GEE5303 Green and Intelligent Building

http://ibse.hk/GEE5303/

Green building basic concepts

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Contents

- What is green building?
- Why going green?
- Basic principles
- Examples

An example of green building in Hong Kong ?!

(A building in Pokfulam; photo taken by Dr Sam C M Hui)

"What is green building?"

Cologne

Building

+

Green

Toronto

Green building is NOT just adding a green outlook

(Photo taken during my travel to Turkey in 1992)

Sustainable Architecture

in ancient time
(cave dwellings)
(3500 years)

- cooperate with nature (climate, topography)
- durable and longlife are the trend

(Video: Cappadocia, Turkey: Inside The Cave Dwellings. National Geographic (4:30) http://www.youtube.com/watch?v=xM-i3wCaXyw)

Photo credit: Renzo Piano Workshop Foundation

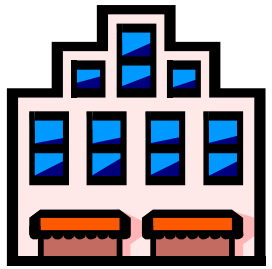
A modern example of Sustainable Architecture:

Jean Marie Tjibaou Cultural Center (by Renzo Piano)

- Integration of regional materials, traditional construction methods, contemporary technology and ecological design

(See also: http://inhabitat.com/jean-marie-tjibaou-cultural-center-inspired-by-native-architecture/)

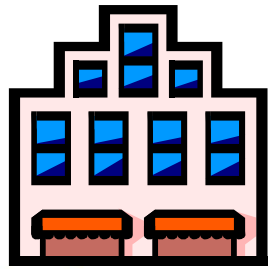
What is green building?



- A loosely defined collection of land-use, building design, and construction strategies that reduces the environmental impacts
- The term "green" is extremely wide ranging, encompassing many viewpoints and open to broad interpretation
  - Debate around green building/architecture
  - Complexity of environmental issues

(See also: Sustainable Architecture http://www.ad.arch.hku.hk/research/BEER/sustain.htm
Green architecture http://global.britannica.com/art/green-architecture)

What is green building?

