Green Buildings: Better Quality of Life, 11 June 2010 (Fri)

Session 4: Improvement of Sustainability

Operation and maintenance to improve energy efficiency and sustainability of existing buildings

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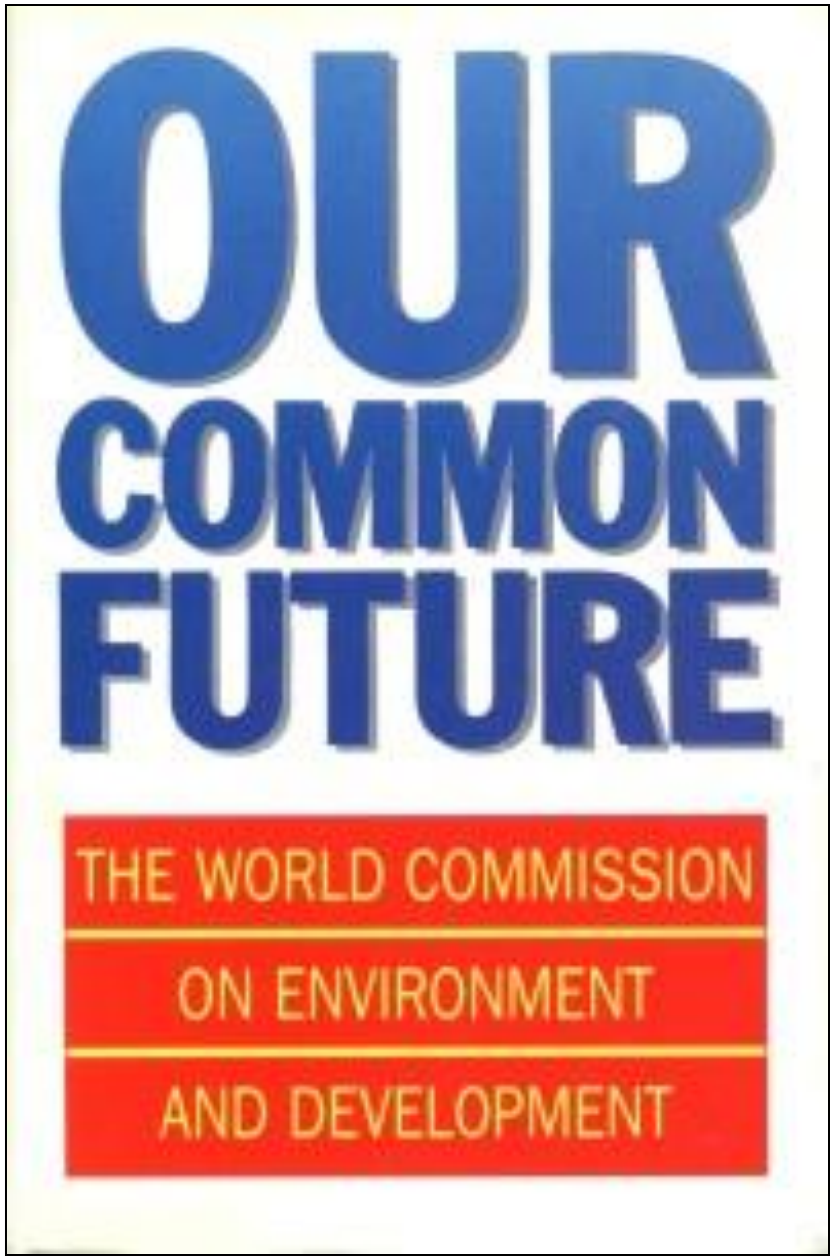


The Brundtland Report defines "Sustainable Development" (S.D.)

Full text of the report:
http://www.un-documents.net/wced-ocf.htm
http://www.worldinbalance.net/agreements/1987-brundtland.html

What is sustainability?

- The Brundtland Report (*Our Common Future)*
  - "S.D. is development which meets the needs of the present without compromising the ability of future generation to meet their own needs." – World Commission on Environment and Development.

「無後為大」– 孔子

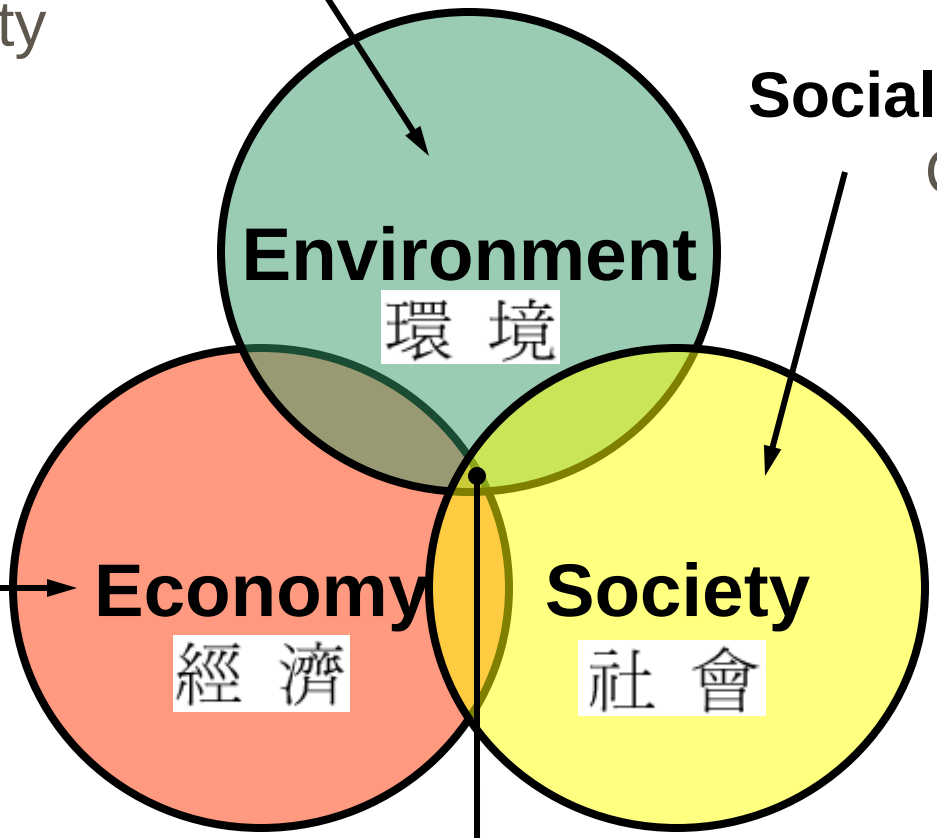
- Two important concepts
  - Needs – maintain an acceptable life standard
  - Limits – within the carrying capacity of supporting ecosystems and resource base

