Application Research of Energy-saving Technique in the Buildings Rebuilt Project in Germany ——Take a kindergarten rebuilding project in Germany as an example

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Abstract. In the current situation, building energy-saving rebuilding has been an important part of urban construction. Through analyzing the application of energy-saving technique in old building rebuilding in Germany and particularly introducing one real project in north Germany, Chinese architects should learn some German successful experiments, and devote themselves to the problem of the old building energy-saving rebuilding in our country.

1. Viewpoints and methods
At present, our earth is in a period of high-speed energy consumption. The energy crisis in the world and the huge contradiction between China's energy demand and supply make the issue of energy conservation get unprecedented attention. Energy conservation has become the top priority of the whole world. The energy consumption of buildings accounts for 30% - 40% of the global energy consumption, so the energy conservation of buildings has become the top priority. On the one hand, China is carrying out large-scale urban infrastructure construction, which has brought great pressure to the environment and resources; on the other hand, there are many old buildings in China's cities, most of which have poor thermal insulation performance and backward technical equipment, and waste a lot of energy in daily use such as building heating, and demolition and reconstruction will lead to a greater energy wave Cost and economic issues. Some data show that the energy consumption of a building construction is equivalent to that of the building used for six years, so it is the most effective solution to carry out the necessary transformation of the old building to make its use function and building performance more reasonable to meet the new needs, and the application of energy-saving design and energy-saving technology is also more important.

Germany has carried out building energy-saving renovation activities very early, and its building energy-saving system and technology are in a leading position in Europe and even the world. Its research and application of building energy-saving technology is not only for the consideration of economic benefits, but also to fundamentally reduce carbon dioxide and other gas emissions, and reduce the global greenhouse effect. Taking a comprehensive view of a number of examples, German building energy-saving transformation technology includes the following aspects: ① Careful and rigorous building quality assessment technology, including the measurement of energy consumption of each part of the building and the measurement of building thermal insulation performance, so as to find out the main...
problems and formulate feasible transformation goals; ② Through careful design and adjustment of building layout, doors, windows and walls, we can make full use of natural climate conditions and reduce building energy consumption; ③ Make full use of pollution-free solar energy. It is usually through the south windows and walls to passively use solar energy and active heat collection to provide hot water for buildings, or to use photovoltaic materials as roofs and external walls to convert solar energy into electric energy for buildings; ④ The technology of waste water recycling and rainwater collection and utilization after purification. Construction water is the most important factor to the surrounding nature, and the transformation mode of building shape is of great significance to reduce the adverse impact of buildings on the environment; ⑤ When choosing building materials, the possibility of saving resources, reducing pollution and recycling should be fully considered. Including the development and application of primary materials such as raw soil and grass, and the development of new low-energy materials. The low energy consumption here not only refers to the good thermal performance of the material itself, which can reduce the building energy consumption, but also refers to the low energy consumption of the material in the production process. Architects can often develop new materials according to the actual situation in the process of specific project design and construction. This paper will take a kindergarten reconstruction project in Germany as an example to analyze and study the application of energy saving technology in German building reconstruction.

2. Examples
In the process of rebuilding a kindergarten in Wismar, Mecklenburg, Germany, architect Martin Wallensak used appropriate energy-saving technology, which greatly reduced the energy consumption and saved the expenses. The kindergarten was built in 1972, one of more than 300 kindergartens in the same form built by the socialist East German government at that time. At present, the building is in good condition, but the facade is old and seriously damaged, the plane function cannot meet the use requirements, and there are great problems in the building thermal insulation performance and ventilation, which cause great energy loss in daily use and require a lot of money for maintenance. Therefore, it is necessary to carry out thorough transformation and renovation. At the same time, the local government also hopes to find a low-cost mode to transform similar buildings, and test the feasibility of several new energy-saving materials and technologies in practical operation.