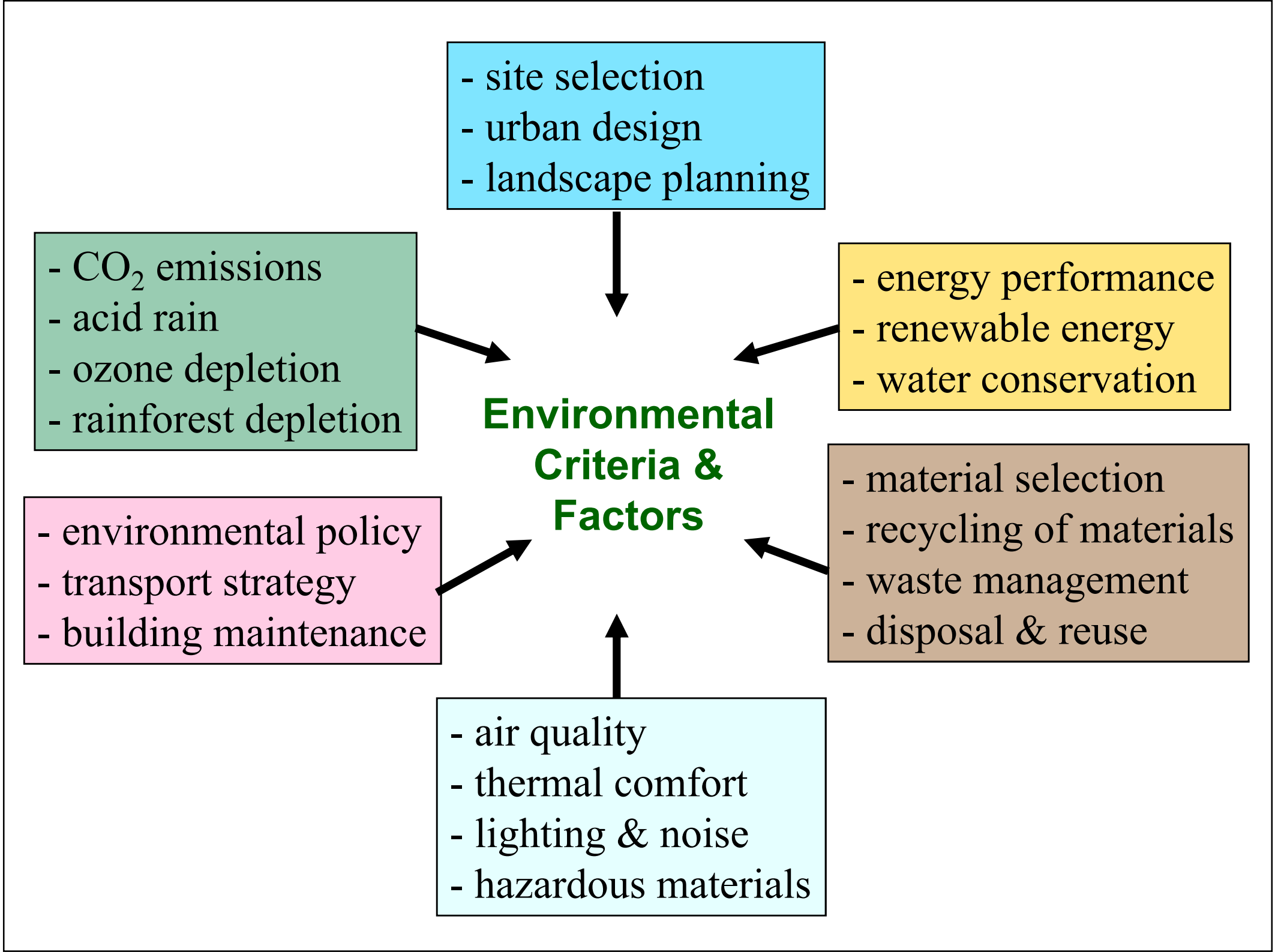


- It involves a *holistic* approach to the design and operation of buildings. It considers:
  - *1) Economy and efficiency of resources*
  - *2) Life cycle design*
  - *3) Human well-being*
- Main objectives
  - Be environmentally friendly and responsible
  - Improve the quality of built environment

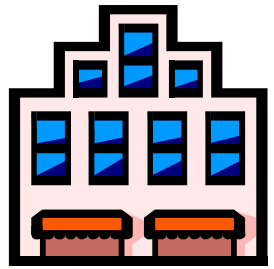
Cradle-to-Grave

Sustainable design requires life cycle thinking.

Cradle-to-grave is the full Life Cycle Assessment from resource extraction ('cradle') to use phase and disposal phase ('grave').

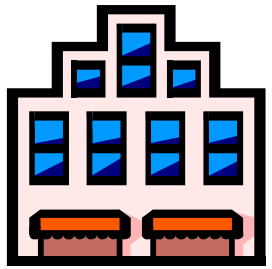

- site selection
- urban design
- landscape planning
- CO_2 emissions
- acid rain
- ozone depletion
- rainforest depletion
- energy performance
- renewable energy
- water conservation
Environmental Criteria & Factors
- environmental policy
- transport strategy
- building maintenance
- material selection
- recycling of materials
- waste management
- disposal & reuse
- air quality
- thermal comfort
- lighting & noise
- hazardous materials

What is green building?



- Green buildings are
  - Energy and resource efficient
  - Non-wasteful and non-polluting
    - Sustainable design that helps minimise broad environmental impacts (e.g. ozone depletion)
  - Highly flexible and adaptable for long-term functionality
  - Easy to operate and maintain (lower running costs)
  - Supportive of the productivity and well-being of the occupants