Environmental Sustainability

Ecosystem integrity
Carrying capacity
Biodiversity

Social Sustainability

Cultural Identity
Empowerment
Accessibility
Stability
Equity

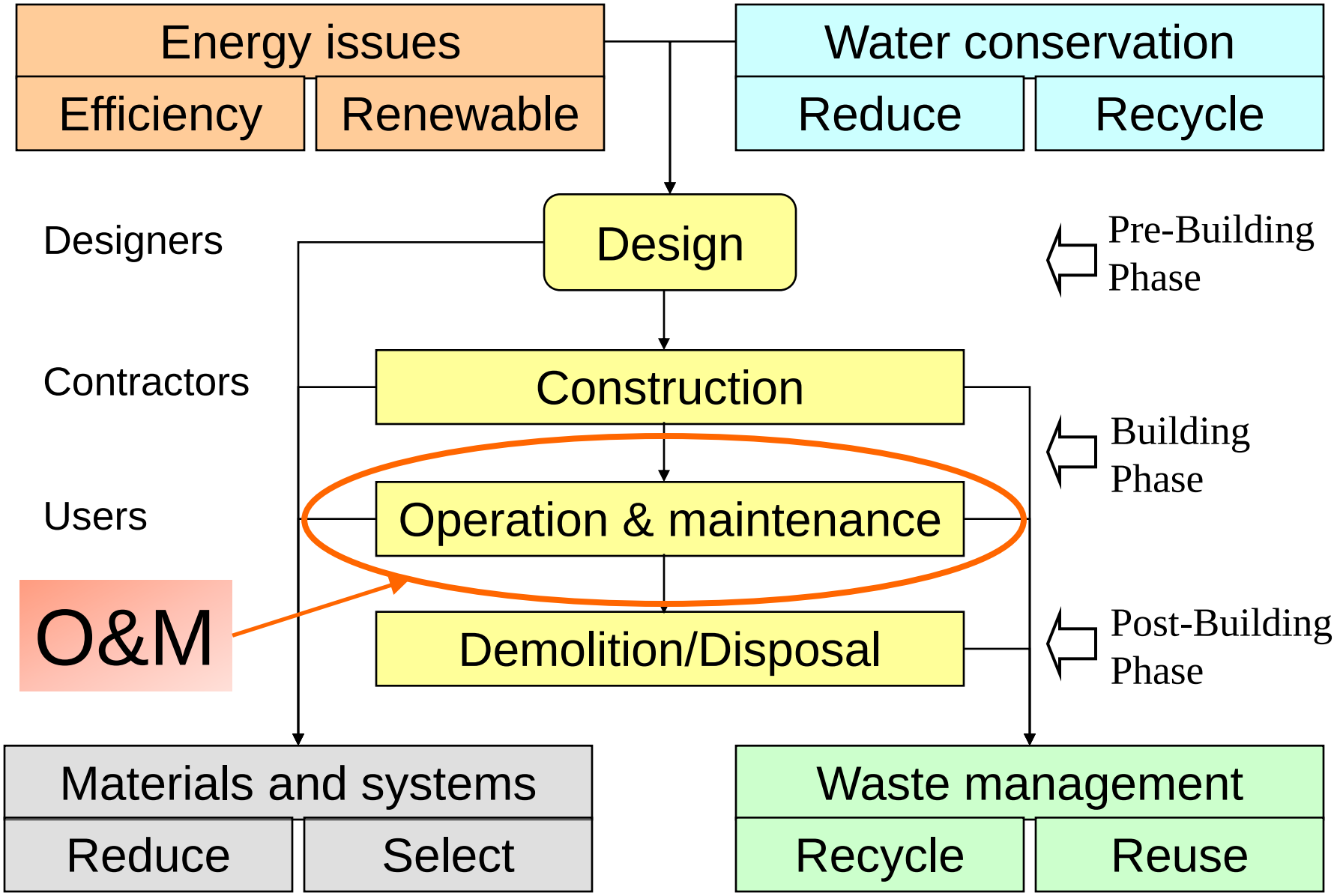


Economic Sustainability

Growth
Development
Productivity
Trickle-down

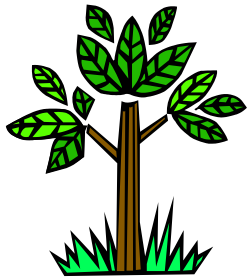
Human Well Being

Three dimensions of sustainability



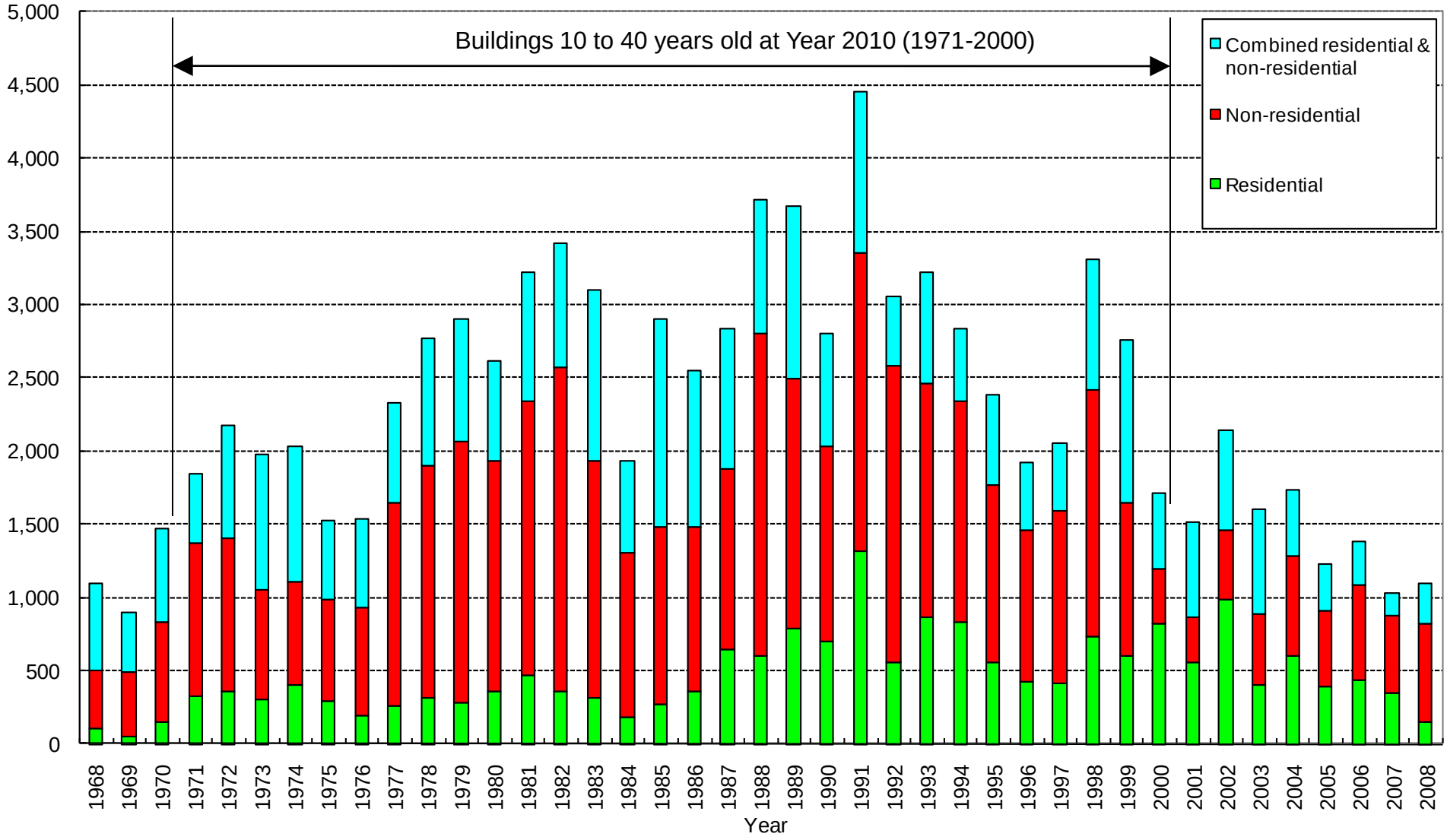
Building life cycle and sustainable construction

Greening existing buildings



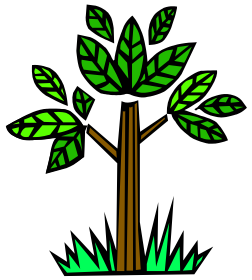
- Existing buildings
  - Major portion of building stocks
  - Consume significant amount of energy/resources
- The potential in Hong Kong
  - Existing buildings 10-40 years old (completed in 1971-2000) = total about 80 millions sq.m
    - Residential: 15 millions sq.m
    - Non-residential: 41 millions sq.m
    - Combined residential/non-residential: 24 millions sq.m

Building Newly Completed in 1968-2008



(Data source: Census and Statistics Department and Buildings Department, HKSAR)

Greening existing buildings



- Need to reduce the cost and environmental impacts of the existing buildings
- Assessment tools for existing buildings, e.g.
  - BREEAM In-Use (building management), UK
  - LEED Existing Building O&M, USA
  - CASBEE for Existing Building, Japan
  - Green Mark for Existing Building, Singapore
  - BEAM Plus for Existing Buildings, HK
  - CEPAS Operation Stage, HK

LEED® for New Construction

Total Possible Points**	110*
Sustainable Sites	26
Water Efficiency	10
Energy & Atmosphere	35
Materials & Resources	14
Indoor Environmental Quality	15

