

THE CHARACTERISTICS OF DEVELOPMENT OF CHINESE GREEN BUILDING

Yang Miao* & Xu Lei** & Jian Ge***

*Department of Architecture, Zhejiang University, Hangzhou, P.R.China, Email:cici0620ster@gmail.com

**Department of Architecture, Zhejiang University, Hangzhou, P.R.China, Email:zdjj@163.com

***Department of Architecture, Zhejiang University, Hangzhou, P.R.China, Email:zdjj@163.com

ABSTRACT: Green Building has become an important part of China's national sustainable development strategies since 2005, and gradually appears to show Chinese own characteristics in the 4 years. In combination with the participation in the top-level Green Building design programs and a number of Demo Projects, the author summarises and analyses the main characteristics of development of Chinese Green Building in the following 7 aspects: 1. The critical role of the government; 2. *Four Savings & One Protection* as the core content; 3. Building energy conservation as a starting point; 4. Technical system; 5. The appropriateness of technology; 6. Security system and market mechanism; 7. Evaluation System. Those summary and analysis will not only be a great help in facing the new challenges, but also a necessary prerequisite to promote sustainable development of Green Building in China.

KEYWORDS: Green Building, China, Characteristics, Demo Projects

1 OVERVIEW OF CHINA'S GREEN BUILDING

In 2005, State Department of China promulgated the *The People's Republic of China Science and Technology and long-term Development Plan (2005-2020)*, which explicitly *building energy conservation and Green Building*, as a national long-term scientific and technological development in the major fields of research. Since then, China's Green Building has been in the full implementation with the strong promotion of government.

The current status of the construction industry in China is considered, which includes several major pressures: 1. The pressure of demand in housing (Figure 1); 2. Resources and environmental pressures (Figure 2); 3. Pressure in improving the quality; 4. A demand of national long-term strategy on the construction industry. Developing the Green Building in China is the only way to get into the world's mainstream and realize the international responsibilities.

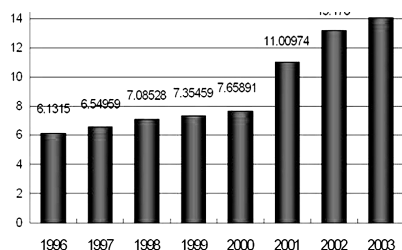


Figure 1 The growth of China's urban housing construction area (1 billions per year)¹

Resource Type	World ranking	Proportion of the world average per person quantity
Freshwater	6	25
Mineral Resources	3	50
Energy	3	70
Natural gas	9	40
waterpower resources	1	63
Land Resources	3	33
Arable area	4	40
Forest Area	5	14.3
Grassland	2	50
Petroleum	16	10

Figure 2 Resource status of China

2 CHARACTERISTICS OF DEVELOPMENT OF CHINESE GREEN BUILDING

Chinese Green Building development system comes from developed countries, mainly reference to the U.S. Green Building Rating System LEEDTM (the US Green Building evaluation system - Leadership in

Energy and Environmental Design Rating System). Thus both of the System Formation and Operation mode are in line with international practice. Chinese Green Building system is formed with Chinese characteristics in accordance with the LEED mode.

Look back to the four-year development course, the Green Building development in China has shown several characteristics in the following 7 aspects:

2.1 The critical role of the government

Since 2005 the biggest characteristic of Chinese Green Building implementation is the government's leadership. All from the implementation details of standards & technology to the formulation of organization institutions & certification authorities, are implemented by the government directly, which is considered as the most vigorous throughout the world, widely different from that of developed countries.

First of all, the government reinforced the support on technology and Input. Fully implementing the scientific and technological development policies of independent innovation is explicitly proposed in the *11th Five-Year plan*.

