

# Economic Benefit Analysis of Green Building under the Background of Low Carbon Economy

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## Abstract

With the rapid development of economy, the energy consumption of China's construction industry is increasing, which has become a development trend of high input, high emission, low efficiency and difficult circulation. This is very worrying and ultimately leads to serious environmental pollution. It is not in line with the path of national sustainable development and does not adapt to China's national conditions. It is necessary to introduce the new concept of green building under the background of low carbon. From the perspective of green environmental protection, the low carbon concept is integrated into the economic benefit evaluation of green building, so as to seek the economic value of green building and promote green building, which will also help to reduce the total energy consumption in China. It is of great significance and value to the sustainable development of economic environment and China's long-term development. However, when green building first emerged, the cost was relatively high and it did not bring good economic benefits to the construction industry. This paper analyzes and explores the concept and economic benefit of green building in low carbon environment.

## Keywords

Low Carbon Economy; The Green Building; Economic Benefits.

## 1. Introduction

With the continuous development of society, China's construction industry has also made great achievements with the continuous development of society and economy. However, the development has brought great damage to the ecological environment. At present, environmental protection has become the key issue of social sustainable development. Therefore, the construction industry should be based on long-term development, keep up with the needs of The Times, and vigorously promote green buildings under the concept of low carbon. Green building is of great significance in improving the economic benefits of the construction industry, realizing environmental protection, and promoting the healthy and sustainable development of the society.

## 2. Low Carbon Concept and the Meaning of Green Building

### 2.1. Low Carbon Concept

With the increasing severity of the greenhouse effect and global warming, "low carbon" life and production have become the new requirements for the development of human society, and the concept of low carbon is deeply rooted in people's hearts. The so-called Low-carbon concept means that in the process of social and economic development, the emission of greenhouse gases containing carbon should be reduced, and the sustainable development of economic environment should be realized by utilizing renewable resources or developing new energy.

Under the guidance of Low-carbon concept, the concept of green building arises at the historic moment.

## **2.2. The Green Building**

Green building, as the name suggests, requires on the basis of the harmonious development of nature, environment and human beings, in the life cycle of the building to save all kinds of effective energy (including land resources, water resources and various building materials), so as to achieve the purpose of reducing pollution, protecting the environment and providing a healthy living space for human beings. The pursuit of green building is to make full use of natural resources, such as light energy, wind energy, biological energy and other material energy, to reduce the emission of harmful substances, in order to avoid people in the rapid economic development at the same time of the destruction of ecological environment.

The cost of a green building from the perspective of a full life cycle cost analysis, including investment, energy, non-energy operation, maintenance and demolition or demolition costs. From the elements, it can be divided into three parts: material energy, operation mode, energy consumption of the building and post-processing of the building. Among them: material energy refers to part of the energy input of the building system. High energy materials result in lower maintenance costs and higher recycling and recovery rates. Therefore, the optimal selection of materials will effectively reduce the energy content of materials and achieve a great reduction in cost. The operational mode and energy consumption of the building can be understood as a green building energy saving through an organic combination of overall and detailed savings measures, such as refrigeration and lighting savings schemes. Post-processing of buildings refers to the transformation and replacement caused by obsolete technology, abandoned building functions and physical decline. The longevity and multi-applicability of the building should be considered in the initial design to save the cost of the post-processing of the building.[1]

## **3. Basic Situation of Green Building Economy Development in China**

### **3.1. The Status Quo of Green Buildings in China**

With the deepening of sustainable development concept in our society, the concept of green building has changed under the intervention of market economy system. A large number of construction practices have proved that in order to expand the market, many real estate developers mislead consumers in the name of green buildings, seriously violating the scientific concept of "people-oriented" development. The main reason is that the work of local governments generally revolves around economic construction, so they ignore the importance of sustainable development intentionally or unintentionally. In the process of attracting investment, they pursue economic interests and reduce the supervision on environmental protection of construction enterprises. For project contractors, due to the lack of successful green construction concept as a guide, in the process of concrete construction practice, do not fully understand the true meaning of green building, lack of technical support, so that the environmental performance of the project is greatly reduced.[2]

### **3.2. Relevant Technical Support and Incentive Policies are Insufficient**

The development of green building economy is inseparable from the support of the government and the attention of the society. As the main body of the market, enterprises play an important role in the green building economy. It is not only a green building, but also a direct designer and a concrete building. Of course, maintenance personnel are also directly involved with the company in terms of green building materials and related technologies. China's green building economy is relatively late to development. Therefore, market acceptance is high, which is an important challenge for China's green building economic development.

