3. HK CHALLENGES OF GREEN BUILDING
MAJOR HK CHALLENGES OF GREEN BUILDING

• MATERIAL FLOW

• ENERGY WITH LOW CARBON EMISSIONS

• INDOOR ENVIRONMENTAL QUALITY

• DENSITY
  • IMPACTS AT URBAN SCALE

• COST AND BENEFIT ANALYSIS. LIFE CYCLE COST

• USE OF LOCAL RENEWABLE SOURCES OF ENERGY
MAIN PROBLEMS TO ADDRESS

HEAT ISLAND EFFECT AND CLIMATE CHANGE

VISUAL POLLUTION

EXCESS OF WATER RUN OFF

DESTRUCTION OF BIODIVERSITY

DESTRUCTION OF NATURAL HABITAT

NOISE

WATER POLLUTION

AIR POLLUTION

EXCESS OF CONSTRUCTION DEBRIS
4. HK GREEN BUILDING, WHERE TO GO?

CONCLUSIONS

• COLLABORATIVE APPROACH BETWEEN DIFFERENT CERTIFICATION TOOLS
  • FOSTERING CHINA – HK EXPERIENCES
  • LEARNING FROM OTHER LATITUDES
  • THINK GLOBAL, ACT LOCAL (POLICIES)
• ACADEMIA-PUBLIC SECTOR-PRIVATE SECTOR
  • FROM LABELS TO CRITERIA
• DEVELOPMENT OF FEASIBLE TECHNOLOGIES
4. HK GREEN BUILDING, WHERE TO GO?
5. RESEARCH ACTIVITIES AND PROJECTS
Sustainable practices

• Renewable Energy
• Daylight & Sunlight
• Natural Ventilation
• Double Skin Façade (DSF)
• Green Wall & Green Roof
Building Integrated Photovoltaic (BIPV) system

Design

Photovoltaic panels to the windows block the sun

3 Sub systems:

• Support sub-system: from the complex composition of crystalline photovoltaic panels, installed on rooftops of buildings;

• Sunshades sub-system: double-glazed photovoltaic panels and equipped with built-in single-crystal photovoltaic cells. These photovoltaic panels installed on the external walls of buildings, for one floor to floor, all 12 windows on the south half of the sun to provide shelter; and

• Skylight sub-system: double-glazed photovoltaic panels and equipped with built-in single-crystal photovoltaic cells. These vertical panels installed on the main entrance lobby to replace some of the existing glass atrium glass wall.

The BBC reports that a miniature urban wind farm is being built on top of a 13-storey building in Manchester city centre using micro wind turbines.

The 24 turbines, which will stand 3m tall, will be erected on top of the CIS building on Portland Street.

The turbines will produce 56,000 units of renewable energy each year, enough electricity to service about 5% of the energy needs of the building.
Natural Ventilation

Solar Chimney

Five Solar chimney will be installed in order to regulate temperature and bring away water vapor. The efficiency of which was investigated during the CFD Study. Natural ventilation is achieved with minimal assisted mechanical ventilation using pendant fans with temperature sensors as control device.
Natural Ventilation

Fig. 9 Air velocity vector in a middle plane in case 3

Fig. 10 Relative humidity distribution in a middle plane in case 3

Fig. 11 Air temperature distribution in a middle plane in case 3

Fig. 12 Air velocity vector in a middle plane in case 4

Fig. 13 Air temperature distribution in a middle plane in case 4

Fig. 15 Relative humidity distribution in a middle plane in case 4
A translucent double curtain wall façade provides a high performance envelope that reduces heating and cooling loads by providing a buffer to extreme outdoor temperatures. Operable windows in the inner wall add to natural ventilation at seasonally appropriate times of the year. 

http://www.aeieng.com/services/sustainable/projects/manitobasustainable.htm
DSF Examples

Gemeinnützige Siedlungs- und Wohnbaugenossenschaft mBH (GSW) Headquarters, Berlin, Germany

The east façade consists of automatically and manually-operated triple-glazed windows with between-pane blinds. Louvered metal panels also occur on the east façade to admit fresh air independently from the windows.

The west façade consists of a double-skin façade with interior double pane windows that are operated both manually and automatically and a sealed 10-mm exterior glazing layer. The interstitial space is 0.9 m wide. Wide, vertical, perforated aluminum louvers located in this interstitial space are also automatically deployed and manually adjustable. The louvers can be fully extended to shade the entire west façade.

Source: http://gaia.lbl.gov/hpbf/perfor_c.htm
Daylighting: Anidolic Light Pipe

This graph shows the three zones of daylight illuminance:

1. less than 100 lux
2. between 100 and 200 lux
3. more than 200 lux

The use of Anidolic light pipes contributes more light in the deep zones (7 to 10 meters from window). To get the maximum benefits of daylight, the integration with artificial lighting should be applied, especially for the zones where daylight illuminance drops to less than 200 lux.

Note: The Government requirement of the minimum illuminance at water surface level is 200 lux.
Green Roof & Green Wall

Benefits of green roof / wall

**Environmental –**
- Improve roof capacity of Rainwater retention
- Mitigate Urban heat island
- Promote Biodiversity

**Energy-**
- Improve energy efficiency by acting as an insulating layer and reducing heat flux through roof
- Roof durability by protecting roofs from climate changes

**Social-**
- Promote health and well being
- Enhance productivity of employees
- Increasing property value
Green Roof / Wall

Design guidelines

- Green roof design could incorporate PV panel
- There is a positive interaction between two sustainable technologies - Green roofs reduce operation temperature of the PV system, thus increasing efficiency and energy yield PV array offers shading for green roof, thus improving growth of plants and increasing number of species.
Green Roof / Wall

Design guidelines

- Skylight design is a good idea for a wide-span green roof with the spaces underneath used for exhibition/library purpose.
Green Roof / Wall

Marché des Halles in Avignon

Musée du Quai Branly in Paris

Source: www.georgehernandez.com
Green Roof / Wall

Caixa Forum, Madrid, Spain

Living Walls, Netherlands

Source: www.environmentalgraffiti.com
Green Roof / Wall

Design guidelines
The structure design should take into account the load of the green roof ingredients—mainly the growing substrate:

80-150kg/M² for an extensive green roof (10-15CM growing medium, planted with sedum grass, generally inaccessible)

250-400kg/M² for an intensive green roof (25-40 CM growing medium, planted with shrubs or trees, accessible).

Extensive Green roof system

Intensive Green roof system

Zinco Green roof system
Green Roof / Wall

RESEARCH
Green Roof / Wall

Research

Measurements on local climate
Green Roof / Wall

APPLICATIONS OF RESEARCH IN BOGOTA
Evaluating cost and benefit analysis of green building materials and construction technologies for better implementation and return on investment

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6th & 7th April 2009

A Study of Innovative, aesthetically pleasing and sustainable-oriented building façade and envelope technologies to gain a competitive edge

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THE MICRO - CLIMATIC IMPACT OF GREENERY IN HIGH RISE URBAN BUILT ENVIRONMENT

- USING SITE MEASUREMENTS AND SKY VIEW IMAGE PROCESSING TECHNIQUES

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Classification of Hong Kong’s Urban Heat Island
Thank you!
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