Secondly, the government invested heavily in the construction of the Demo Projects. The platform of Green Building technology and product of Tsinghua University in Beijing and the Office Building of Green Building Engineering Research Center of Shanghai Research Institute of Building Sciences were finished in 2004 and 2005 respectively, and Shanghai historic protection building Wenyuan Building in Tongji University in 2007. Later in 2008, the State Council put forward *Organize the implementation of 30 energy-efficient, Green Building Demo Projects*.

Finally, the government strengthened the implementation of energy-saving, so as to promote Green Building. According to Ministry statistics, the rate of the implementation of mandatory energy-saving for the new buildings in design periods increased from 53% in 2005 to 97% in 2007; and that in construction period rose from 21% in 2005 to 71% in 2007. It will be endeavored to the end of this year, the rate of the implementation of mandatory energy-saving for the new buildings in construction period will grow to 90%.

2.2 Four Savings and One Protection as the core content

In 2006, China's STANDARD defined green building as *Architectures that save resources (energy, land, water and material) furthest, protect the environment and reduce the pollution, provide a healthy, suitable and high-efficient living space for human, be harmonious with the nature*. The core is *Four-Saving and One Protection*, which is considered as the goal of Chinese Green Building is in accordance with the general strategically targets of the 11th Five-Year plan. It is the direction made by the government based on current status and possible future goals of Chinese architecture.

2.3 Building energy conservation as a starting point

The national *11th Five-Year Plan* proposed to build a resource-saving and environment-friendly society, and the building energy conservation is specially mentioned in the chapter of circular economy development, which is taken as the priority project of the key field Urbanization and Urban Development in *the National long-term Science and Technology Development Plan*.

China has initially established the 50% energy conservation as the goal of building energy conservation design standard system after 10 years' exploration. Especially in 2005, architecture design was requested to follow the *Public Building Energy Conservation Design Standard*. Ever since the building energy conservation became a mandatory regulation, the increase of the energy consumption has been well controlled. Like in 2006, Chinese unit GDP energy consumption dropped for the first time. Figure 3 shows the importance and the necessity of Building energy conservation as a starting point.

Throughout the four years of vigorous promotion of Chinese Green Building since 2005, Chinese government established series of activities including special plans of national and regional building energy conservation, and relevant policies and regulations. Besides, the government organized building the technology research and form the supporting system of building energy conservation initially.

2.4 Technical system

The development of Chinese Green Building is still in its preliminary period, without the formation of complete, holistic and systematic system supported by independent innovation. Hence, in the technical field, including building energy conservation, natural ventilation, decoration materials and waste recycling,

etc,China started technical system of Green Building with importing the technology from developed countries,then applied the integrated technology ,and followed by the development of integrated and source innovations which are just started and urgently needed in China.

2.5 The appropriateness of technology

China has broad territory with huge differences of climate as well as energy consumption characteristics between northern and southern China.(The climate divisions are Northeast Cold Zone, North-China Cold Zone, Central Hot Summer and Cold Winter Zone , Hot zone in South China, Yunnan-Guizhou Moderate Area, Qinghai-Tibet alpine zone, Northwest Dry&Cold Zone.Figure 4) . At the very beginning of the promotion of Chinese Green Building, both technology and theory are directly from the western countries in US and Europe which are mainly suitable for cold areas. That means the Chinese Green Building follows the characteristics of high-latitude regions.As a result,the appropriateness issues remain unsolved for other climate zones in the initial period. Therefore, the appropriateness of technology should be emphasized in the future.

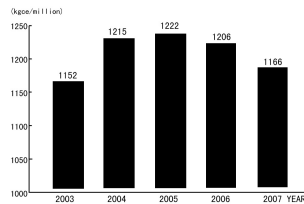


Figure 3 Energy consumption per unit of GDP of China 2003-2007 (kgce/million)

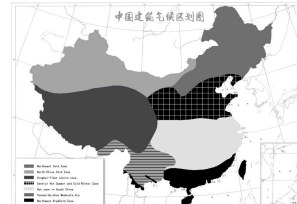


Figure 4 7 climate divisions of China²

2.6 Security system and market mechanism

As it is government-oriented in China, the Green Building is only in an advocating or forcing phenomenon period according to market economic system and humanities advocate in the society. And it is even a speculation for some market participants, far away from the social consensus.One of the biggest reason is the incentive system hasn't received the attention which it deserves in China.