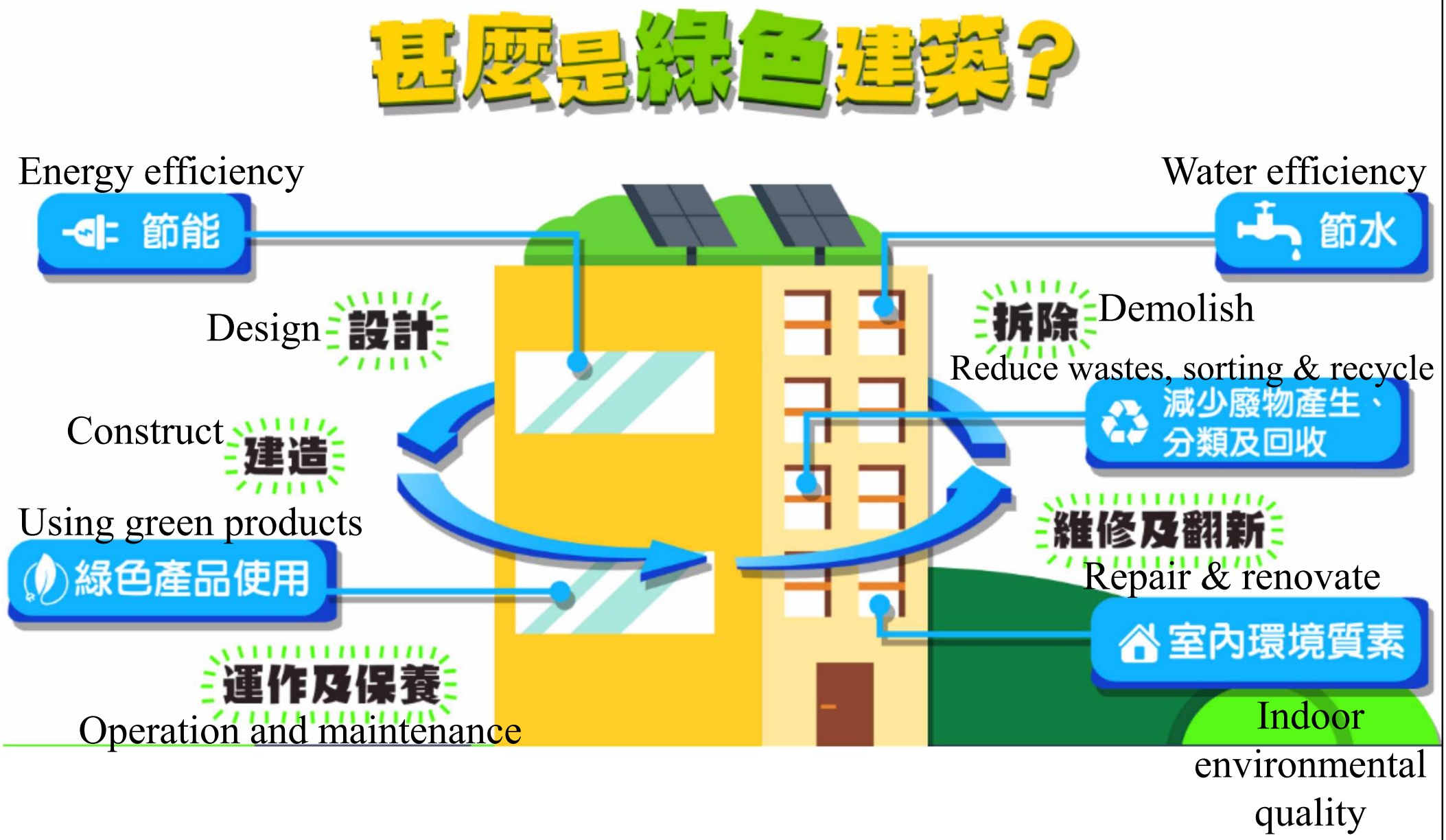
What is green building?



- **Definition of Sustainable Building** [by an OECD project]
  - Have minimum adverse impacts on the built and natural environment, in terms of the buildings themselves, their immediate surroundings and the broader regional and global setting
  - Apply practices which strive for integral quality (economic, social and environmental performance) in a very broad way

(Source: http://www.oecd.org/env/consumption-innovation/oecdworkonsustainablebuildings.htm)