2.1 Energy saving reconstruction design in architectural design
The main building of the kindergarten is two cuboids connected with a corridor in the middle. Its original
Idea is to make the main rooms get sufficient lighting. However, this type of building leads to too large external wall area, poor thermal insulation design, poor adjustability of the existing heating system and other factors, which makes the indoor climate of the building vulnerable to external influence. It is too hot in summer and too cold in winter. Building energy saving makes daily use difficult. The basic idea of plane function transformation is to create a centralized space for children to gather, rest and play, so as to enrich kindergarten life. Demolish the connecting parts of the two buildings and use the space between the two main buildings to rebuild a large courtyard as a children's activity site, close one part as children's play space, and reduce the number of external walls of the building. Move the entrance to the other side and add steel structure to remove the floor of the middle floor, creating a multi-functional hall. The new interior wall is hung with locally produced wooden boards, which not only beautifies the new courtyard space, but also forms shadows to reduce the indoor temperature of the classrooms on both sides, and reduces the noise impact in the large space. The roof of the courtyard space adopts a new type of ecological isolation material, which not only allows sunlight to enter the room, but also has the effect of heat preservation and heat protection. The new space between the two old buildings will become the buffer of heat, reduce the influence of the outside on the indoor temperature, and supplement and adjust the indoor climate environment. In winter, the space is heated by solar energy, and the heat is slowly transferred to the classrooms on both sides, so as to reduce the heat loss of the classroom space on both sides. In the hot summer climate, the new material roof provides enough shadow, and the wooden partitions on both sides of the wall also absorb part of the heat, reducing the indoor temperature. The thermal insulation performance of the external wall of the building also needs to be enhanced. The method is to build a layer of wall outside the external wall, increase the thickness of the wall and add a new thermal insulation system. At the same time, the new facade provides a new image for it.

2.2 Improvement of building technical facilities
Due to the obvious aging of water, heating, electricity and other pipelines in the original building, and the change of plane pattern, the reconstruction of the building also includes the reconstruction and renewal of various facilities and pipelines. All kinds of new pipelines are placed in the same pipeline and distinguished by color to reduce the impact on the building structure. The new heating system is set in the original external wall to avoid the occupation of indoor area, and try to increase its surface area to achieve the best heating effect. As a result, the thermal insulation performance of the building will not be weakened due to the thermal insulation layer of the new external wall. Building ventilation is completed by opening the outer surface of the building. A heat exchange system and all ventilation pipes are designed between the new and old exterior wall surfaces. When the indoor air is discharged, the heat carried by the system is exchanged into the system and stored. When the fresh air enters the room through the system, it is preheated to reduce the adverse effect of air circulation on indoor heating. In the reconstruction, we also pay attention to the use of new energy. Solar energy absorption devices are installed on the surface of the new exterior wall and the roof, and the absorbed energy is used to heat the water reservoir for daily life.

2.3 The application of new technology and new material in reconstruction

2.3.1 New ecological isolation roof material
In the reconstruction design, a new type of roof material has been successfully applied to the roof of the new central courtyard. This material is composed of two layers of arc foil and its air interlayer. This material has the advantages of light weight, easy installation and so on. It has a certain degree of light transmittance and the same heat insulation performance. The mechanical device can blow air to the air interlayer in the center of the material to make use of the air. The flow of air takes away heat to enhance the thermal insulation effect of the roof. This material plays an important role in shaping the central space.
2.3.2 Vacuum wall insulation material
This kind of vacuum wall insulation material is used for the first time in such a large project. According to the principle of vacuum non-heat transfer, it uses solid enclosure material as the protective layer of vacuum part, and uses ceramics to connect all parts to form a stable and reliable insulation system. Compared with the traditional insulation material, this new vacuum insulation material has more perfect performance.

2.3.3 Sunshade photoelectric system combination
On the one hand, it can provide shading for the main rooms in summer, and it can be adjusted according to the sunshine angle. On the other hand, it can absorb solar energy and make use of it, which can not only provide the operation of the system itself, but also provide energy for the hot water system.

| project                | Before transformation | After transformation       |
|------------------------|-----------------------|----------------------------|
| Facade effect          | No characteristic     | Characteristics of the times|
| Insulation effect      | Commonly              | Good                       |
| Ventilation effect     | Good                  | Good                       |
| Scale of activity space| Small                 | Bigger                     |
| Energy saving effect   | High energy consumption| Good energy saving         |

3. Conclusion
Through the joint efforts of a group of architects with ecological and environmental awareness, the design methods and technologies of building energy-saving transformation are becoming more and more mature. However, how to turn it from experimental use to universal application is still a problem in front of people. The main reason why some methods and technologies cannot be popularized is that this kind of transformation needs extra cost, and from an economic point of view, this extra cost cannot be balanced with the energy cost saved by building energy-saving transformation in the short term. In general, the climate conditions in Germany and Beijing are similar. There are many similarities in the reconstruction of existing buildings between the two countries, such as poor quality of old buildings, low comfort, poor environmental quality, unsatisfactory energy-saving effect, serious energy waste, etc. To pay close attention to the problems in the reconstruction and design of building energy conservation in China.

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