

Green Building Trends in China



Abhishek Lal

Program Manager
Environmental Market
Solutions



Yingchu Qian

District Manager & Director
of Projects
Environmental Market
Solutions

China has one of the world's largest and fastest-growing construction industries. While this growth has helped fuel economic development, it has also contributed to environmental degradation. "Green building", i.e. more sustainable and environmentally friendly construction is rapidly being developed as a more sustainable mode of development. In addition, local Chinese manufacturing is quickly developing the ability to support this trend towards high-performance green building.

Introduction

The building industry is one of the biggest sectors of the Chinese economy, contributing 16.75 percent of GDP in 2005. At the same time, growth in real estate and construction is consuming tremendous resources – 16 percent of fresh water, 25 percent of timber, 30 percent of energy and 20 percent other materials. Construction also has an impact on local and regional water bodies, air quality and social structure. Such growth creates a more energy-intensive economy that is more dependent on foreign oil. It is projected that within five years 60 percent of gas and oil will be imported, while energy consumption per capita will be seven times that of Japan, six times that of the United States, and 2.8 times that of India.

Because of the impact on energy and the environment, it is critical that the building industry develops in a way that is environmentally friendly and sustainable over the long term. Green building is a powerful tool that can be used to achieve this goal.

What is Green Building?

In recent years the Chinese government has developed several concepts related to green building – for example, "ecological building" and "sustainable building". Despite slight differences in terminology, these concepts essentially communicate the same principles of sustainability. China's Green Building Evaluation System, released on 1 June 2006, officially defined "green building".

While the definition does well to cover energy savings, occupant comfort, environmentally friendly materials, and healthy indoor environments, it does not address the financial impact of sustainable design. This is a key factor that must be included in the definition if green building is to be broadly accepted by realtors and developers. An effective model for green building will not only benefit the bottom line, but can also contribute to addressing environmental issues such as global warming, ozone depletion, water scarcity and depletion of other natural resources. By generating demand for environmentally sound products, the building industry can also "green" the many industries that supply the construction market.

Finally, an important concept in green building is "integrated design". Integrated design is used to create buildings that optimise energy performance and involves focusing on how all the key building systems function together. Computer modelling is used to understand the relationship between building systems, energy savings, and the resulting financial benefits of different strategies.

The Development of Green Building

The idea of sustainable design and high-performance buildings has progressed in tandem with environmental awareness and demand for energy efficiency in countries such as Germany, the UK, the US and Canada. The trend towards green building has also been heavily influenced by demand for healthier indoor environments, and

Pic. 1 | Low-E Process Line



concerns about poor indoor air quality, or “sick building syndrome”. Such concerns are important, highlighting the trend towards environmental responsibility and enhancing building occupant comfort. The latter focus is of particular relevance to building owners and companies that have embraced sustainable design, since occupant comfort can significantly improve worker health and productivity.

In China, green building reached a milestone in 2004, when the United States Green Building Council (USGBC) presented leadership awards to ten Chinese real estate developers and government leaders for their “pioneering work in transforming the world’s largest building industry”. The developers – some of China’s largest – were the first to pursue the USGBC’s Leadership in Energy and Environmental Design (LEEDTM) certification. This event demonstrated China’s acceptance of green building standards in general and USGBC’s LEEDTM rating system in particular.

Today, more than 45 projects in China have achieved or are aiming for LEEDTM certification. These buildings represent a construction area of more than 5 million square metres. There are other guidelines being used as well, including China’s national standard for green buildings, or Germany’s Energy Passport, a design tool used to develop energy-saving strategies. There is much more potential for growth in green building as China moves to develop a national green building council modelled on the USGBC and similar organisations around the world.

Financial Benefits of LEEDTM Projects

The following table presents a sample of Chinese LEEDTM projects and the associated incremental costs of sustainable design and technology. The table presents additional up-front investments and the simple payback, or number of years it takes for energy savings to cover the initial investment.

Case Study of Tongji United Plaza

Table 2 presents a detailed case study of Building B, Tongji United Plaza – a 28,880 m² office tower located in Yangpu district, Shanghai. This case illustrates the process of energy analysis and integrated design. Energy and financial analysis for the building, conducted by the owner and local design institute, indicated that high-performance design would incur an incremental cost of only RMB 3.5 million for the developer.

