

Development of Green Building Based on Modern Science and Technology in China

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Abstract : On the basis of the introduction of the implication and characteristic of green building, this paper discusses the influence on the development of green building which has been made by modern revolution in science and technology and analyses the advantage and deficiency existing in the development of green building in China. Confronted with the challenge of energy-saving and environmental protection that come from the development of building industry in China at the present stage, the strategy to develop green building is studied and some suggestions and concrete measures are proposed. In the end, this paper indicates that we should develop the green building based on the modern science and technology, which will accord with sustainable development strategy and help to realize the harmony development among people, building and natural environment.

Keyword: modern revolution in science and technology ; green building ; energy-saving ; environmental protection ; sustainable development

1 INTRODUCTION

Science and technology is the ladder of the progress of human society, and it is also the ladder of development of building ^[1]. In recent years, under the impetus of information technology which is looked as the sign of modern revolution in science and technology, our building science and technology has made considerable progress in researching and developing, popularizing and transforming, industrialization, etc. A batch of great achievements in such fields as house construction of the cities and towns, city sustainable development, energy-saving of building, information construction, sewage and garbage disposal, chemical building materials are been made, which has produced remarkable economic benefits, social benefit and environmental benefit.

Although the construction industry of China is developed fast, some questions are exposed at the meantime: Firstly, the energy-saving technical level of the building of China is not high and the problem of the energy wasting is serious. According to statistics, the area of house that China builds up every year is between

1,600 million to 2 billion square meters in recent years, which exceeds the total amount that all developed countries build up every year. But it's a pity, not only 99% of nearly 40 billion square meters of building that has already had, but also more than 97% in the newly-built buildings are high energy-consuming, and the heating energy consumption of unit construction area is more than 2-3 times the newly-built of building of developed country. Secondly, the environmental protection technical level of the building of China lags behind and the problem of destroying environment is serious. For a long time, the building of China has been relying mainly on the brick mixes structure and concrete structure. According to the incomplete statistics, China produces 700 billion bricks and 500 million tons of cement every year. The cost that produces the brick is destroying about 10,000 hectares of farmland and the coal of quota of expenditure is about 70 million tons. To produces the cement is to discharge about 300 million tons of carbon dioxide gas of the greenhouse every year, and the mine destroyed and waste water discharged are difficult with statistics. Brick and concrete are unrecycle material and the building rubbish formed is difficult to deal with, which cause great

pressure to environment of China.

Facing the above challenges, people have proposed the view that depending on modern scientific and technological progress to develop green building. The so-called green building means the building that offers healthy and comfortable work space, inhabit space and active space to mankind, and it makes high efficiency of resource and influences the environment with the minimum limit at the same time in the whole life cycle of itself. The green building has two following major characteristics: For one thing, the green building should be the energy-saving type building. In the view of energy consumption, we should utilize renewable natural energy as much as possible, such as solar energy, wind energy, etc, and consume little routine energy, such as petroleum, coal, and so on. For another, the green building should be the environmental protection type building. In the use of the construction materials, we should insist on four "R" principle of Reduce, Reuse, Recycle and Renewable and try our best to use those nonpoisonous, pollution-free, retrievable, renewable building materials and products to realize the sustainable development of the building on higher level^[2].

The green building recommends energy-conservation, ground-saving and water-conservation, pays attention to environmental protection, and accords with the strategic demand for sustainable development of our times. Thus, proposing the development tactics and measures of the green building based on the discussion of the influences that modern revolution in science and technology has made on it and analysis of the advantage and deficiency in the development of green building will have important realistic meanings to transform the traditional construction with high-new technology and to realize the coordinated development of the mankind, society and natural environment in China.

2. THE INFLUENCES OF MODERN REVOLUTION IN SCIENCE AND TECHNOLOGY ON THE DEVELOPMENT OF GREEN BUILDING

Modern revolution in science and technology, which begins in the middle period of the 20th century, is the third scientific technical revolution after the scientific technical

revolution first, second in history, and it is the synthesis of modern scientific revolution and modern technical revolution. The modern revolution in science and technology has greatly promoted the development of global scientific and technological and deeply influenced the process of human history, thus, it has become the main motive force of promoting social development.