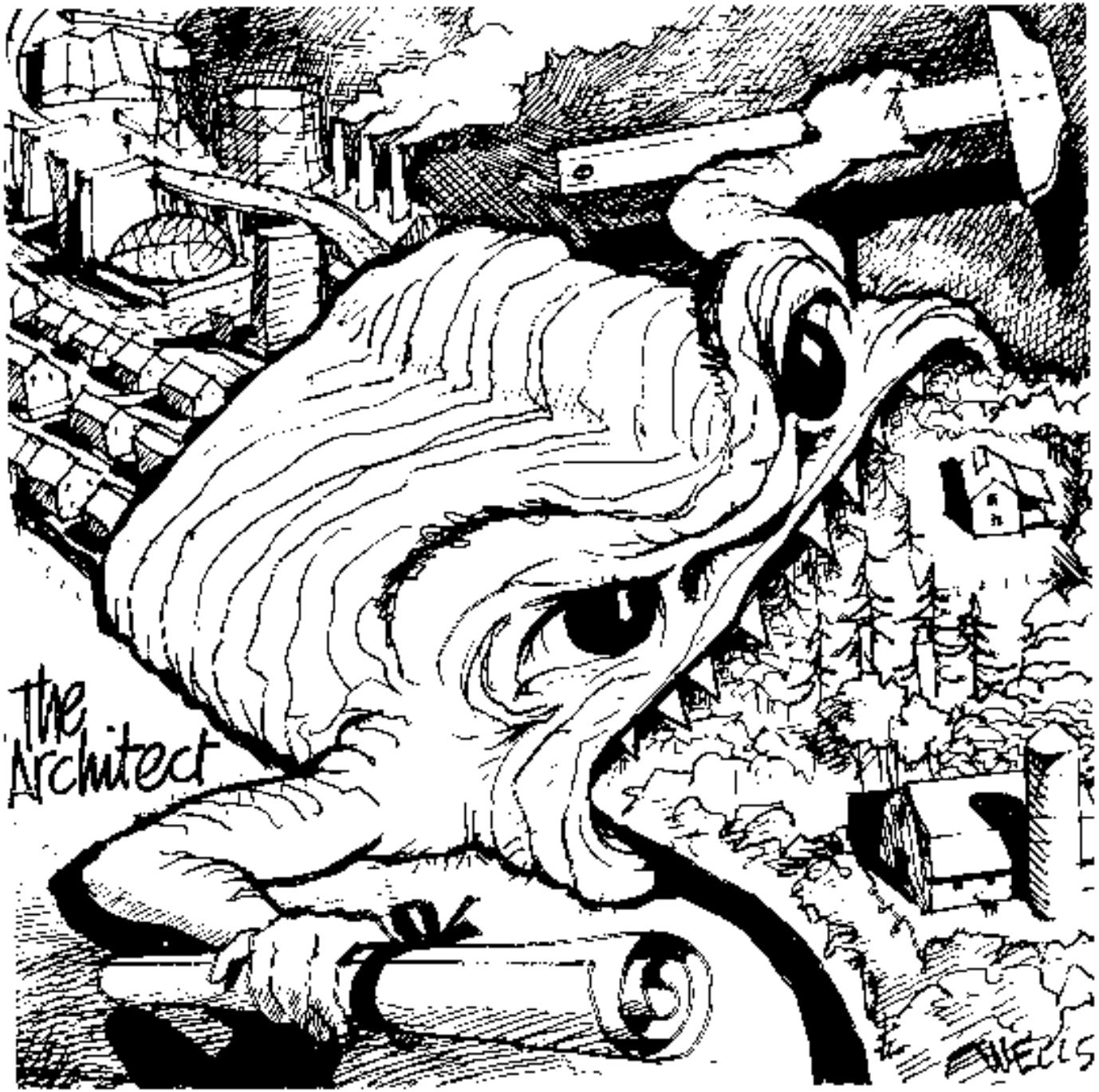
What is Green Building?



(Source: Hong Kong Green Building Council 香港綠色建築議會)

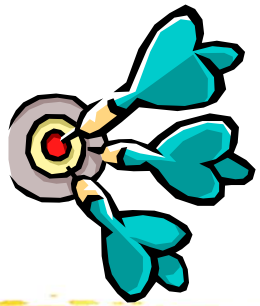
"It's not easy being green." -- Kermit the Frog, 1972.

Why going green?



Drawing by the American architect Malcolm Wells

Why going green?



