Sustainable Building Development in China

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Outline

1. Construction Development in China
2. SB challenge and opportunities in China
3. Integrated Eco-building technology application
1. Construction development in China
I. China overview
Brief information

- Population: 1,300,000,000
- Land territory: 9,600,000 km²
- One of the Four Cultural Ancient Countries (cultural heritage over 5000 years)
Cultural heritage

The Great Wall
Cultural heritage

Terra-cotta Warriors

The Museum of the Terracotta Warriors and Horses

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Cultural heritage

The Forbidden City

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Cultural heritage

The Gardens of Suzhou

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II. Construction in China

- GDP in year 2005: **2400 billion US$**
- ~5% of the world GDP and ranked No. 4 in the world
- GDP growth rate: **9% annually**
Construction market

- Existing building area: 40 billion m²
- New construction annually: 2 billion m²
By year 2015, half of the world’s new building construction will take place in China; more than one-half of China’s urban residential and commercial building stock in 2015 will likely be constructed after the year 2000.

---The world
Expo 2010 Shanghai

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Modern Shanghai

Formula 1 motor race

Magnetic train

New airport

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Modern Shanghai
Beautiful city
2. SB challenge and opportunities in China
Resources in China

China is a large country but is short of resources. The per capita resource of

- Agricultural field: \( \frac{1}{3} \) of the world average;
- Water: \( \frac{1}{4} \) of the world average;
- Forest area: \( \frac{1}{5} \) of the world average;
- Oil is: \( \frac{1}{10} \) of the world average;
- Natural gas: \( \frac{1}{22} \) of the world average.
Challenges in China

Consumption:
- 8% of the oil consumption;
- 40% of the cement;
- 31% of the coal;
- 25% of the aluminum.

Outputs:
- 5% of the world GDP.
Construction sector in China

- Building consumes 27.6% of the total energy.
- Building material consumes another 16.7% of energy.
- 2 billion m² new buildings in 2003, but only 5% with energy saving performance.
- 20 billion m² more in the coming 15 years.

Large quantity of energy will be needed in future!
Construction sector in China

Sustainable building and construction: the only development option of China!
Green buildings campaign in China

- International Green Building Conference
  - Experts from all over the world;
  - Took place annually since 2005;

Vice premier Zeng, Peiyan come to the conference
Green buildings campaign in China

- National Project of Building Energy Conservation, as one of the 10 national energy conservation projects.
  - New buildings: to save energy by 50%;
  - Building retrofit: heating and air conditioning energy efficiency;
  - Renewable energy: solar energy, heat pumps

By year 2010, to invest more than 400 billion US$ for this project and expects to save 100 million tons of STD coal.
Green buildings campaign in China

- National Evaluation Standard for Green Building
  - Land savings
  - Energy saving
  - Water saving
  - Material saving
  - Environment friendly
  - Operation optimization

- Green building Guidance
  - Points how to construct a green building
Green buildings campaign in China

- Local government and institutes
  - Theory researches
  - System performance update
  - Technology integration
  - Demonstration projects
3. Integrated Eco-building technology applications
Eco-building concepts

Environmental Protection

Energy Saving  Eco-building  Resources Saving

High Quality
SRIBS Eco office building

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Technical objectives

- To save energy by 75% compared with traditional existing building
- 20% of the total energy consumption is from renewable energy
- 60% of the resources are the 3R materials
- Healthy and comfortable indoor environment
Integrated technologies

Natural ventilation
Integrated technologies

Energy efficient building envelope
Integrated technologies

Day lighting
Integrated technologies

Hot water-silicon cooling (15kw) system

PV panels (5kw) linked with power network
Integrated technologies

Liquid desiccant cooling HVAC with heat pump system
Integrated technologies

Concrete made of reused aggregate
Integrated technologies

Eco-planting

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Integrated technologies

Rain water collection and grey water technology
Integrated technologies

Integrated control system
Integrated technologies

Comfortable indoor environment

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SRIBS Eco house

SRIBS Eco apartment
Technical objectives

- Low energy consumption
  - “Zero” energy consumption house
  - Low energy consumption apartment
- Efficient use and reuse resources
- High quality of indoor environment
Energy efficiency

Heat transfer coefficient

$K_{\text{wall}}: \quad 0.3 \text{ W/ m}^2\cdot\text{C}$

$K_{\text{roof}}: \quad 0.25 \text{ W/ m}^2\cdot\text{C}$

$K_{\text{window}}: \quad 2.5 \text{ W/ m}^2\cdot\text{C}$
Energy efficiency

Shading
Energy efficiency

Heat pump
Energy efficiency

Renewable energy

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Resource efficient technologies

3R material
Resource efficient technologies

3R material
Resource efficient technologies

Water saving appliance
Resource efficient technologies

Garbage sorting and central transporting system
High quality of environment

Day lighting

Natural ventilation
High quality of environment

Roof garden  Vertical planting
High quality of environment

i-home system
Future applications

2010 Expo Shanghai related constructions
Future advanced Eco-home exhibition –2030?
Conclusions

- China is a prosperous country, but still a long way ahead for sustainable development.
- SB in China has been payed enough attention and relative measures are being taken.
- As the largest city, Shanghai is playing an important role for China’s development.
- Events like Expo and Olympics will provide a huge stage for the world.
Thanks for your kind attention!

Welcome to Shanghai China!