Analysis on the Development State and Prospects of Green Residential Building in China

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Abstract
This paper focuses on analyzing the concepts of green building and green residential building and the analysis is about the development state of green residential building at home and abroad. The paper also studied the current development trend of green residential building, and the prospects for development and development direction of green residential building in China is put forward to provide a reference for the application of green building.

Keywords: green residential building, the development state, the prospects for development

1. Introduction
Green building refers to the maximum conservation of resources (energy saving, land saving, water saving and materials saving), environmental protection and pollution reduction in the whole life of the building to provide people with a health, application and efficient space. The "green" of so-called "green building" means a concept or symbol instead of a general sense of three-dimensional greening or roof garden, which refers to building environmentally friendly, making full use of natural resources, and without breaking a basic ecological balance under, it is also called the sustainable building, ecological building, energy conservation and environmental protection and return to nature building construction [1].

The basic meaning of green building can be summarized as follows: to reduce the building load on the environment, which means saving energy and resources; to provide a safe, healthy, comfortable and good living space; to be high contact to the environment and achieve the harmony and sustainable development among human and architecture and environment.

The design concept of green building includes energy conservation, resource conservation, return to the natural, comfortable and healthy living environment and so on, with its construction features including specific requirements for building geographical conditions, no toxic and hazardous substances in soil, suitable geothermal, clean groundwater and moderate geomagnetism [2]. Green building should be made of natural materials, and wood, bark, bamboo, stone, lime and...
paint, etc., used in the construction should pass the inspection process to be sure harmless to humans. In addition, according to geographical conditions, green building should set the solar heating, hot water, power generation and wind power generation device in order to take full advantage of the renewable energy provided by natural environment. With the global climate warming, the extent of concern for energy efficiency in buildings all over the world is increasing, there is a growing awareness of the CO$_2$ produced by the building energy that is a major source of global warming. Thus, the energy-efficient building has become an inevitable trend of building development with green building also emerged.

2 Analysis of domestic and foreign research status of green residential building

2.1 The Foreign Development State

In developed countries, the implementation of building energy efficiency and promoting green building has a long history, and a very sound technical system, supply system as well as evaluation system for components have been established. The important thought of sustainable development is put forward in the 1980s. On the United Nations Environment and Development Conference held in Rio de Janeiro, Brazil in 1992, the idea was written in all documents for the meeting, and a consensus was reached around the world, then this idea was integrated into the architectural thought. In 1993, “The Guiding Principles of Sustainable Design” published in America listed the sustainable architectural design detailed rules and regulations. June 1993 in Chicago, the World Architecture Construction Federation (WACF) adopted a "Declaration of Chicago" to continue encouraging sustainable development [2].

In 1991, “green building - designed for sustainable development” coauthored by Brenda and Robert Vale came out, the main point is: ① energy saving; ② design combined climate; ③ material and energy recycling; ④ respect the user; ⑤ respect base environment; ⑥ overall design concept. In 1994, California's famous Yisuo Lai Institute where Sim Van der Ryn is in, held the nation's eco-design conference in Big Sur City, the conference combined dispersive research achievement by adopting the creation of "International Ecological Association," to guide the younger generation, and issued the BIG SUR appropriate statement which call for ecological revolution. In 1995, he and S. Examination jacket (Stuart Cowan) co-wrote "eco-design" (Ecological Design), a book known as a revolutionary attempt in architecture, landscape, urban and technical, five design principles and methods was suggested: ① design results are from the environment; ② ecological spending should be evaluation criteria; ③ design with nature; ④ public participate in the design ⑤ natural thespians. In 1994, Hart Kauf (Volker Hartkopf) professor added a layer of built laboratory for sustainable building, on the roof of original old building in the American Pittsburgh Carnegie Mellon University, which used the latest, most advanced technology and equipment, known as "smart" office space, used the adjustable natural light, adjustable aluminum spacer, adjustable natural ventilation and air conditioning system; the ground was made overhead floor, pipes was located under the floor, and the floor could be open everywhere; installing computer and telephone networking plug socket, local exhaust ventilation and lighting; office space can be separated and combined with a highly flexible arrangement, furniture was designed according to ergonomic principles, etc. As pilot trial for the future of office space in the 21st century, the project got a lot of building manufacturers’ support and funding, as well as attention of the US government and the community of experts. The test became famous because of both theoretical support and built object. In 1995, the German K. Daniels (Klaus
Daniels) published "Ecological Building" (The Technology of Ecological Building), which specifically and clearly introduced the basic principle of eco-building and various technology, with citing examples. March 1996, 30 renowned architects from 11 European countries, such as R. Piano, R. Rogers left the grid and Hull et al., signed the “European Charter for Solar Energy in Architecture and Urban Planning”, the most illuminating advice about specific planning and design is proposed and the social responsibility in the future of human society which architect should bear was indicated. In 1997, when Graham was summarizing the literature related to sustainable development, he said: "Ecology was certainly a prerequisite for sustainable development”.