Table 1 | Initial Costs for Green Building vs. Operational Cost Savings/Return of Investment

LEED Status	Increased Initial Cost (%)	Energy Cost Saving	Simple Payback Period (Year)	Reference Chinese Projects
LEED Certified	0-3%	ASHRAE achieved	2-3	Skyway Hotel, Trane TC Factory, GE Corporate Center, etc.
LEED Silver	2-3%	10-20% reduction	2-4	Tiage Apartment, Lesong Shopping Mall, Plantronics Factory, Tianhong Headquarter, DOW Shanghai Center, etc.
LEED Gold	3-5%	15-40% reduction	3-5	Plantronics Office, Interface Showroom, Tongji United Plaza, etc.

Notes:

1. IIC, Incremental Initial Cost, means the additional capital cost required to achieve LEEDTM.
2. The percentage of IIC is compared to total construction fee, including equipment costs and related installing fees.
3. The baseline of IIC is the general design, which should meet the local mandatory codes, including Energy Saving standards.

The payback is based only on the energy saving, not other benefits such as water savings, increased productivity - fewer sick days, reduced churn rate (employee turnover) and market branding. However, studies have indicated that the monetary value of increased productivity is at least 10 times greater than energy efficiency.

Table 2 | Incremental Cost and Payback Analysis

Green Strategy	Annual Energy Cost (RMB)	Extra Initial Cost		Annual Energy Saving (RMB)	Simple Payback Period (Year)	
		Developer	Tenant		Developer	Tenant
Original Design	4,674,799	-	-	-	-	-
ASHRAE Budget	3,806,723	-	-	-	-	-
LPD Optimization	3,243,084	277,950	1,057,050	563,639	0.49	1.88
Daylighting	3,364,915	171,310	486,190	441,808	0.3	1.10
Shading Device	3,789,272		446,100	17,451		25.56
High Efficiency Heat Pump	3,624,791		144,000	181,932		0.79
Integrated Design	2,801,243		4,846,800	1,005,480		4

Tongji United Plaza

The Market for Green Building Products and Materials

The demand for high-performance buildings could become a catalyst for the transformation of the construction products and materials market, which includes not only advanced, high-end technologies, but also some traditional materials. The following section is intended to provide an overview of some of the many green building products available to the construction industry.

Building Envelope

In recent years, China has introduced a series of stringent codes to encourage an energy efficient building envelope. There are many options for building envelope-related energy-saving strategies in the market, such as high performance glazing, insulation and shading devices. Here we shall focus on glazing and insulation materials to provide a general picture of the industry in China.

Pic. 2 | Building B of Tongji United Plaza, which is located in Yangpu district, Shanghai

The market for low-E¹ glazing has been one of the most remarkable areas of growth for China's green building industry. Local low-E glazing manufacturing has developed very quickly in recent years, with production increasing by an annual average of 30 percent. A leading manufacturer, Shanghai Yaohua Pilkington, has shown particularly strong growth, increasing by some 300 percent a year. Good-quality low-E glazing produced by local Chinese manufacturers, some in partnership with multinational companies, is now readily available in the China market.

The market for insulation materials is also growing, but from a smaller scale, since Chinese commercial and residential developments have traditionally used little, if any, insulation. This is changing with the growing popularity of insulation products such as XPS, EPS and fibreglass. In addition, Western companies offering higher-

performance insulation products, such as Icynene², have started to make inroads into the China market.

According to the Chinese Polyurethane Industry Association polyurethane foam insulation is used in only ten percent of Chinese commercial insulation. However, they project that the figure may go up to as much as 50 percent in the next five to ten years, reaching US and European levels of insulation use. While this represents noticeable progress, there is still a need for more awareness of the benefits of insulation, as well as the enforcement of energy codes.

Heating, Ventilation and Air Conditioning (HVAC) Systems

Heating and cooling represent the largest percentage of building energy demand. With growing concerns about global warming and rising energy prices, there is a greater incentive to use more energy efficient HVAC systems.

