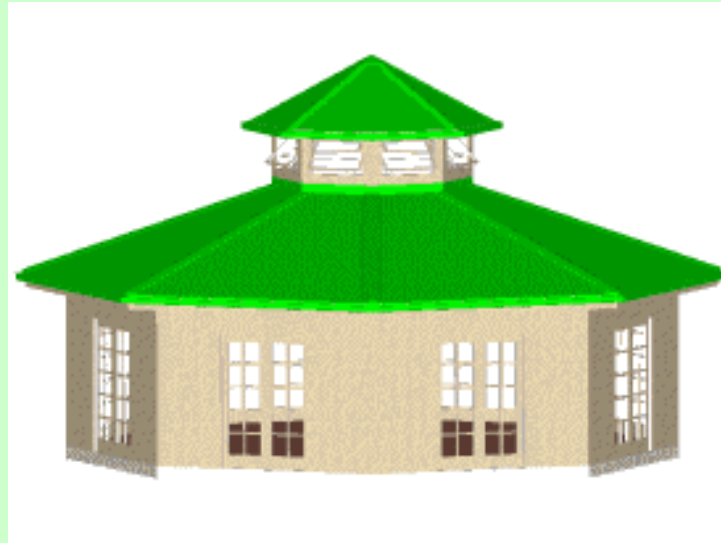


# GEE5303 Green and Intelligent Building

<http://ibse.hk/GEE5303/>



## Green building basic concepts



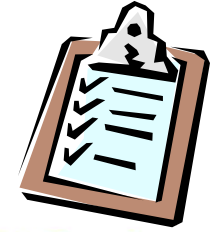
*Ir. Dr. Sam C. M. Hui*

Faculty of Science and Technology

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Jul 2016

# Contents



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





**“What is  
green  
building?”**



An example of green building in Hong Kong ?!