Green building standards and evaluation systems around the world include: BREEM evaluation system of the UK; ecological building guide LNB of Germany; GBTTool of Canada; Green Building Rating System of US LEED; building environmental assessment system of Australian NABERS; ESCALE of France; ECOPROFILE of Norway. Though these systems have their own characteristics in assessing content, assessment methods, and other quantitative indicators, but basically take reducing the impact on the natural environment, conserving resources and energy to build a healthy and comfortable living environment as the goal, and set out the quantitative criteria and the corresponding assessment system from site selection and planning, the impact on natural ecological environmental, resource conservation and renewable energy resources, indoor environmental quality and other aspects, the evaluation system has played a positive role in guiding the green building design, construction, specifications which guiding construction industry into green sustainable development.

2.2 Domestic Development Situation

Our country’s green building started later, in 1986 the northern residential building design standards for energy efficiency was enacted, and now, only Beijing, Shanghai, Tianjin, and a few other large cities have an ideal energy-efficient building, energy efficiency is currently only 33%, which is 20 years behind and a difference of 10 percentage points compared with developed countries. Over 430 billion square meters’ buildings in China, 99% of them are high-energy buildings, even among new construction, more than 95 percent have still high energy consumption. Our implementation of building energy efficiency is issued in 1986, and "the northern region residential building design standards for energy efficiency " is as a symbol of the start. After nearly 20 years of efforts, energy efficiency in buildings has been step by step, and made great achievements [3], at the same time, along with the ideology of sustainable development recognized by the international community, the concept of green building in China is also gradually taken seriously. We have done a lot of work in green building development to carry out the key technical studies of green building, set up a "National Green Building Innovation Award”, and taken practice of green building in office buildings, universities, libraries, urban residential areas, rural housing and other construction types.

At present, there are still many problems in China's energy-saving and green buildings, one is the whole community did not fully understand the importance of energy-saving and green buildings, lacking of basic knowledge and awareness of the initiative and energy-saving green buildings; the second is the lack of effective incentive policies to guide and support energy efficient and green building; third is the lack of laws and regulations which operational stakeholders must be actively involved in forcing the parties to energy, land, water conservation and environmental protection; Fourth, comprehensive standards about building energy, land, water,
timber and for environmental protection has not been established; Fifth, the lack of effective administrative supervision system.

In our northern town, heating energy consumption accounted for 36% of the total building energy consumption, becomes the biggest component of building energy consumption, heating average energy consumption of standard coal equivalent of 20kg / (㎡ year), which is 2 to 4 times of Nordic at the same latitude conditions, there are three main reasons of high energy consumption: First, the envelope insulation is bad; second, heating systems are not efficient, with serious heat loss in transmission and distribution sectors; Third, heat efficiency is not high, the average energy saving potential of the current source of 15% -20% due to a great quantity of inefficient small coal-fired boilers. The total residential area of the town is about 10 billion ㎡. The energy consumption except heating includes lighting, cooking, hot water, appliances, air conditioning, electricity consumption, which was equivalent to 10 kWh / (m² year) ~ 30 kWh / (m² year), which is approximately 10% electricity consumption of the annual electricity supply.

Energy supply and economic development in China must take into energy supply problems from the new building. According to the current situation of building energy consumption, by 2020, building energy consumption in China will increase 2.5 trillion kg per year consumption of coal and 580 billion - 6300 billion kWh/year than that in 2004, and it is equivalent to a total power of 1.3 trillion degrees which is equivalent to 1.3 times the current total building energy consumption. According to the experience of developed countries, with the development of cities, the building will exceed the industry, transportation and other industries and ultimately become the priamcy of social energy consumption and reach to around 33% [4]. If the urbanization process of China is in accordance with the development model of developed, per capita building energy consumption is close to the level of developed countries, 25% of the world's current total energy consumption needs to be consumed to meet building energy requirements of China. Therefore, we must explore a way to save unlike other countries in the world to make a significant reduction in energy consumption and achieve sustainable development of urban construction.