** Out of a possible 100 points + 10 bonus points*

*** Certified 40+ points, Silver 50+ points, Gold 60+ points, Platinum 80+ points*

Innovation in Design	6
Regional Priority	4

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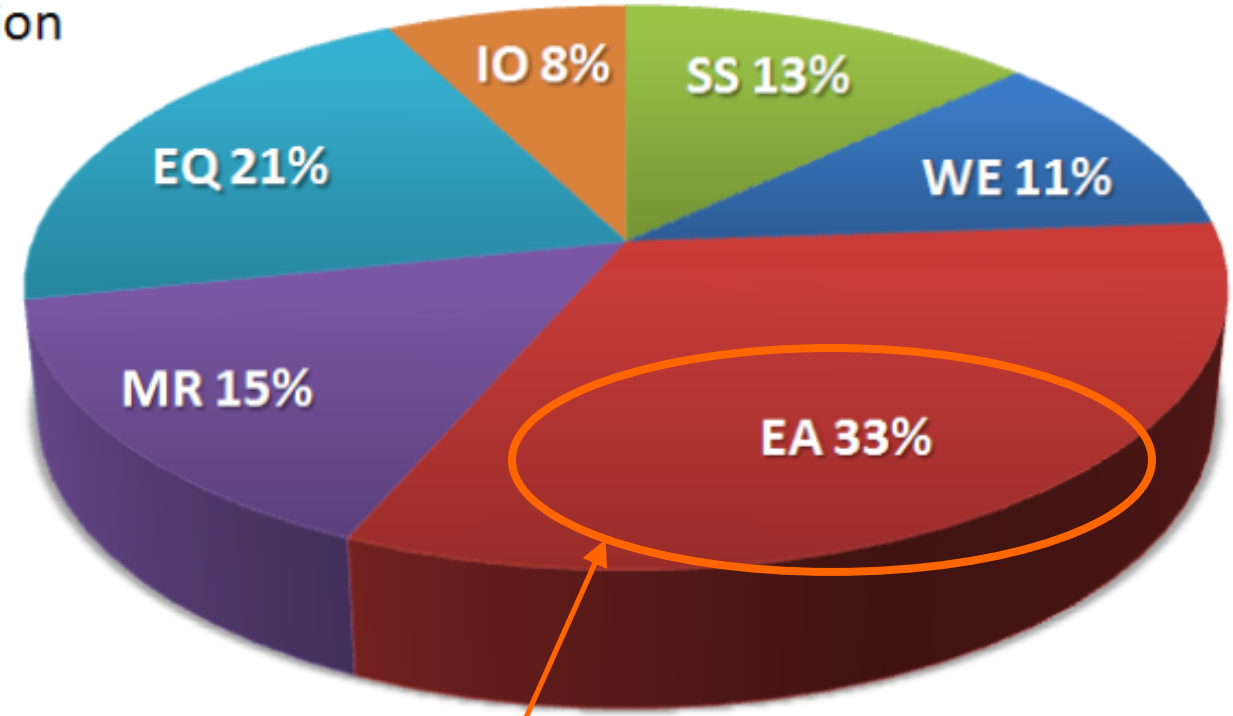
Innovation in Operations	6
Regional Priority	4

For LEED version 3

(Source: US Green Building Council)

LEED-EB Operations & Maintenance

Point Distribution



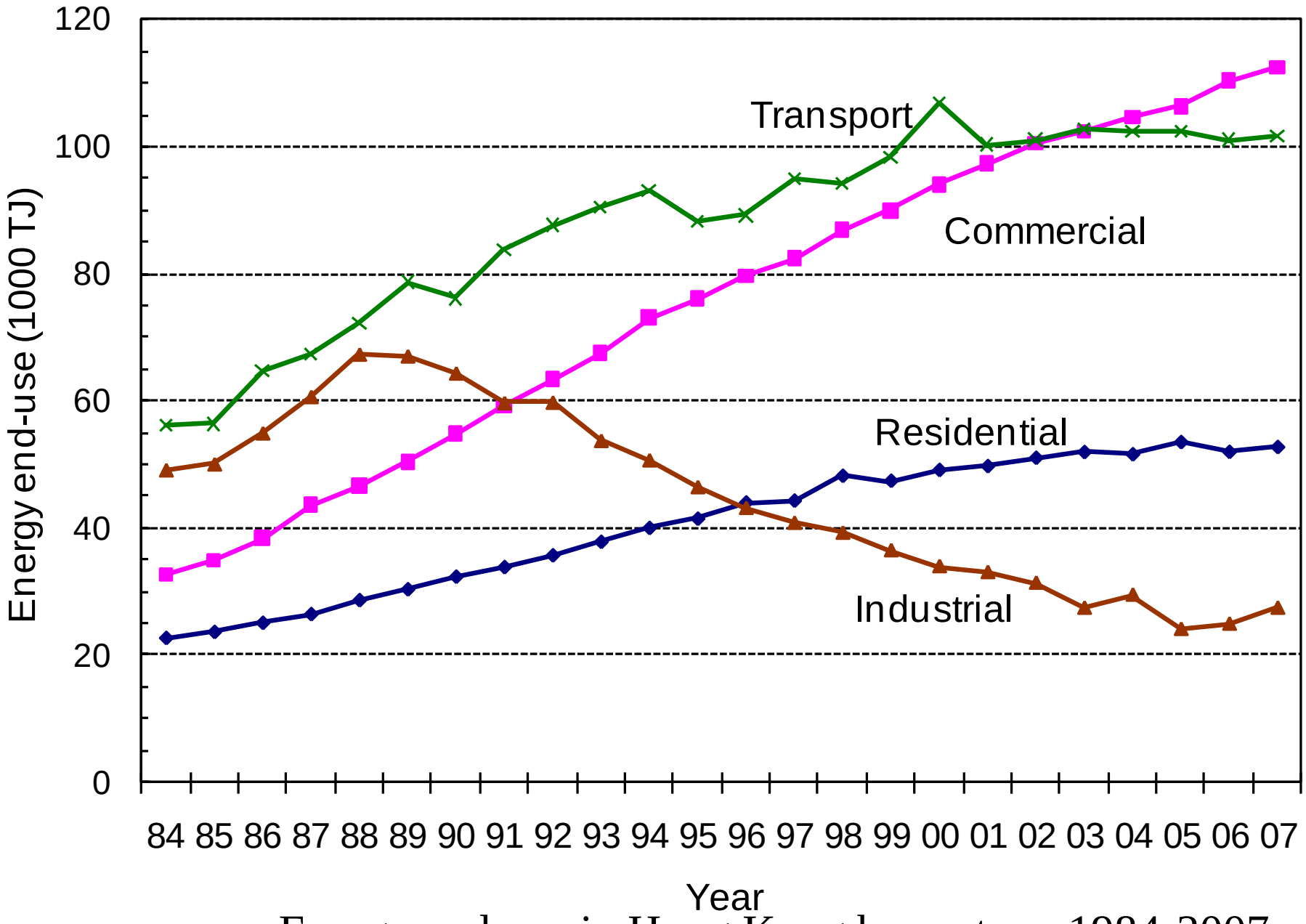
SS: Sustainable Sites
WE: Water Efficiency
EA: Energy & Atmosphere
MR: Materials & Resources
EQ: Indoor Air Quality
IO: Innovation in Operation

Energy issues is the key

(Source: US Green Building Council)