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



Cologne

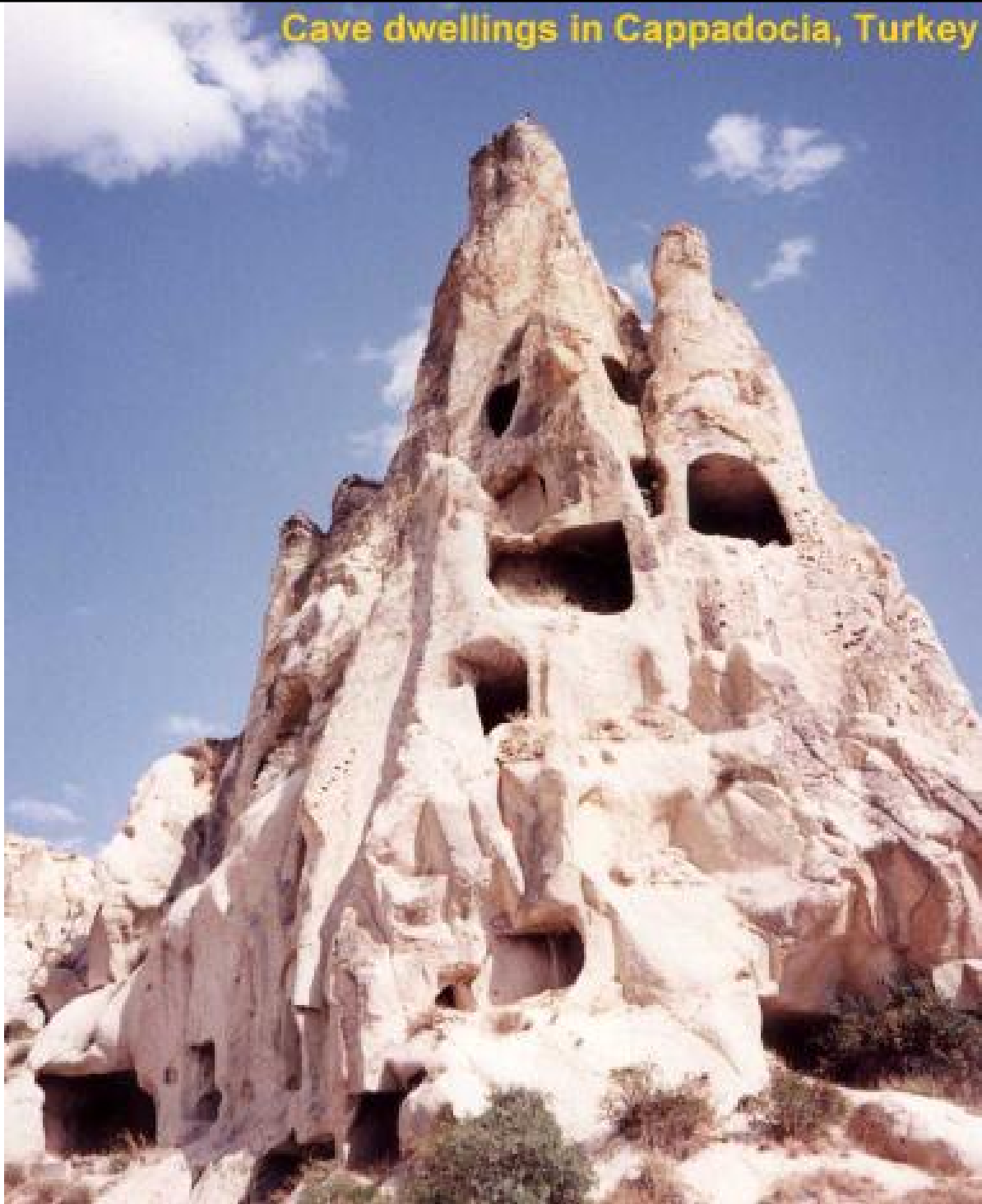
Building  
+  
Green

Toronto



Green building is NOT just adding a green outlook

## Cave dwellings in Cappadocia, Turkey



(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





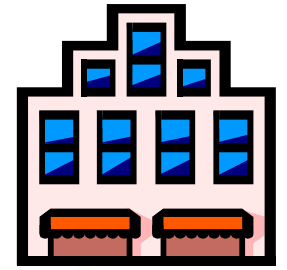
Photo credit: Renzo Piano Workshop Foundation

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

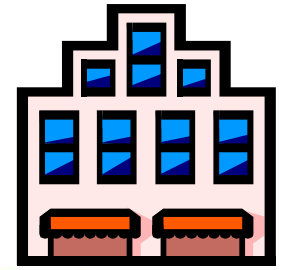
# What is green building?



- 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



# 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<sub>2</sub> emissions
- acid rain
- ozone depletion
- rainforest depletion

- energy performance
- renewable energy
- water conservation

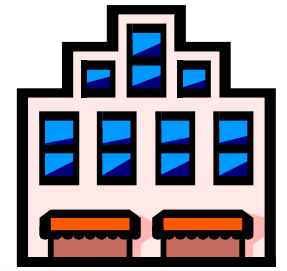
**Environmental  
Criteria &  
Factors**

- environmental policy
- transport strategy
- building maintenance

- material selection
- recycling of materials
- waste management
- disposal & reuse

- air quality
- thermal comfort
- lighting & noise
- hazardous materials

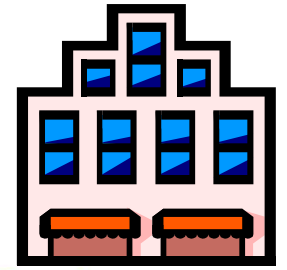
# What is green building?



- 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?