### **3.3. Relevant Laws, Regulations and Policies Need to be Improved**

The development of green building economy has had an important impact on the whole society. In terms of resource and environmental protection, it is closely related to people's social life. In order to effectively realize green building economy, sustainable development and healthy development, the country and the government must formulate corresponding laws and regulations, and there should be a series of matching systems and institutions. Only in this way can we effectively implement the specific plan to promote the development of green building economy. With the support of certain policies, the development of green building economy will also increase rapidly.

### **3.4. Economic Benefits of Green Building**

Green building in the field of environmental protection in our country reflects the value of environmental protection is very important, at the same time, green building in the process of social and economic development in the economic benefits cannot be ignored. The traditional economic benefit analysis of green building does not take into account the carbon emission and benefit reduction of green building. Green building is an organic concept. The concept of "green" runs through the mining, processing and transportation of materials. The planning, construction, use and demolition of buildings cover the whole life cycle of buildings, among which "green building" focuses on the harmony between indoor and outdoor environment of the regional ecological environment. Including the circulation of air, the use of daylight, landscape environment and other convenient comprehensive consideration is expected to provide residents with a living space with excellent conditions in all aspects, and have an impact on the surrounding environment.[3]

## **4. Economic Benefit Analysis of Green Building under the Background of Low-carbon Economy**

### **4.1. Economic Cost Analysis of Green Building under the Background of Low-carbon Economy**

In the traditional investment philosophy, investors pay more attention to the cost effectiveness in the early stage and the cost effectiveness in the construction process, and usually pay little attention to the cost effectiveness of the later operation. The economic costs of green building, mainly including four aspects: building decision cost, construction cost, construction cost and construction cost of recycling, the whole process, not only need to measure the effect of buildings on the surrounding environment, but also need to evaluate the whole construction project and budget, for the source of the issue and the future direction, resource consumption, etc., the impact on the environment. Through improvement there is also less adverse impact on the environment of the surrounding ecological environment and buildings. The environment makes the living room very healthy and comfortable.

### **4.2. Government Departments should Strengthen Guidance**

The development of green building economy in China is, to a certain extent, related to the government and related departments. The green economy can drive the development of health care, and promote it to continue to rise. The development of economy has a direct relationship with the government's macro-control. Therefore, the government and relevant departments should comprehensively improve the laws and regulations, and develop a set of complete supporting procedures, requiring relevant staff to carry out strict operation, so that the construction enterprises have certain constraints, so that the relevant green design, technology and concept can be realized. Buildings really go into all construction companies. Of course, enterprises' technological innovation and R&D investment cannot be separated from the

government's policy support. Therefore, the government must pay more attention to the development of China's green building economy, not only to strengthen market guidance, but also to provide strong policy support.

### 4.3. Pay Attention to Industry Innovation

The rapid development of green building economy is inseparable from the effective innovation of industrial technology. In the process of the whole work, innovation is needed to break through the bottleneck of China's green building economic development, to ensure that China's green building is truly realized, saving energy and reducing environmental protection. People are becoming aware of the importance of protecting the environment. If they want to grow healthily in the environment in which people live, they must pursue a Low-carbon economy. Green building in low carbon economy is the inevitable trend, though. Green buildings in the context of low carbon can effectively reduce carbon dioxide emissions, slow down global warming, and contribute to the development of physical and mental health.

### 4.4. Establish and Improve Relevant Evaluation Criteria

For the world, green building economy is not a new term, but in China, the development of green building economy must have authoritative, reliable, scientific evaluation standards and evaluation system. Only by meeting certain criteria can one have a direction of implementation. Therefore, the government must step up efforts to establish a set of green building scientific evaluation standards and evaluation system in line with China's social development, so that these standards have a certain normative nature and can guide, regulate and supervise green related units. Build related business.