Energy efficiency in buildings

- Buildings constitute 30-50% of energy needs
  - Residential + commercial + industrial
  - The potential for energy saving is large
- The real cost of energy
  - Energy price
  - Environmental costs or externalities
    - e.g. $$ for pollution control & “repairing” of environmental damages
  - Need to internalise the externalities

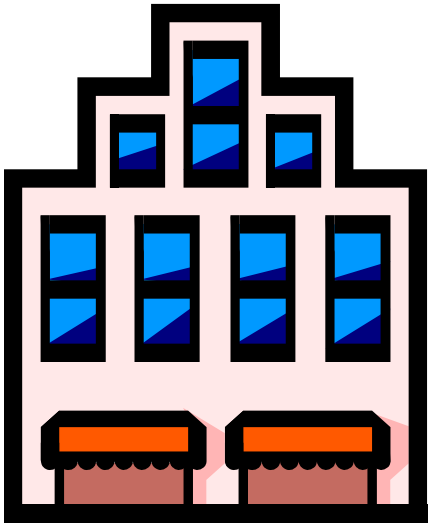


Energy end-use in Hong Kong by sectors, 1984-2007

(Data source: EMSD)

Energy efficiency in buildings

- For new buildings
  - Designing the building
    - Design strategy
    - Control strategies
    - Commissioning
- For existing buildings
  - Operating and upgrading the building
    - Building management
    - Refurbishment/renovation/retrofitting
    - Maintenance and monitoring



Energy efficiency in buildings

- Policy to promote building energy efficiency: HK building energy codes
  - Lighting
  - Air-conditioning
  - Electrical
  - Lifts & escalators
  - Performance-based code

- Put under the Hong Kong Energy Efficient Building Registration Scheme (voluntary)
  - Will become mandatory soon

Building Energy Codes in Hong Kong

(Source: www.emsd.gov.hk)

Good design practices

Integrated & holistic approach (total energy)

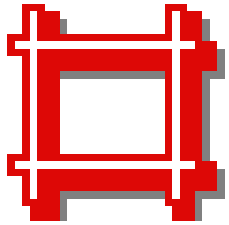
Efficient systems & equipment

Good house-keeping

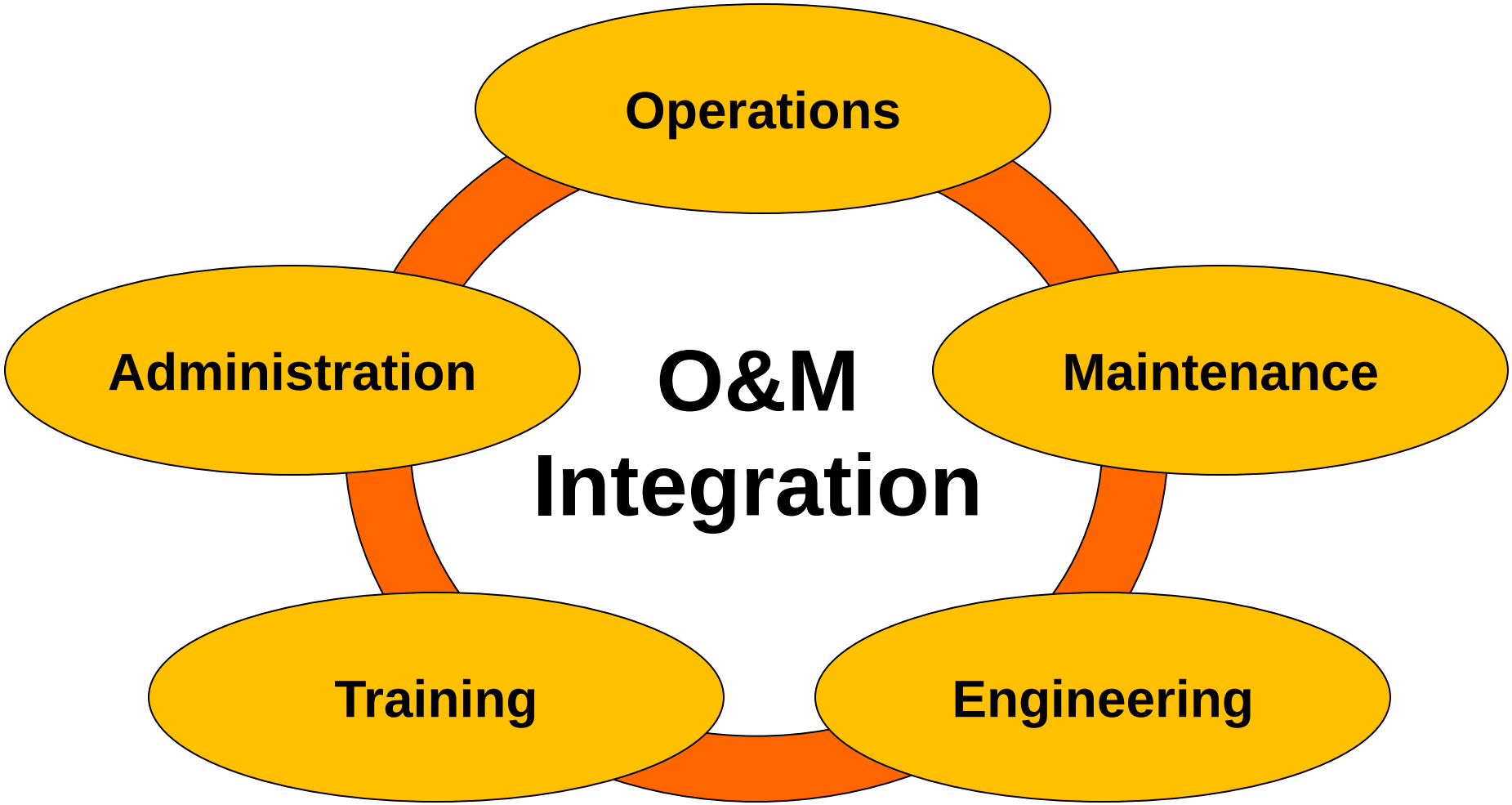
User education & awareness

Efficient operation

Operation and maintenance



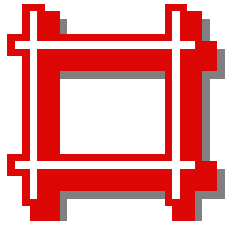
- Aim: to operate building services systems and facilities for maintaining the built environment
- Maintenance work includes
  - Preventive/predictive/planned maintenance
  - Corrective/repair maintenance
  - Trouble calls
  - Replacement of obsolete items
  - Predictive testing & inspection
  - Overhaul