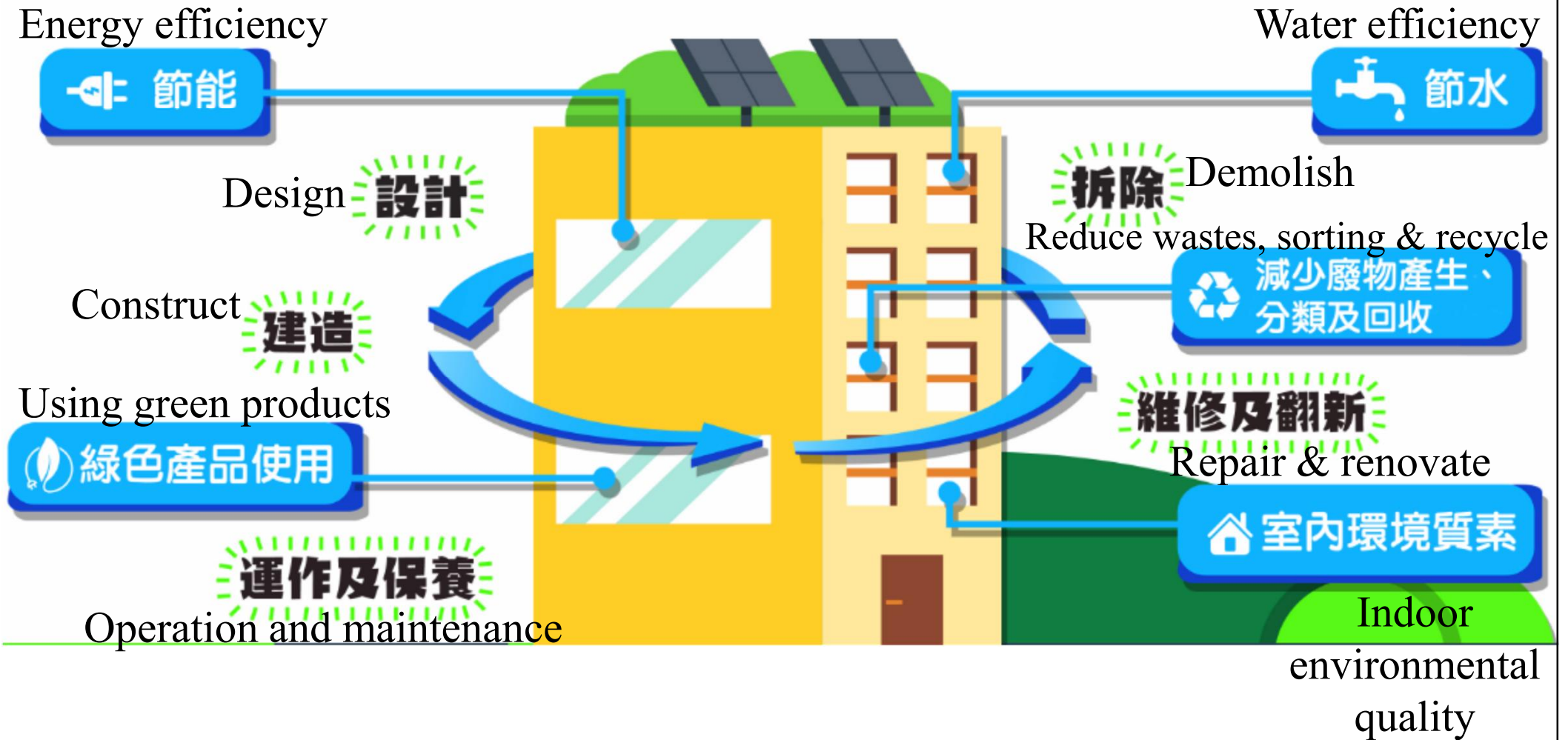


- **Definition of Sustainable Building** [by an OECD project]
  - Have minimum adverse impacts on the built and natural environment, in terms of the buildings themselves, their immediate surroundings and the broader regional and global setting
  - Apply practices which strive for integral quality (economic,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