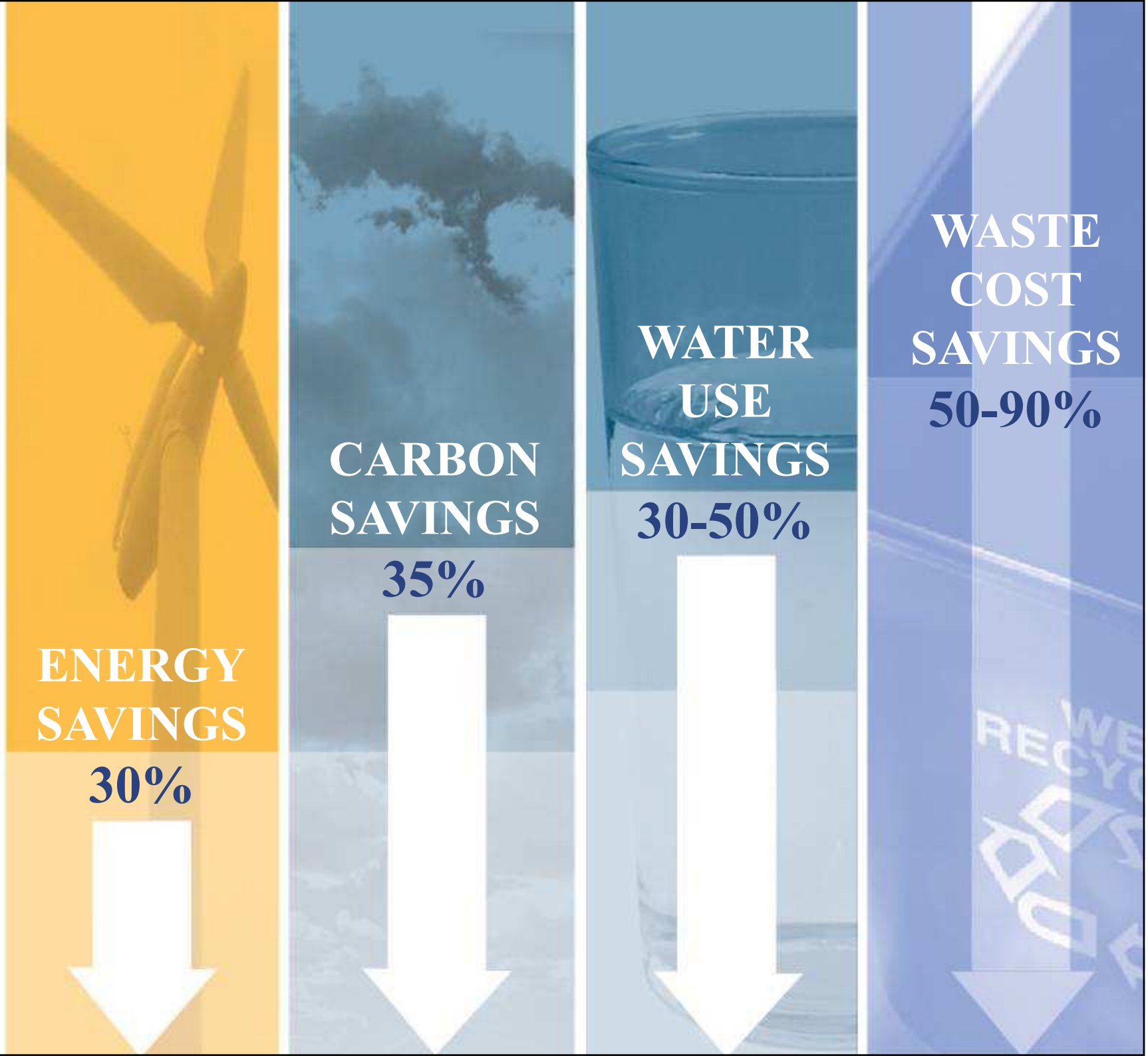
- Buildings consume significant resources
  - Consumption of energy & water
  - Use of building materials
  - Transport of materials & products
- Construction as the worst polluters
  - Operation on site and off site
  - Waste from construction/occupants
  - Pollutants from buildings

Why going green?

- Green buildings pay
  - Direct benefits (e.g. energy/cost savings)
  - Indirect benefits (e.g. healthier conditions)
  - Wider global benefits (e.g. reduced CO_2 emission)
- Life-cycle benefits
  - Total economic and environmental performance
  - Long-term "*sustainability*"

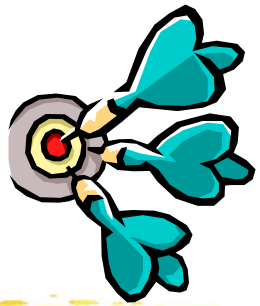
(See also: Why Build Green? (US-EPA) http://archive.epa.gov/greenbuilding/web/html/whybuild.html)

Average Savings of Green Buildings



Source:
Capital E

Why going green?