Operation and maintenance (O&M) management

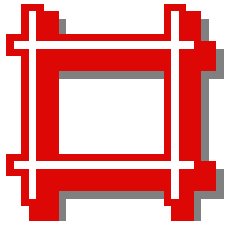
(Source: FEMP, 2004. *Operations and Maintenance Best Practices: A Guide to Achieving Operational Efficiency*)

Operation and maintenance



- Major equipment:
  - Chillers and chilled water pumps
  - Cooling towers
  - Fans
  - Boilers
  - Lighting
  - Lifts and escalators
  - Building automation systems
  - Air compressors

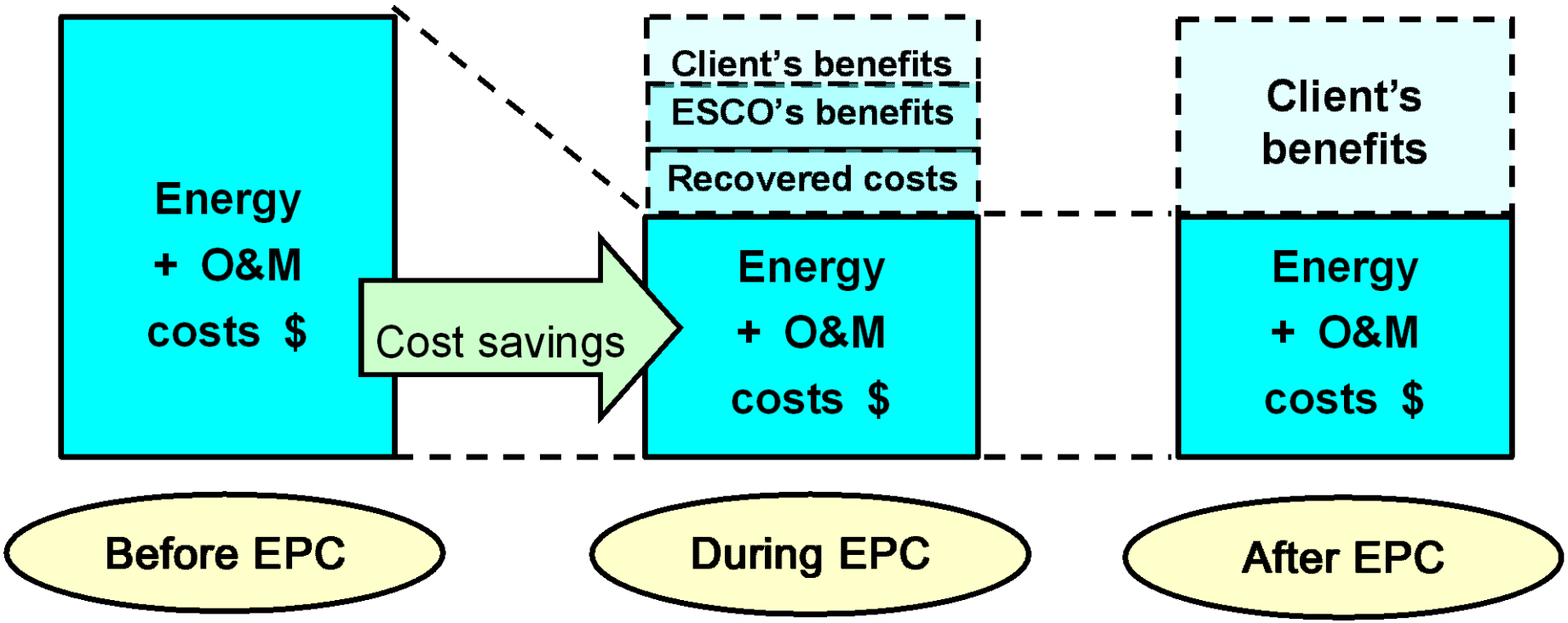
Operation and maintenance



- Barriers
  - Low awareness on O&M requirements
  - Lack of funds and budget constraints
  - Lack of proper O&M policy and procedure
- Technical difficulties
  - Lack of proper O&M information (e.g. O&M manual and commissioning record)
  - Lack of industrial O&M standard
- How to resolve them?