### 4.5. Economic Benefit Analysis of Green Building

#### (1) Traditional economic benefit analysis

The traditional economic benefit analysis of building does not take into account the benefits of carbon emission reduction of green building. The main calculation idea is to discount the future cash income at an appropriate rate of return to consider the relationship between income and cost. Typical is the calculation of the financial net present value (NPV):

$$NPV = \sum_{i=1}^n (CI_i - CO_i)(1+i_c)^{-i} \quad (1)$$

Where: CI is the cash inflow, CO is the cash outflow; n is the calculation period;  $i_c$  is the benchmark rate of return set. When  $NPV \geq 0$ , it indicates that the profitability of the project has reached the expected rate of return, and the project is acceptable. When  $NPV < 0$ , it indicates that the profitability of the project is lower than the expected rate of return, and the project is not acceptable.

This calculation method of economic benefits cannot fully cover the real benefits of green buildings, resulting in low calculated actual benefits, which further affects the relevant decisions of enterprises. In a sense, it also affects the promotion and popularization of green building in the market economy. The cost of green buildings is relatively higher than that of ordinary buildings. According to the traditional economic benefit analysis, the benefits of green buildings are bound to decrease compared with those of ordinary buildings. In the market economy pursuing profit maximization, enterprises are naturally unwilling to engage in the development of green building projects. This also shows that the traditional economic benefit analysis method cannot effectively guide the decision-making, we need to explore a new economic benefit analysis method.

(2) Economic benefit analysis based on calculation of CO<sub>2</sub> emission reduction value.

Green building is an organic overall concept. The concept of "green" runs through the whole process of material mining, processing, transportation, building planning, design, construction, use, renovation and finally demolition, covering the whole life cycle of a building. Secondly, "green building" pays attention to the harmony with the regional ecological environment and its own indoor and outdoor environment, including the comprehensive consideration of daylight utilization, air circulation, landscape environment and other aspects, in order to provide residents with a building living space with perfect conditions in all aspects, and have a long-term positive impact on the surrounding environment. Again, "green building" emphasizes the finiteness of building materials and energy and their savings, thus in the "green building" in the design stage, construction stage, so that the building is completed in each link of the process of using are factors that influence the carbon emissions when the economic benefits of the green building analysis introduced in carbon trading, it is possible to build green building carbon emissions reduction per unit time Small amount and value models are shown in Equations (2) and (3).

$$Q_i = \sum_{j=1}^m \omega_j Q_j \quad (2)$$

$$R_i = PQ_i \quad (3)$$

In the formula,  $\omega_j$  represents the weight of factors affecting carbon emission reduction;  $Q_j$  represents the contribution of corresponding factors to carbon emission reduction;  $Q_i$  represents the carbon emission reduction of green building per unit time;  $P$  is the trading price of carbon emissions, where  $P = P_0 + \varepsilon$ ,  $\varepsilon$  is a random variable,  $E_\varepsilon = 0$ ,  $P_0$  is the benchmark trading price;  $R_i$  is the value of carbon emission reduction.[4]

The improved financial net present value (NPV\*) is then calculated as follows:

$$NPV^* = \sum_{i=1}^n (CI_i - CO_i + R_i)(1 + i_c)^{-i} \quad (4)$$

By combining Equations (2) and (4), we can get

$$NPV^* = \sum_{i=1}^n \left( CI_i - CO_i + P \sum_{j=1}^m \omega_j Q_j \right) (1 + i_c)^{-i} \quad (5)$$

After comparing the NPV formula based on the CO<sub>2</sub> emission reduction value with the traditional NPV formula, the value-added part of the economic benefits of green buildings based on the Low-carbon concept can be obtained, which is represented by  $\Delta NPV$ .

$$\Delta NPV = \sum_{i=1}^n \left( P \sum_{j=1}^m \omega_j Q_j \right) (1 + i_c)^{-i} \quad (6)$$