2.1 The Influence of New Material Technology on the Development of Green Building

New material technology is the foundation of modern technical revolution, including the research and development of intelligent material, environmental protection material, renewable material, heat insulating material, and durable material. Since 1990s, with the increasing development of material industry, metal, glass, new-type plastics, composite material and so on are widely put into the project practice, which impacts the traditional construction and offers the new thinking for people to develop green building with the modern scientific and technological means. For example, replacing the traditional clay sintering brick with new-type green energy-saving composite wallboard, has not only reduced building energy consumption, but also avoided destroying the cultivated land and polluting the environment because of producing the clay brick. Replacing the traditional brick structure and concrete structure with the new-type structure system of building-the steel structure not only has reduced the pollution to the surrounding environment during its construction, but also accord with the social value trend of environmental protection building sustainable development because the steel is renewable materials, after the building is removed, the part of steel construction of the house can be all retrieved, other related materials can most be reused.

In recent years, with the development of bionic technology, photoelectric technology, nanotechnology and material synthetic technology, the construction material is developed in new function material, bionic material and new concept material direction. Antibiotic material, air-cleaning material, noise-defending and electromagnetic radiation material and the material that can produce the air anion, are applied to the new-type building gradually. Using these new-type construction

material can reduce microbe pollution , chemical pollution and physics pollution and improve air quality effectively, thus the building may offer people a comfortable and healthy life and working environment. Therefore, new material technology has offered the essential material base and technical support for development of the green building.

2.2 The Influence of the New Energy Technology on the Development of Green building

The new energy technology is the pillar of modern technical revolution. Energy used by people grows from timber to the coal, then grows from petroleum to the nuclear energy, and at present, people are researching and developing in such new energy as solar energy , geothermal energy ,etc. The solar energy is the most important energy in the green energy, which is the abundant, nonexhaust, exist-widely natural energy , and its advantage is extremely abundant , clean , safe and cheap ^[3]. People have applied solar energy technology in the building field Since ancient times. The early solar energy buildings are usually called the passive form solar energy building beacause they make the room warm and bright with natural transmission of heat energy and light energy of solar energy. And then, with the development of science and technology, people develop from the passive form into the active solar energy building gradually to meet the people's requirement of improvement to the living environment. Under serious situation day by day of the energy and environmental problem in our times, some developed countries develop so-called " zero-energy building " , namely utilize solar energy to offer all energy that the building needs. The solar energy technology has become a new developing and hot technology. It is the necessary outcome of the development of science and technology to combine the solar energy with building, and to develop the simple place which only mankind live , hide wind screen rain , avoid heat and cool for thousands of years into a independent energy, circulating-oneself type new-type building.

Besides developing and utilizing solar energy, in order to reduce the reliance on the petroleum and coal and win the sustainable development of the energy, people also develop the application in the building of renewable resources, such as the water and electricity ,

nuclear energy, wind energy, living beingsing, geothermal energy ,etc. According to present actual conditions, the prospect of developing new energy is no doubt wide, but we should also emphasize the research and use of the energy-saving technology at the present stage. It is more feasible to improve the energy efficiency by the way of energy-saving, and its potentiality is enormous. Energy-saving is regarded " the fifth energy "as important as coal , petroleum, electricity of natural gas by some experts. In most countries, it is impossible to change fundamentally the basic pattern of energy structure relying mainly on coal near future. The direct result that the energy efficiency improves and the consumption of energy reduces is the reduction of the coal traffic volume and emission of filth. So, at the present stage, we not only need to develop and utilize new energy in a more cost-effective manner, what's more important , is that we should promote the development of the green building relying on the scientific and technological progress to reduce building energy consumption .