Operation and maintenance

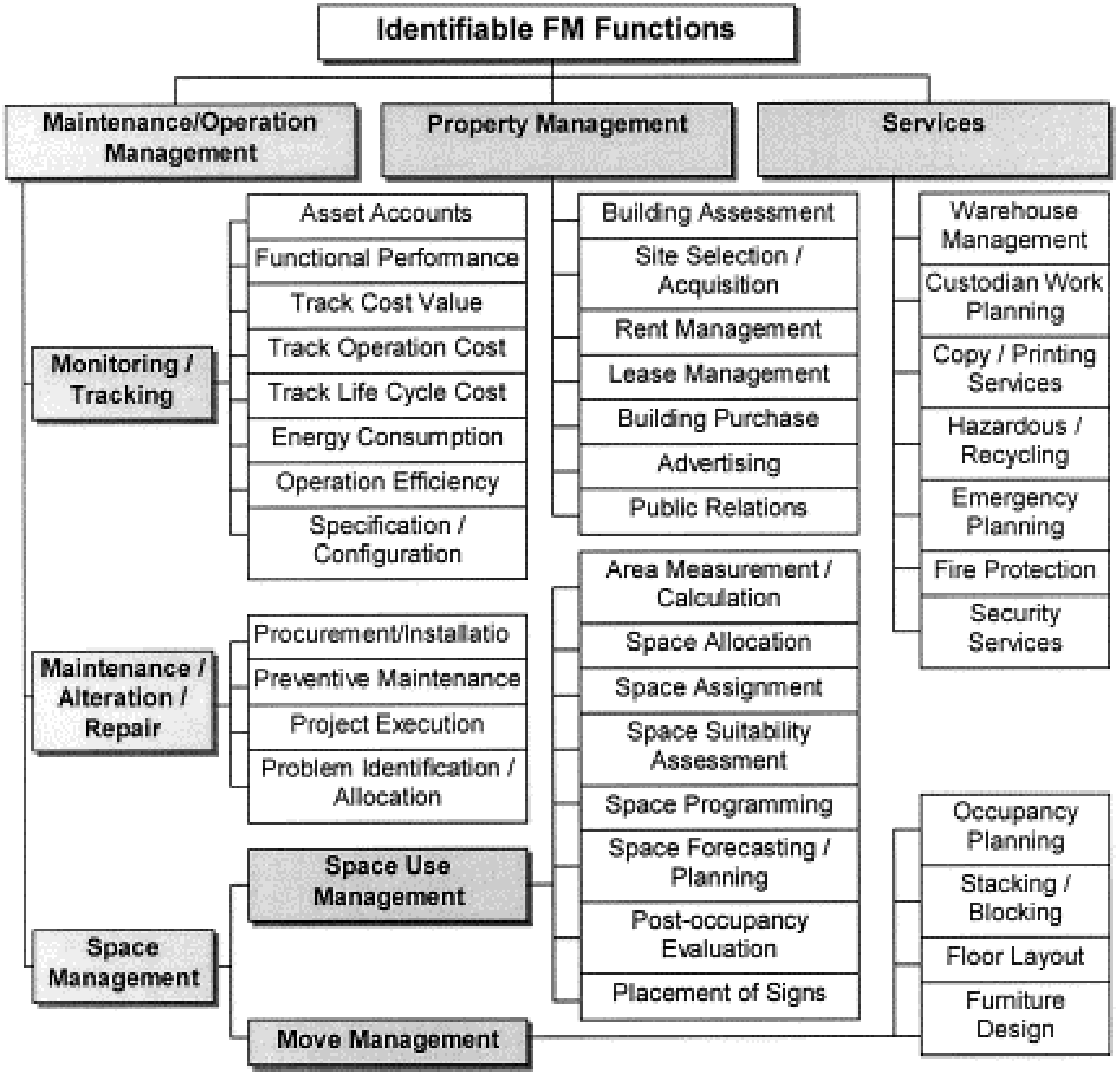
- Energy performance contracting (EPC)
  - = energy savings performance contracting
  - A financing technique to raise money for energy efficiency investments based on future savings
- Energy services companies (ESCO)
  - Offer EPC services, without upfront capital on building owners
  - Becoming an important trend in many countries like USA and Japan; start to grow in HK



Basic concept of energy performance contracting (EPC)

Integrated facility management

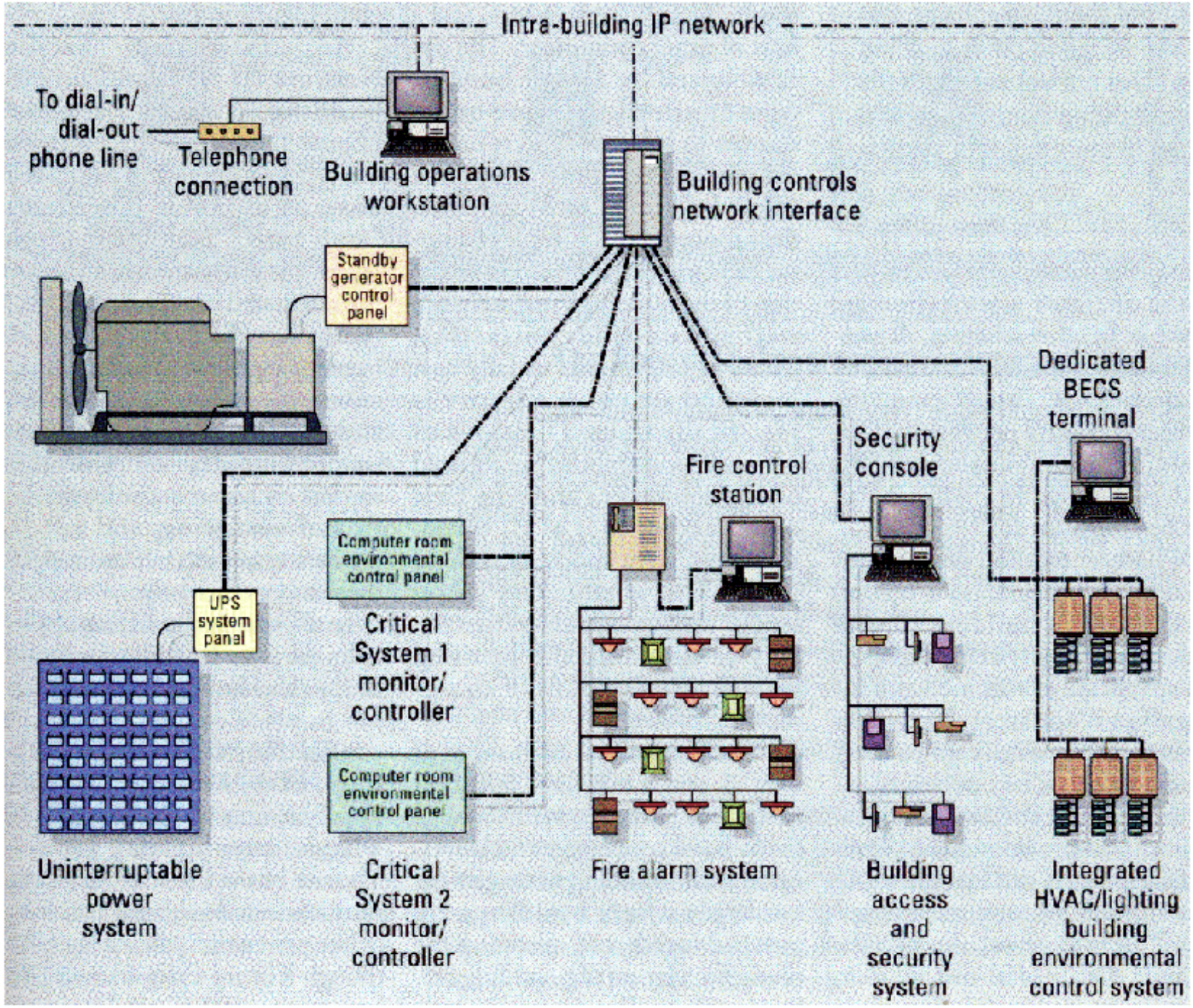
- Integrated facility management (IFM)
  - Total integration of facilities resources at the network level
  - To optimize the ability to effectively address energy management and other cost of operations issues
- Planning and control: 5 key areas
  - 1) Scope management, 2) cost management, 3) time management, 4) work management and 5) risk management