## 5. Economic Benefit Analysis of Green Building under the Concept of Low Carbon

### (1) Calculation method of environmental value.

Under the concept of low carbon, green building has made great progress. The reason why there is a certain degree of progress is that compared with traditional construction projects that consume a lot of energy, green building can effectively reduce carbon emissions. In green building projects, the economic benefits brought using green energy saving technologies generally need to be calculated by the method of "without comparison", and a scientific and reasonable method is selected for evaluation, to further clarify the evaluation parameters and indicators. In addition, the calculation of green buildings can also be carried out in the way of market value calculation, that is, the difference between the economic benefits before and after the adoption of Low-carbon technology is calculated. Indirect costs are calculated as the cost of damage to the environment during the construction of a building. Taking public buildings in green buildings as an example, the fundamental principle of its design is the whole problem of resource conservation in the life cycle of the building. For example, the wall adopts composite insulation board, sound insulation rub, and the use of green paint, heat insulation materials and other water supply and drainage system design, and so on.

### (2) Analysis of direct benefits in green building.

Under the guidance of Low-carbon construction, green building has achieved higher economic benefits, which are mainly divided into direct economic benefits and indirect economic benefits. The direct economic benefits mainly come from the following points: the money saved by green buildings with low carbon concept compared with traditional buildings; The money saved by the full use of resources in the construction project: the economic return brought by the increase of the green area of the building; Economic benefits brought by resource recycling and utilization. In addition to this, the economic benefit of green building in the concept of low carbon can also through to improve the economic benefits of the green energy saving technology, these economic benefits are generally carried through to resources and energy value calculation, for example, in the green building, water, electricity supply, land resources and heating can be calculated using the following formula:

1) Economic value of water energy = Total amount of energy storage x unit price of energy consumption.

2) Economic value of electric energy = Total amount of energy saved x unit price of energy consumption.

3) Economic value of land resources = Total amount of land saved x unit price of land.

4) Economic value of heating energy = Total emission saved x Heating price.....

The comprehensive calculation of these specific project benefits is the direct economic benefits brought by green building projects under the concept of low carbon.

### (3) Indirect benefit analysis of green building.

Generally speaking, the economic benefits brought to society by the construction of green buildings are what we call indirect economic benefits. For example, the increase of building greening area can improve the air quality within a certain range of the region, which has a positive effect on the control of carbon dioxide pollution emission and the improvement of air quality. These are indirect benefits brought by green buildings. The indirect benefit calculation (measurement) method generally follows the opportunity cost method and the alternative market method, with the help of these two methods for scientific calculation. After the alternative market method is generally applied in Low-carbon and environment-friendly building projects, the relevant information of nearby real estate projects is referred to summarize the profit and loss of economic benefits brought by environmental changes and

estimate the income. The opportunity cost method refers to the current net benefit estimation of the undeveloped construction project and the prediction and estimation of the possible economic benefits after development. If the comprehensive estimation shows that the economic benefits after development are far greater than the net benefits, then the construction development activities can be carried out. [5]

(4) Analysis of economic benefits brought by carbon dioxide emission reduction.

The concept of low carbon is in line with the current development trend of The Times. People have more and more requirements for a healthy life, which promotes the development and progress of construction to a certain extent and plays a certain role in promoting the whole society. Under the concept of low carbon, green building gradually to more environmental protection, more energy saving direction. In general, the government will calculate the carbon emissions of the local economy under its jurisdiction, and sell them by auction through authoritative agencies, which can be transferred. In this way, the green building will be linked to the interests of all parties, thus promoting the relevant units or enterprises to effectively reduce the waste of resources and achieve energy conservation and emission reduction.

## 6. Summary

To sum up, the implementation of low carbon concept can effectively reduce the cost of building construction, and the implementation of green building, in line with the needs of various industries to achieve long-term and stable development, is also the requirements of China's national conditions. Therefore, it is necessary to vigorously implement green building, which can not only effectively manage China's construction industry and control local housing prices, but also be the requirement of China's sustainable development strategy and lay the foundation for the development of China's circular economy.

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