3. THE ADVANTAGE AND DEFICIENCY OF DEVELOPING GREEN BUILDING IN CHINA

At present, no matter Amrica or Europe, through the exploration of developing green building for a long time, have made great progresses in solar energy utilization, energy-saving, water-saving, and material-greening. According to the technological achievement acquired, they make a series of technical standards of developing green building combining the situation exist. The development of the green building of China starts relatively late, however, through the implement of a large quantities of country's technological innovation projects, energy-saving techical level of the building has been improved greatly in recent years. The combining and application technology of the solar energy with the building has made the phased break-through and the green environmental protection building materials are used widely, thus the development of green building of China is promoted greatly.

3.1 The Advantage of Developing Green building in China

3.1.1The state policies support the development and application of the green building

Faced to this severe fact that the energy utilization ratio of building is lower and environmental pollution problem is serious in China, the state and ministry of construction have issued a series of policies to encourage the development of the green building actively. China's building technology policy(1996) has put forward the concrete demand to the building energy-saving. Energy-saving law of the People's Republic of China(1998) is fundamental laws and principles to economizes energy in China. There are a lot of clauses (such as the 11th , 12th , 13th , 14th and 37th, etc.) that relate to building energy-saving among them, especially article 37 stipulates clearly: "The design and construction of the building should be in accordance with relevant laws, administrative statute, and adopt energy-saving building structure, materials, utensils and products to improve the thermal and insulating performance, and to reduce energy consumption of heating , refrigeration and illumination ". Development Reseach Center of the State Council points out in the reports of "The Comprehensive Development Strategies and Rresearch in Policy of Chinese Energy", which was finished recently: China should implement the sustainable energy development strategies of " energy-saving priority , structure optimization , environmental friendship " in the following 20 years...In order to establish the important strategic position of energy-saving, it is proposed that economizing the resources should be considered as the fundamental state policy. Ministry of Construction determines to set up " The Innovative Award of National Green building " in August of 2004 to carry out the scientific development view, to promote sustainable development of economizing resources , protecting environment and construction cause, and to accelerate andadvance the healthy development of the green building and technology of China. The issue of these policies and measures will greatly promote the development of green building of China.

3.1.2 There are wide market prospects to develop green building in China

As the environmental consciousness of the whole society being strengthened constantly, people have already paid attention not only to the quality of the single building but also to the environment of the district, not

only to the safe-structure, but also to the quality of the indoor air, not only to the material firm-durable and cheap, but also to the impact that the material consuming on environment and energy. Constructing the green building and ecological house is becoming the goal pursued by more and more developers and architects. However, will green energy-saving building make construction cost higher or make consumer burden more? As to this, some experts point out that a lot of green buildings make use of geothermol power , solar energy , wind energy to realize and reduce energy consumption, which can be up to 75%, even 85%. According to the calculating of related departments, if energy-saving is up to 60%, the construction cost only increases than that of the traditional building by 5%~7%. Eeven if the construction cost of green building which adopts intelligent design, the cost only increases by 10%~20%. However, after green building is used for 5 years, we can retrieves the cost with using energy-saving.The green building can make the disease rate drop greatly and help to make improve people's vitality. Reducing other energy consumption at the same time, it also make social cost and ecological cost drop greatly, which has long-term interest to consumers, and it will be favored by more and more consumers.

3.2 The Deficiency of Developing Green building in China

It is very urgent to develop green building in China if it takes the sustainable development path. Although the energy saving of the building has moved forward by the efforts of nearly 20 years, compared with the developed country, the energy-saving of building of China lacks basic research and there is less fund input, which make the newly-built building difficult to build according to the energy-saving standard. The energy-saving renovation of the existing building and other developing research items are difficult to develop. In addition, there exists following insufficiency during the development of green building in China:

3.2.1 People know insufficiently about the development of green building in China

At present, quite a few of people can't realize the importance of the work to promote energy-saving and environmental protection in the development of green

building, which can implement scientific development view, build the well-off society and guarantee the national energy safely for sustainable development. According to statistics, the mankind use more than 50% of the raw materials that obtains from the nature for building all kinds of buildings and affiliated facilities, and these buildings have consumed about 50% of the global energy again in the course of constructing and using. In the developing countries, the increasing amount of buildings still seriously occupy the land and destroy the ecological environment. And for a long time, the national controlling over energy lays particularly stress on industry and traffic energy-saving, but it lacks effective encouragement policy to guide and foster the green building.