- Benefits of sustainable buildings:
  - They are designed to be cost effective
  - They boost employee productivity
  - They enhance health and well-being
  - They reduce liability
  - They create value for tenants
  - They increase property value
  - They benefit the community
  - They achieve more predictable results

Green Building Evolution (3:47)

http://www.youtube.com/watch?v=MroerBD69bA

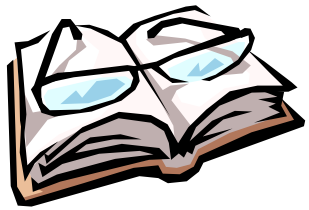
WORLD GREEN BUILDING COUNCIL

www.worldgbc.org

The story of the evolution of the green building movement told through image and dance. At the opening of the WorldGBC Congress/GBCSA Convention in Cape Town in 2013.

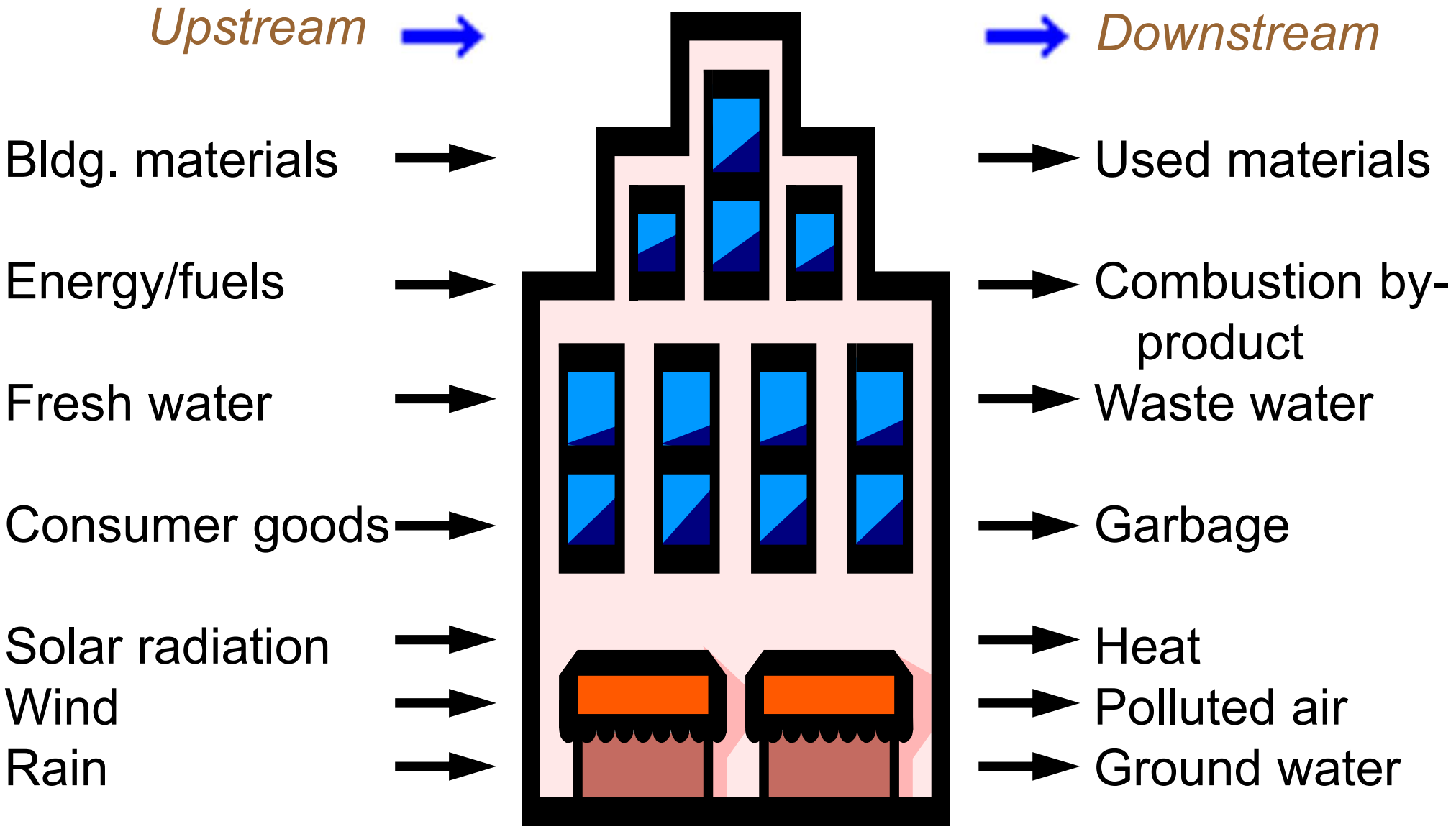
Basic Principles

Basic principles

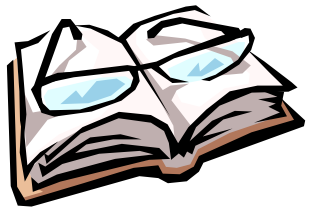


- Aims of green building design
  - Reduce energy in use
  - Minimise external pollution & environmental damage
  - Reduce embodied energy & resource depletion
  - Minimise internal pollution & damage to health
- Green design requires resolving many conflicting issues and requirements