Several companies in the China market are supplying energy efficient chillers, boilers, energy recovery systems and other energy-conserving products. Many major multinationals, including Trane, Carrier and York/Johnson Controls, have set up manufacturing bases in China for heating and cooling equipment, thus making it possible to source these more efficient products in China. A number of companies have set up manufacturing bases primarily to export energy efficient HVAC equipment to the US and other markets where green products are in greater demand. This investment, and "technology transfer" is beneficial in introducing new technologies to Chinese consumers. For example, a handful of

Pic. 3 | Daylight Analysis Rendering Picture**Pic. 4** | Geothermal Heat Pump Site Work

- 1: Low-E, or low-emissivity glazing, refers to windows and other glass products coated with microscopic layers of metallic oxide that selectively reflect wavelengths of light. The result is a window or glazing product that can reflect heat (or infrared wavelengths) while allowing visible light to enter the building, for a more energy-efficient window system. Under the mandatory provisions, a window, including its frame, must have a U-value of less than 2.8w/m²*k for a window-to-wall ratio of 0.4–0.5 in the hot-summer/cold-winter zone.
- 2: Icynene produces a spray polyurethane foam product with very low volatile organic compounds.

manufacturers are now producing geothermal heat pumps in China. Geothermal, or ground-source heat pumps employ a system of coiled pipes several meters beneath the earth's surface to "pre-cool" or "pre-heat" incoming air. Another example is the manufacture of high-efficiency condensing boilers in China, by companies such as Viessmann.

Lighting Systems

Lighting efficiency is an important element in high-performance buildings. Like HVAC manufacturers, many major lighting fixture producers have a manufacturing base in China, thus making high-performance lighting systems and controls available for building projects. Some of the key technologies available in China include T8 and T5 fluorescent lamps, as well as lamps with low mercury content. Several manufacturers, such as General Electric, are also producing lighting controls, occupancy sensors, and dimming systems that modulate lighting levels in proportion to available daylight.

Fit-Out Materials

Despite the improving supply of energy efficient equipment, there is still a lack of products and materials that meet stringent indoor environmental quality standards. As stated earlier, indoor environmental quality and indoor air quality (IAQ) have become important issues in improving occupant health and comfort. Many building materials pose a threat to IAQ because of high levels of volatile organic compounds (VOCs). Chinese manufacturers can take advantage

Pic. 5 | Direct/Indirect Lights



of this "gap" in product availability to meet the demand for environmentally sound, low-emitting paints, sealants, carpets and other interior finishes. As with all of the above green products, low-emitting finishes could be a lucrative market for Chinese manufacturers, both for export and for the domestic market.

Summary

The World Bank estimates that roughly half of the world's new building construction will take place in China between now and 2015. The majority of these projects are large-scale — commercial office buildings between 1 and 1.4 million square meters and mixed-use developments of up to 929,000 square meters. China's entry into the World Trade Organisation, its successful bids for the 2008 Olympic Games and 2010 World Expo, and its general integration into the world economy have all contributed to an investment boom that promises good times ahead for the building industry. Through green building, this growth can become a path to sustainability. ■

PROFILE

EMSI provides planning, architectural and engineering services that focus on creating energy efficient, resource conscious, healthy and productive buildings and neighbourhood developments. Our mission is to foster a global sustainable built environment by helping to create developments that are economically beneficial and environmentally responsible. EMSI is the leading sustainable design consulting firm in Asia, having completed LEED design for a wide range of building types totalling over 10 million SF in construction area. Our clients include several Fortune 500 companies as well as some of the world's leading A/E firms and commercial real estate developers. For more information on EMSI please visit www.emsi-green.com.

CONTACT

Abhishek Lal | Program Manager | EMSI | 6856 Eastern Avenue, NW | Suite 206 | Washington, DC 20012

Tel: 202-291-3102 | Fax: 202-291-3107 | E-mail: alal@emsi-green.com | Web: www.emsi-green.com

Yingchu Qian | District Manager & Director of Projects | Environmental Market Solutions, Inc. (Shanghai Branch)

Suite F, 18F, No. 1, South Ruijin Road | Shanghai | China | Tel: +86 21 64435765/64435766

Fax: +86 21 64435767 | Email: ycqian@emsi-green.com | Web: www.emsi-green.com