3.2.2 there are not perfect standard system to develop green building in China

The concept of the green building is comprehensive, not only weighing the impact on external environment by the building, but also relating to the quality of indoor environment, not only including the physics performance of the building, but also containing the factors of some humanity and the society. However, people's understanding about green building may be different perhaps due to different idea, local technology and the economic level. Therefore, a set of clear system in assessing green building play an important role in making the green building break away from the plans or hopes and helping people to understand the intension of the green building. Although the design standards directed against three climate districts to save energy 50% in building of China had already issued and implemented, the energy-saving standard directed against industrial building has not been issued yet. The comprehensive standard systems of building about energy-saving, ground-saving, water-saving, material-saving and environmental protection have not been set up, which has influenced the development of the green building of China in some degree.

4 DEVELOPMENT TACTICS OF THE GREEN BUILDING IN CHINA

The green building is a system engineering, which runs through the whole course of planning , designing,

constructing and using on later stage. It displays concretely that the energy-saving and environment-protective principle should be adhered to during the course of planning to design, the construction course should have energy-saving, consumption-reduction, low-pollution characteristics, and the result of the building should have environmental protection , energy-saving , suitable foring characteristics. To set up and amplify the policies and regulations system of developing green building, technical standard system and administrative supervisory system should be established as soon as possible in the future. International exchange and the training and propaganda work should also be strengthened. In the practice, environmental index of the building should be investigated during the course of designing in order to accelerate the popularization and application of the new-type green building materials; During the course of constructing, environment control should be strengthened to make construction course for energy-conservation, consumption reduction and low pollution. At the time of the final acceptance of the construction work, the owner should not only inspect for acceptance the structure security , but also assess and confirm all kinds of environmental protection indexes. Besides above measures, the quality compensation method of building construction including environmental protection content should be made and the ISO14001 Environment Management authentication should be carried out to accelerate the development of green building.

Developing green building based on scientific and technological progress at the present stage, more efforts should be paid to study and develop new-typy exterior-protected construction at first. In the general heating building, the energy-consumption of the building mainly consists of two parts, namely the heat escaped form exterior-protected construction and heat consumed by the air that permeate into the building from doors and windows. The statistics shows the heat rate energy of exterior-protected construction accounts for 71%-77% of the consuming energy in the building in different disticts. That is to say, no matter the northern area or the southern area, the loss of heat of the building exterior-protected construct is the position that technological measure should be taken in the energy-conserving design of

buildings. In the exterior-protected construction, the window account for 50%~60% of building dawdle heat, thus it is obvious the most important position of building to consume energy. Outer wall accounts secondly for about 30%~45%, so the outer wall should be classified as position that technological measure should be taken emphatically of building energy-saving, too ^[4]. Secondly the development and utilization of the building system of steel structure should be strengthened. Steel construction is most suitable innovating structure system in building, which not only can respond to the request of the architectural large room and plan separated flexibly, but also make the utilization ratio of steel construction area higher. The steel construction building still has characteristics such as light conducts oneself, good performance of earthquake-resistence, few wet work on the spot, high degree of mechanization, short cycle of construction. The materials that the steel construction building use is mainly the green , recoverable or apting degrade material. when building is removed, some steel construction of house can recover 100%, other related material can be maily retrieved, accord with the building sustainable development demand of environmental protection. In addition, in order to reduce the reliance on the non-renewable resources, developing green building should pay attention to the technology of development and use of the new energy, especially to the development and use of solar energy technology.

5 CONCLUSION

At fast developing stage of the industrialization and urbanization, China will confront with the enormous pressure of restraining of resources and deterioration of

the environment to keep GDP increasing by more than 7% every year in the following 15 year. Establishing the goal to solve the two major technology difficult problems that the construction faces at present, the green building recommend energy-saving and pay attention to environmental protection, which has not only accorded with the energy development strategy of China, but also complied with the demand for sustainable development of our times. The green building also help to realize the harmony development among people , building and natural environment. Therefore, developing green building based on the scientific and technological progress must become the theme of the construction in the 21st century.

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