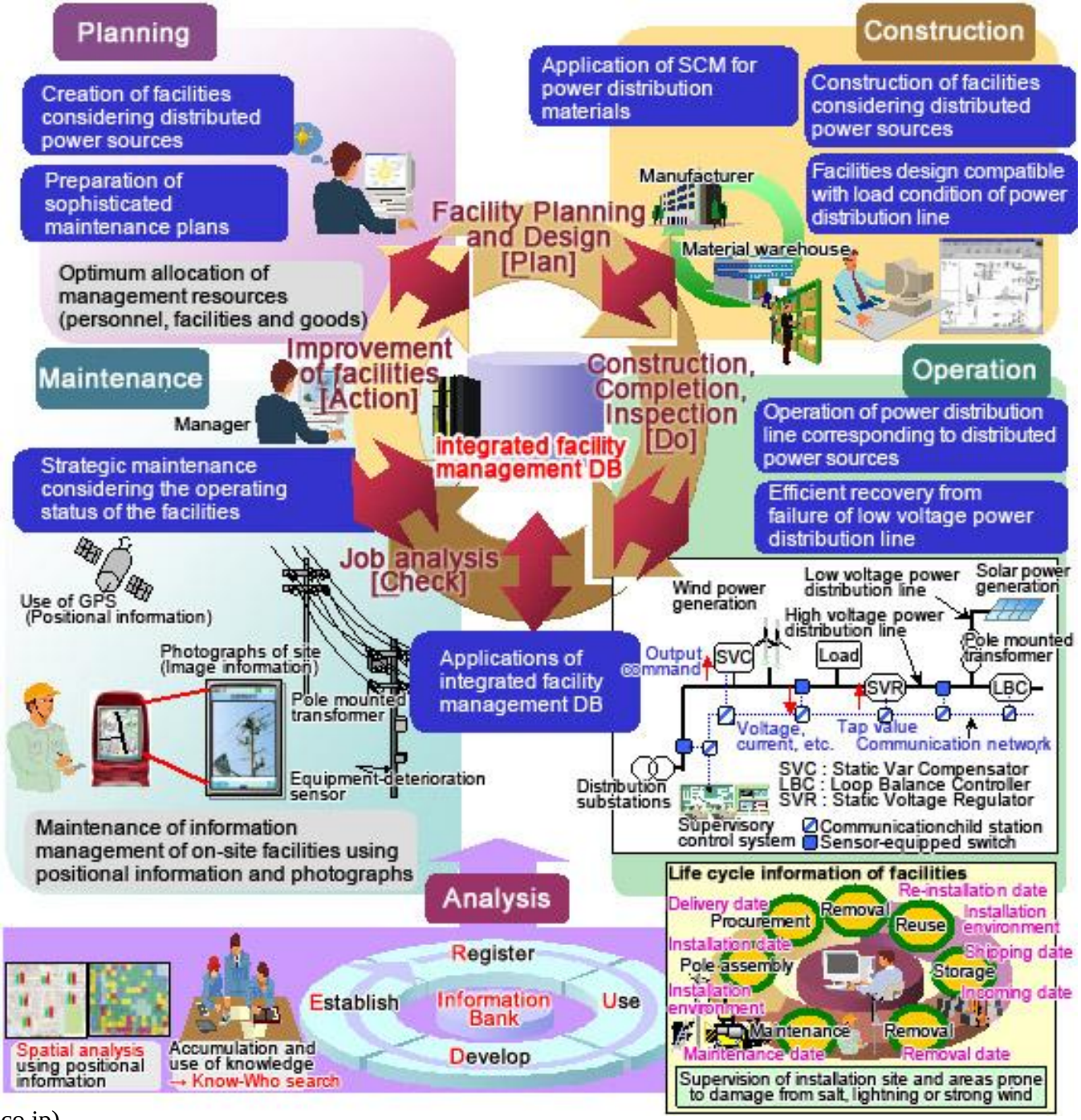
(Source: Yu, K., Froese, T. and Grobler, F., 2000. A development framework for data models for computer-integrated facilities management, *Automation in Construction*, 9 (2): 145-167.)

Integrated facility management

- Computer-based IFM
  - Utility and energy management
  - Maintenance management
  - Space management
  - Tenant management
  - Environmental compliance
- Use of information and communication technologies, particularly Internet and Web-based technologies



(Source: Hartman, T., 2001. Whole building networks - beyond HVAC, *Network Controls*, May 2001, pp. 36-43.



(Source: www.hitachi.co.jp)

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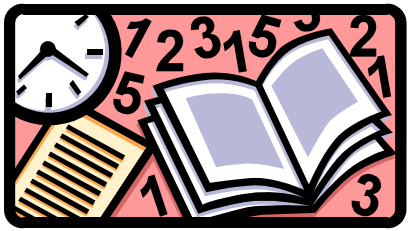

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THANK YOU 謝謝