# What is Green Building?

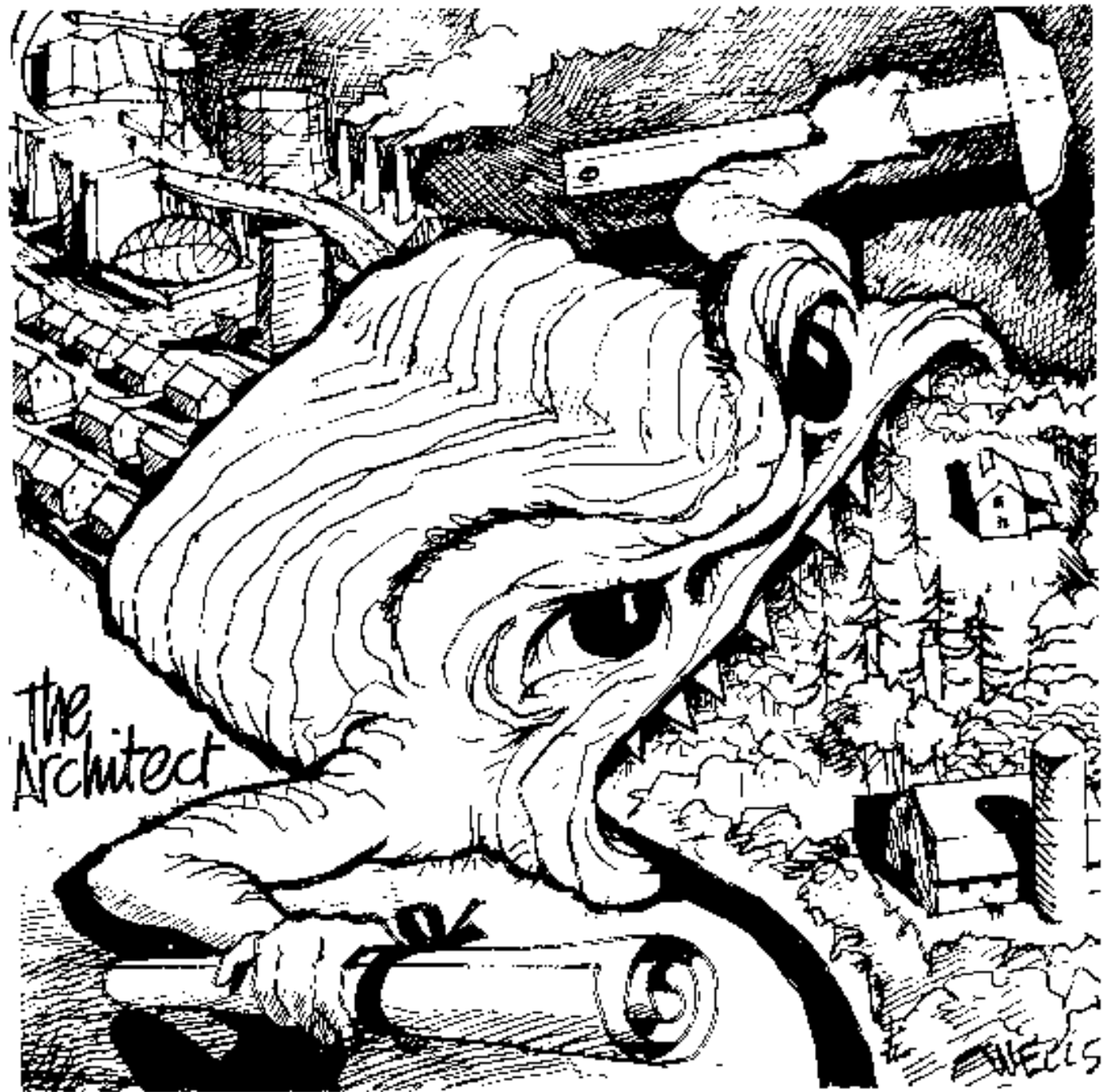
## 甚麼是綠色建築?



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

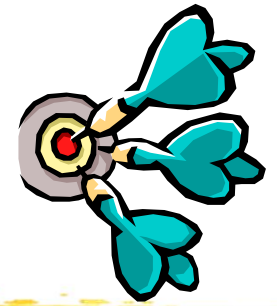


**Why going green?**



Drawing by the American architect Malcolm Wells

# Why going **green**?

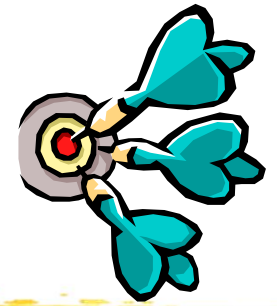


- Buildings consume significant resources
  - Consumption of energy & water
  - Use of building materials
  - Transport of materials & products
- Construction as the worst polluters
  - Operation on site and off site
  - Waste from construction/occupants
  - Pollutants from buildings





# 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<sub>2</sub> emission)
- Life-cycle benefits
  - Total economic and environmental performance
  - Long-term “*sustainability*”



# Average Savings of Green Buildings

**ENERGY SAVINGS**

**30%**



**CARBON SAVINGS**

**35%**



**WATER USE SAVINGS**

**30-50%**



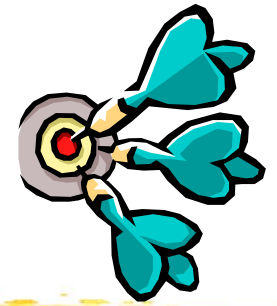
**WASTE COST SAVINGS**

**50-90%**



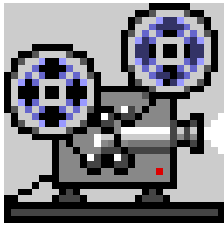
Source:  
Capital E

# Why going green?



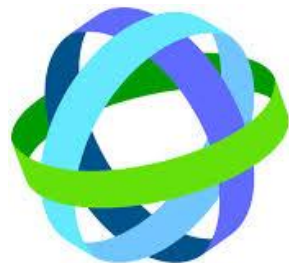
- Benefits of sustainable buildings:
  - They are designed to be cost effective
  - They boost employee productivity
  - They enhance health and well-being
  - They reduce liability
  - They create value for tenants
  - They increase property value
  - They benefit the community
  - They achieve more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