China's current promotion of Green Building has adopted a policy to encourage rather than mandatory promotion, and there are no preferential policies for Green Building, which cause lots of problems in the operating of the Green Building markets. It makes the Green Building hard to “green” develop only with the encouragement of the government and the self-discipline of developers.

2.7 Evaluation System


Chinese Green Building system reference to LEEDTM, is a voluntary used assessment system standard and operating system. The main purpose is to regulate a complete and accurate concept of Green Building to prevent the abuse of Green Building.

Currently there are two types of marks; one is the Green Building design evaluation, valid for one year. The other is Green Building Labeling. The former includes two types of architectures- public buildings and residential buildings, ranking by three levels, 1, 2 and 3. The Innovation Award of Green Building is selected from the same level, which is the highest award of the architectures in China.Similar to LEED, the appraisal of the Chinese Green Building will be ranked by qualitative and a large number of scoring. The relevant department will execute the certification by evaluating the six aspects including Land-Saving ,Energy-Saving etc. The trial operation of marks of national Green Building was started in 2008; it is still in the boot period,first Evaluation & Labeling Projects were published in2008(Table1).

The evaluation system of Chinese Green Building has just been established, the current evaluation system is still much to be desired: First, the level of enactment are not high or authoritative enough, and the rating system is not mandatory,with no economic incentive mechanism; Secondly,there're too much qualitative indicators with too little quantitative indicators and poor operability. Thirdly it lacks corresponding laws and policy support. The real assessment of Green Building should be supported by objective, scientific, systematic, technological and political legal system.

3 CONCLUSION

Green Building in China is developed in order to solve serious practical problems ,and is also a natural return to what should have been, from the defect of the science and technique. The only way to achieve a 'double wins' result in both construction technology and quality is to change the traditional constructing system innovatively. Only in this way can China develop healthily with successful transformation!

	Project	Developer	Evaluation	Picture
Public Building	Office Building of Green Building Engineering Research Center of Shanghai Research Institute of Building Sciences	Shanghai Construction Scientific Institution Ltd	□□□	
	Extension Project of Shenzhen Overseas Chinese Town Sport Center	Shenzhen Overseas Chinese Town Real Estate Company	□□□	
	Expo Center of World Expo 2010 Shanghai China	Shanghai Expo Corporation Ltd	□□□	
	Office Building of Greenland Huichuang International Plaza	Shanghai Greenland Yangpu Real Estate Limited	□□	
	Fengxian Greenland Jade Plaza Building3	Shanghai Greenland Hui Real Estate Limited	□□	
	The headquarter building of Bank of China	Bank of China, General Affairs Department	□	
Residential Building	Jindu Han Palace	Wuhan Zhe Jindu Real Estate Development Co., Ltd.	□	
	Jindu Matrix(Building 1,2,3,5 and Building 6)	Hangzhou Qide Real Estate Limited	□	
	Fourth phase of Shenzhen Vanke City	Shenzhen Vanke Real Estate Co., Ltd.	□□□	
	Wanda Plaza in Wuxi (C, D Area)	Wuxi Wanda Commercial Plaza Investment Co., Ltd.	□	

¹ LongWeiding, Baiwei ,The prospects of development of China's civil air-conditioning[EB / OL] <http://enpinfo.com/HVAC/Tech/Expert/200708/14717.html>

² LuJisheng, Strategic Enterprise Management (Second Edition).BeijinTsinghua University Press, October 2003

REFERENCES

[1] Chinese Urban Studies. China's Urban Studies series of reports - Green Buildings 2009 [M]. Beijing: China Architecture Industry Press, 2009