3. Analysis of the prospects for development of green residential building in our country

With the rapid socio-economic development, three global issues about population, resources and environmental outbreak in China. According to the statistics, about half of the total energy consumption of China is used in construction industry, which is quite amazing compared with the developed countries especially European countries, and China is known as the most wasteful country in worldwide in building.

Our country is a developing country with a large population and the relatively poor per capita resources. In China, the amount of per capita land is only 33% of the world average level, and only 23% of 9.6×10¹² ㎡ land resource is suitable to live, in which only 13% is arable land and per capita arable land only reaches 900 ㎡ with still declining year by year. There is a shortage of water resources in our country and per capita possession of water resources is about 2200 ㎡, besides, there is more than 65% water shortage in 600 cities, of which 15% is in severe water shortage. There are 40 billion ㎡ existing buildings in China, and with the economic developing, 30 billion ㎡ will be built by 2010. The unit building energy consumption in our country is 2 to 3 times of that in developed countries under the same conditions. For example, construction steel is up 10% -25%, more than 80 kg concrete is consumed in per cubic meter. Greenhouse gases of
building energy consumption is about 25% of total emissions. The coal-burning pollution index of northern city reaches 2 to 5 times of upper limit in the World Health Organization, which has resulted in a heavy social burden of energy and serious environmental pollution and became an outstanding problem that restricted the sustainable development of China. Meanwhile, some problems are prominent, such as the growth mode of the construction is extensive, quality and efficiency not high; high consumption and low efficiency of building construction; some local blindly expand the size of city, layout is unreasonable, unjustified appropriation of farmland; valuing ground construction while despising underground construction; water pollution.

The development of green building is a key strategy to achieve sustainable development of the building, even though sustainable development has become a consensus, the principles are embodied in the architectural design of sustainable development. Due to the lack of consistent understanding from content to method, there is a great difference in practicing, sustainable development is put forward in an increasingly striking contradiction between human development and the environment. Sustainable development cannot be narrowly shown with several environmental indicators, we should see it as a development model proposed on the law of ecosystem, which requires attention in the development of renewable resource and no damage to the environment. Thus, it is a new ecological value and it's also an important guiding principle which advocates social justice by promoting the formation of public and individual behavior, and has gradually become the norm for people's social behavior.

The impact of building on the environment and resources not only covers a wide range but also is profound, especially for the cities with rapid development in China. For example, in recent years, annual construction started or restarted in Beijing reached hundred million square meters and more than twenty million square meters are completed per year. The urban landscape is rapidly changing because of this high density and high strength-building activities, and there is the exchange of material and energy in the urban ecosystem and the external environment. Only for building materials, such as steel, cement, plate glass, building ceramics, sanitary ceramics, bricks, sand, stone items in China, energy production amounted to 160 billion kg of standard coal and it is accounting for about 13% of the national energy production. Although the production of new wall materials increases rapidly, solid core clay reaches to 80%, for which not only annual coal consumption exceeds 500 billion kg, but also nearly 65 million m$^2$ of land resources is destroyed each year, and a lot of harmful emissions and greenhouse gases is pulled out into the environment.

When building systems are in use, alteration and removal process, more than several tens of times energy and material exchange occur. Some data indicate that the energy consumed by a building for 6 years is equivalent to the energy consumed in the building., and the life of the building is supposed to reach 50 years to 100 years and only 14% of the national population of heating population. 130 billion kg standard coal per year are used for heating which accounting for 10% of the energy production, and heat loss caused by poor insulation wall materials is estimated at 120 billion kg standard coal. The residential heating energy consumption of China is 3 times that of developed countries per unit of area. At the same time, the summer air-conditioning and modern lighting energy consumption are also at an alarming pace.

4 Conclusion

Green building or sustainable building or ecological construction will become the mainstream of 21st century architectural design. However, to become the guidance of architect, not only
involves in all aspects of society, but also deals with many problems of understanding, technology, institutions and policy. Based on the above actual needs, we should continue to study from the technical point of view in order to provide a reliable theoretical support for the implementation of the green building. Since the residential building occupies an important position in the building and is a major event about people's livelihood, it is the first step in the promotion of green building to achieve the green residential building. The building system can be said an important flow of energy and material in biosphere, and its sustainable development has a special significance for achieving sustainable development strategy.

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References