Resource and material flow in the building ecosystem

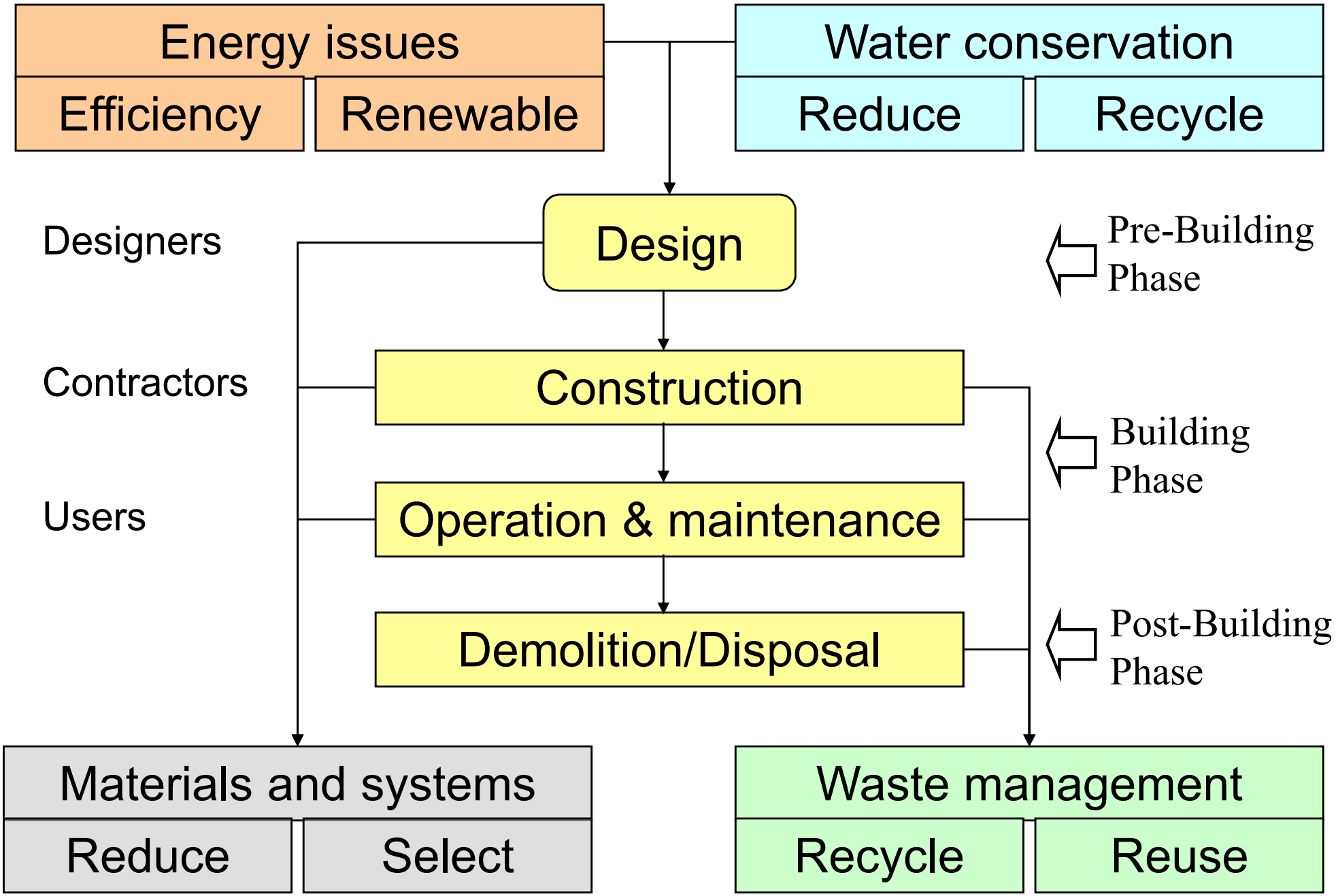


Basic principles

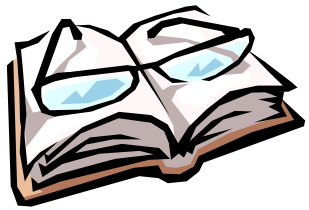


- Green building design involves
  - Holistic approach (whole systems thinking)
    - Each aspect is considered in relation to all others
  - Interdisciplinary efforts
    - Understanding & contribution from all involved
  - Understanding of building performance
    - Assessment & evaluation of performance
  - Caring for people
    - Well being of the occupants and users

Building life cycle and sustainable construction



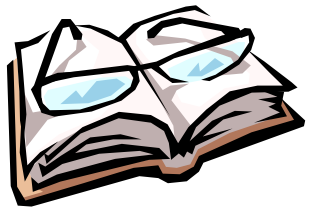
Basic principles



- Green strategies at different stages:
  - Inception (briefing, targets, site)
  - Design
    - Preliminary studies
    - Sketch studies
    - Pre-project
    - Basic project
    - Execution of project
  - Construction (tendering, supervision, acceptance)
  - Maintenance and Refurbishment

(See also: http://ibse.hk/GB_design_strategies.pdf)

Basic principles

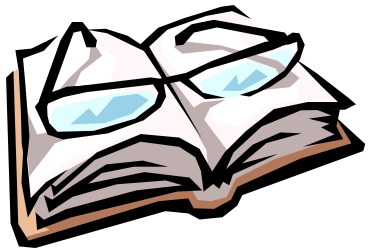


- Major concerns
  - Conserve non-renewable energy & scarce materials
  - Minimise life-cycle ecological impact
