is taken as an important work in residential building design. It should think highly of the application of new heat preservation materials, so as to achieve optimization of building performance at the same time of realizing the aim of energy saving. In residential building, the outdoor doors and windows are the key locations that may easily cause energy consumption. Both thermal energy and cold energy will cause considerable energy loss. Based on it, it is necessary to attach importance to the rational selection and application of door and window products, ensuring that they are excellent in thermal heat preservation effect. In the meantime, it is necessary to perfect the vertical greening design of the building's outer wall and the roof greening design. The so-called vertical greening refers to planting or hanging some plant materials on the surface of residential buildings to reduce the heat generated by sunlight and improve the level of comfort. As for the roof greening design, it is passable to plant some small-scaled flowers and turf, which can not only play a certain greening effect, but also improve the heat preservation performance of the roof and relieve the urban heat island effect (as shown in Figure 3, 4).
3.4.3 Natural vegetation design.
In the process of landscape design of residential buildings, the principle of adaptation to local conditions should be obeyed. Select the local climate, soil and native plants to ensure the coordination between the two for the convenience of forming a more stable and coordinated ecological community. Native plants not only have strong adaptability and tenacious vitality, but also have a low incidence of diseases and insect pests. Moreover, it should conduct management and maintenance regularly after finishing the design and construction of the residential building vegetation landscape, so that its value role can be brought into play for a longer period of time, and create a healthy and comfortable landscape environment for residents [4].

3.4.4 Design of water resources recycling utilization.
In recent years, water resources are becoming increasingly scarce in China. Therefore, it is particularly important to do a good job of saving water. The design and construction of residential building will lead to serious water pollution and waste of water resources. In consequence, it is a must to take it seriously, follow the the requirements of green, conservation and sustainable development, as well as strengthen the design of water resources recycling in residential building. In the design and construction of residential building, it is possible to effectively collect and use rainwater and reduce ground water consumption by means of setting up reservoirs. Furthermore, it can also organically combine water scenes design and rainwater, promote the operation of water scenes by the aid of rainwater, and reduce the application as well as consumption of electricity and water resources, so as to achieve the purpose of energy saving [5]. In addition, focused on some domestic wastewater, it must also do a good job of purification and recycling [6]. For example, the water that is used to wash vegetable can be used for toilet flushing, vegetation irrigating and so on after purification, which can save water resources to a great extent (as shown in Figure 5 below).
3.4.5 Daylighting design.

Daylighting design is an important work in residential building design [7]. Whether the daylighting design is scientific and reasonable is the key factor influencing the indoor environment comfort of residential buildings. On the basis of it, in the process of residential building design, full consideration should be given to factors such as building orientation and floor spacing. At the same time, it is necessary to carry out scientific and reasonable planning and design in combination with the sunshine conditions in various areas, so as to improve the indoor daylighting effect. (as shown in Table 1)

| Building climate zone | I, II, III climate zone | IV climate zone | V, VI, VII climate zone |
|-----------------------|------------------------|----------------|------------------------|
|                      | Large city | Small & mid-scaled city | Large city | Small & mid-scaled city | Winter solstice |
| Daylighting standard day | Great cold | ≥2 | ≥3 | Winter solstice | ≥1 |
| Daylighting hours (h) | 8-16 | 9-15 |
| Effective daylighting time zone (h) | Sill surface of ground floor |

Table 1. Sunshine requirements for different climate zones

Not only that, under the background of green ecological energy saving and environmental protection, the solar panels can be installed on the top of residential buildings to realize the collection of solar energy and convert it into electrical energy or thermal energy, so as to reduce the waste of power resources and achieve good energy-saving effects [8].

4. Conclusion

To sum up, under the concepts of green, ecology and environmental protection, residential architectural design has aroused great concern from all walks of life. The shortcomings of traditional residential building design methods in the new era are increasingly obvious. Therefore, it is a must to think highly of the application of the concept of green ecological architecture, give full play to the advantages of green, ecological, and environmental protection, improve the ecological and environmental protection of residential buildings, and promote the sustainable development of the construction industry.
References

[1] Jin, Z.S., Hu, S.B., Jian, C.S., Zhou, Y.R., Yang, P. (2018) Analysis of the development trend of green architectural design in green architecture. Building materials and decoration ,26: 82-83.

[2] Che, S.J. (2019) Analysis on green architecture and building energy-saving design. Popular Science., 01: 5-6.

[3] Xu, C.J. (2016) Discussion on the technology of residential green building design from the perspective of environmental protection. Sichuan Cement ,06: 94-95.

[4] Jiang, X. (2019) Discussion on interior design based on ecological theory. Interior Architecture of China ,09: 122-123.

[5] Cui, W.Y. (2019) Application of residential building design under ecological theory. Scientific and Technological Innovation ,17: 126-127.

[6] Hu, Q.T. (2017) Application of ecological architecture theory in residential building design. Building materials and decoration ,40: 79.

[7] He, S.Q. (2010) Energy saving and application of modern residential buildings. Chemical Industry Press.

[8] Deng, F. (2015) Form Follows Ecology——Study on the design of contemporary ecological residence surface. China Architecture & Building Press.