Green building assessment in China: Present and future

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1. INTRODUCTION

In the long humanity history, building is all along one of the most necessary substance for human being. It is quite difficult to express how much benefit people get from housing. Nevertheless, at the same time when people enjoy their housing, new problems appear. Actually, building is one of the main consumers of natural resource as well as the main producers of environmental loadings. For example, in U.S the construction industry (including infrastructure) is responsible for some 15% of CO$_2$ equivalent emissions (Hendrickson and Horvath 2000). In the European Union, buildings are estimated to consume approximately 40% total energy, and also to be responsible for some 30% of CO$_2$ emission, and to generate approximately 40% of all man-made waste (Sjöström and Bakens 1999). Moreover, sick building syndrome reported by persons living in modern houses forces us to think more about what building brings to us besides warmth and comfort. Green building, which is also called sustainable building, then come into being. With the more and more attention being paid by the global building researchers, many international organizations, such as iiSBE, have been founded to push forward the development of sustainable building. One of the achievements in green building research is the foundation of many green building performance assessment systems. For example, the Building Research Establishment Environmental Assessment Method (BREEAM) in U.K, the LEED system built in U.S.A, the QUANTUM in Netherlands, the ECO-PRO in Germany, the EQUER in France and the Athena in Canada etc. These systems have undoubtedly acted as an important director in green building practice.

In China, a country with long civilized history, sustainable development concept has been already identified in the old times. Xun Zi, a philosopher in Chinese history, has systematically put forward the theory that people should have respect for the ecologic rules and attach importance to the sustainable application of natural resources. At present, although there are plentiful resources in China, large amount of population has made the average resource shared by one person relatively low compared with other countries. Therefore, the actualisation of sustainable development should be adopted without delay. The white book which is issued in 1994, with the name of ‘The 21 century agenda -Population, environment and development in China’, has set out the general strategy and action plan for the sustainable development. In 1996, the Ninth Five Year and 2010 Vista Plan has again made sustainable development as an important strategy for the social and economic development in China. All of these has shown the fact that sustainable development has been paid much attention to by the Chinese government. As a result, in Chinese construction industry many regulations and policies have been made under the direction of the sustainable strategy.

2. GREEN BUILDING ASSESSMENT IN CHINA: CURRENT SITUATION

2.1 Overview
The Environmental Protection Law and the Construction Law can be taken as the basic foundation of green building in China. Shown in Figure 1, on the base of these two laws, many regulations and rules have been made in different profiles of green building assessment, such as the Regulations on Environment Protection Management of Construction Project, the Energy Saving Management Regulation for Civilian Use Building and the commercial house performance assessment institution etc. These regulations and institutions have taken great effect on the green building assessment for the life-cycle of a construction project.

![Diagram of green building assessment in China](image)

### 2.2 Environmental influence assessment

One important part of the green building assessment in China mainly concentrates on the environmental influence assessment of construction project. Especially on the environment loadings analysis and evaluation. Based on such an assessment system, the environment influence of a project can be identified. This assessment work is usually done in the feasibility study phase of a project. If a construction project has the possibility of great influence to the environment, an environmental influence report book must be made. The report should include the following content:

- Project background
- Current environmental situation of the project surroundings
- Analysis and prediction of the project environmental influence
- Economic and technical evaluation to the measures for environmental protection
- Cost and benefit analysis for project environmental influence
- Suggestions for the environmental monitor of the project
- Conclusion of the environmental influence assessment

According to the conclusion of the environmental influence assessment, project which has a bad environmental performance can not be constructed. This environmental assessment system has successful prevent the natural environment from being destroyed by the construction project. The Regulations on Environment Protection Management of Construction Project, which is issued in 1998, has a definite description of the requirement in detail.

### 2.3 Energy saving assessment

With the rapid development of Chinese economy, large amount of energy consumption has made the government pay much attention to the energy saving problem. This can be demonstrated by the enactment of the Energy Saving Management Regulation for Civilian
Use Building in 2000. From then on the green building assessment has formally added the content of energy saving assessment especially in the feasibility study phase of a project. According to the regulation, the feasibility study report or design task book of a new civilian use construction project must have the specific analysis and assessment of energy saving performance of the building. If the energy saving performance is not good, the project can not be permitted for construction. Furthermore, the project design must obey the energy saving design standard. If it is not fit for the energy saving standard, the design alternative must be changed. At the same time, the energy saving performance assessment of construction inventory has been gradually put in force. And the application of energy saving technology is strongly recommended.

2.4 Green building assessment in the commercial house performance assessment system
Recently, the execution of the commercial house performance evaluation institution has push the green building assessment on a high level. Performance assessment for commercial house is a very important institution in Chinese construction industry. The purpose is to eliminate the asymmetric phenomenon in the housing transaction process and regularize the housing market. According to this institution, the commercial house which has been built up must be evaluated using the performance assessment system and labelled a bank before it is put into the housing market. So the purchaser can directly identify the quality of the house according to the bank. The assessment system for commercial house consists of five indicators, including applicability, safety, durability, environment and economic performance. The environment and economic performance has directly reflected the green building performance. In detail, the environmental performance includes the sub indicators list below:

- the reasonableness of planning
- water hygiene
- green grass allocation
- outdoor noise and air quality

And the economic performance includes:
- operation energy consumption
- maintenance cost

Besides these two direct indicators, there still some sub-indicators in the other three performance categories which have shown the green building concept. For example, the heat preservation and adiabatic performance, which is one sub indicator of applicability, also reflect the energy saving performance of the building. And the Prevention from poisonous and harmful substance sub indicator of safety, can also reflect the green performance of a building.