  - Use renewable energy and materials that are sustainably harvested
  - Protect & restore local air, water, soils, flora and fauna
  - Support pedestrians, bicycles and mass transit
  - Reduce human exposure to noxious materials

Examples

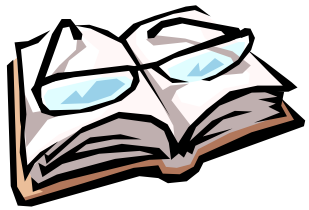
- Design of new buildings
  - MCMC Green Building (Malaysia) (5:04)
    - http://youtu.be/mHq-oI8UijQ
- Operation & maintenance of existing buildings
  - Taipei 101: Tallest green building (3:43)
    - http://youtu.be/b7ShsogLZ7I
  - Empire State Building: Leadership in American Progress in Sustainability (5:49)
    - http://youtu.be/17i7Q5Dr3PA

Further reading



- What is a Green Building?
  - http://businessfeed.sunpower.com/business-feed/written-what-is-a-green-building
- Video:
  - A Tale of Two Futures: Sustainable Buildings or Unsustainable Climate Change (3:22) http://youtu.be/3TioZ2sVL-E

Further reading



- Teaching Kit: Sustainable Design for Buildings (ArchSD)
  - http://www.archsd.gov.hk/archsd/html/teachingkits/tk1/
    - Sustainable planning
    - Sustainable building design
    - Green procurement
    - Green construction management
    - Sustainable maintenance