2.5 Other assessment systems
Apart from the assessment of environment influence and energy saving, with more and more inhabitants identify that building has an important influence on people’s health, the indoor environmental quality healthy monitor also begin to be used to the building product. For example, the detection and assessment of specific radiation and inner air quality has come into being. As a result of market demand, many companies or organizations which engage in indoor environmental quality detection have been set up.

In addition to the environment assessment of building itself, the assessment of the construction process has also been assessed. For instance, according to the Construction Law, the construction company should control and deal with the environmental pollution caused by dust, waste air and water, garbage and noise in the construction site.
3. CONSTRUCTION AND IMPLEMENTATION OF GREEN BUILDING ASSESSMENT SYSTEM: FUTURE TASK

3.1 Construction of green building assessment system: from segregation to integration
According to the introduction in the second part, we can find out the former green building assessment systems exist almost every phase of project construction process. However, these building assessment regulations and systems separate with each other. There still lack of a systematically unified project life-cycle green building assessment system at present. The shortcomings is that, depending on isolated systems, we can only get the partial optimising alternative for a certain phase, but not the global optimising one for the life-cycle of the construction project. For example, we choose the best design alternative according to the environment influence of the project, but from energy saving point view, it is usually not the best one. Even can it be the worst one. Green building is a multi-object optimisation process. Therefore, it is necessary to build an integrated system for green building assessment. The green building assessment integration has two meaning. One meaning is that green building assessment should integrate different phases of the project life-cycle. As shown in figure 2(a), the green building assessment system should include the feasibility, design, construction, operation and even the demolish process of construction project. To build such a integrated system, the cooperation of the experts in different construction process is needed. In other words, the economic and environment expert in feasibility study phase, the design consultant expert in design phase, the construction expert in construction phase and the expert in project operation and demolish phase should be together to construct a green building assessment system for the life-cycle process of the construction project. With the help of such an integrated system, any decision in different phase of a certain project can be made from a life-cycle multi-object sustainable building optimisation standpoint. The other meaning is the integration of different specialities. For example, in the design phase of a construction project, which play an important role to realize sustainable construction, we need architecture, structure engineer, facility engineer and so on. During the process of green building design, if they only pay attention to the assessment system of their own major, it is unavoidable to take some adverse effect to other domain. For example, when the architecture choose a walling material which is excellent for energy saving, maybe it is not good for the structure bearing capacity. Therefore, to build green building assessment system which integrate the information of different specialities, shown in figure 2(b) is also in dire need.

3.2 The object of green building assessment: No only new buildings but also old ones
In addition to the integration of green building assessment systems, another thing should be pointed out is that the assessment system should not only include the new buildings but also the old ones. Formerly, the object of green building assessment in China mainly concentrates on the new building. Take the performance assessment system for commercial house for...
example, the time of assessment is when the building has just been built and will put to the housing market. In fact, large amount of existing old buildings are also playing an important role in green building field. For instance, bad sewage system of old buildings can make big trouble to environment. And inferior heat preservation performance because of the poor envelope system of old buildings can also cause large quantities of energy waste. Furthermore, in some of the old residential districts, the indoor air quality is much worse. Therefore, green assessment system for such building should also be carry out. There are two obvious benefits to build such a system. First, based on a green performance assessment system, we can have a clear understand about the green character of a certain building, which can help us have a more reasonable maintenance and renovation plan for it. Secondly, also through a green performance assessment system, we can identify the green performance of all the buildings of a city or a certain urban district, which can help us make a more efficient policy for sustainable urban renewal and development.

3.3 Implementation of the assessment system: from passive reception to initiative action

Indeed, the implementation of green building assessment system is not less complicated than the construction of such a system. In a manner of speaking, the green assessment system is formerly a passive reception system, which is shown in figure 3(a). The law and regulation has been made by the government. And the real state broker, the designer and the general contractor, who play an important role in the green building implementation, usually passively accept the laws and regulations. In other words, they just separately pay attention to the restrictions with regard to their corresponding responsibilities in the green building laws or regulations and try to make sure they obey the rules so that they will not be punished. As long as the project meets the demand of the green building rules, they usually do not want to spent much time thinking about how to get better design alternatives from the sustainable construction point of view any more. At the same time, the purchasers also passively accept the real estate because they lack of the knowledge and awareness of the importance of green building.

To change from such a passive reception system to an efficient initiative action system, two measures are suggested. Shown in figure 3(b), the first way is that the government should use suitable tax policy to provide incentive for green building implementation. For example, if the real estate company adopts green building methodology in their project, they will have a tax reduction. Then the real estate company, which is the main director of planning, design and construction of a real estate project, will ask the designer and general contractor to choose optimising design and construction alternatives following green building concept. The same
incentive policy can also be used to design consultant and construction company. Another way is to increase the propagation and education of the green building idea, through which the purchasers can identify the importance of sustainable construction and understand the green building performance of a building. Then they will choose their houses more deeply based on the green building standard. As a result, the market will let the real company actively think more about using green building assessment in the process of project planning, design, construction and so on.

4. PERSPECTIVE
Green building has been widely accepted as one of the most important development strategies for construction industry all over the world. In China, with the largest population in the world, green building is absolutely a wise choice for the development of the country. At present, the rapid progress of Chinese economy, the improvement of people’s sustainable development consciousness, the enhancement of international cooperation in sustainable construction field, have provided a good environment for the development of green building. Undoubtedly, green building will make great progress in China in the near future.

REFERENCES
Environmental Building News http://www.buildinggreen.com/
Environmental Protection in China http://www.zhb.gov.cn/