## Green Building Evolution (3:47)

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



WORLD  
GREEN  
BUILDING  
COUNCIL

[www.worldgbc.org](http://www.worldgbc.org)

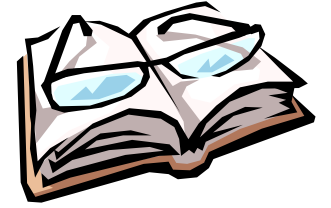
The story of the evolution of the green building movement told through image and dance. At the opening of the WorldGBC Congress/GBCSA Convention in Cape Town in 2013.





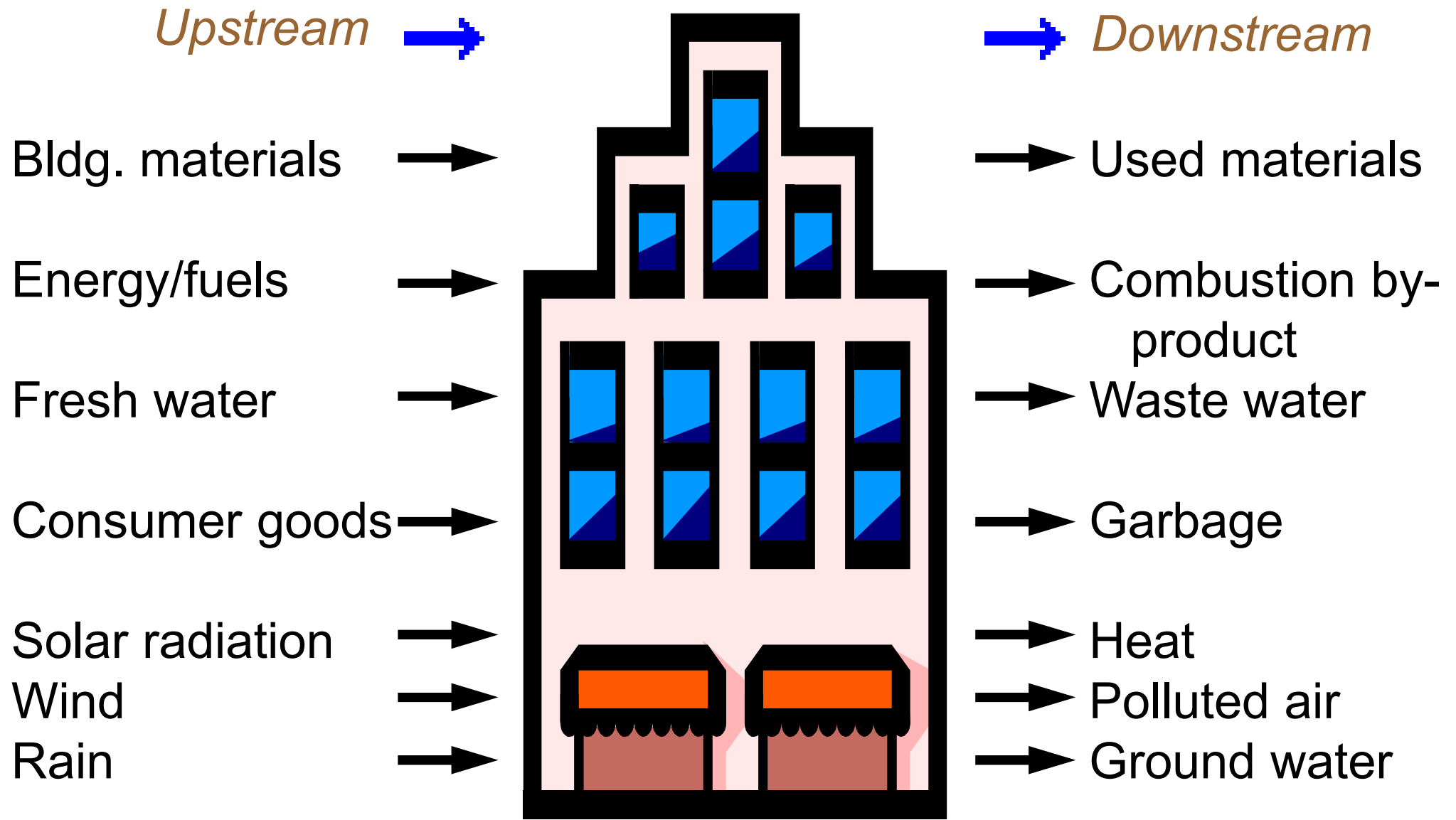
# Basic Principles

# 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

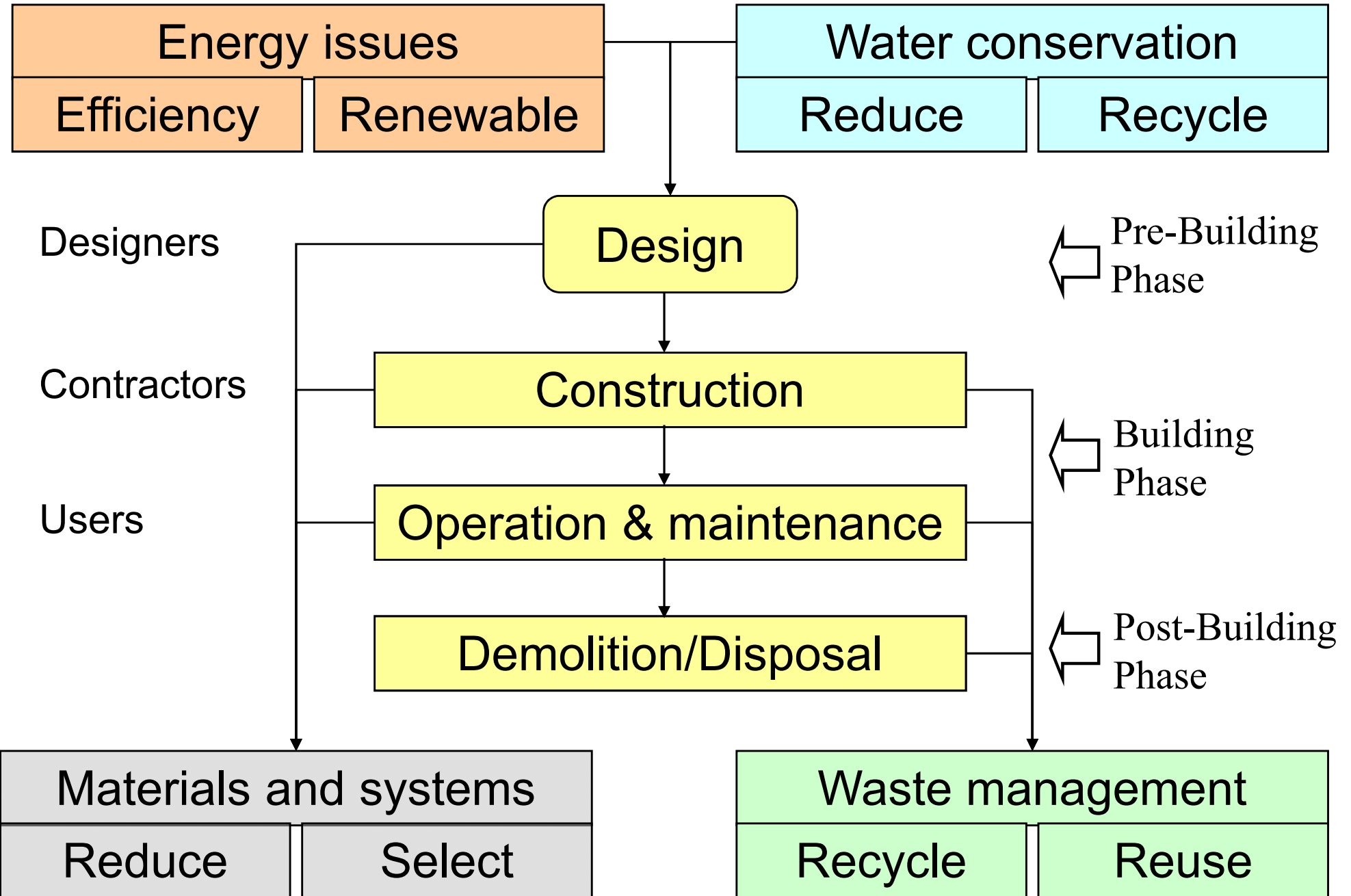


# Basic principles



- 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



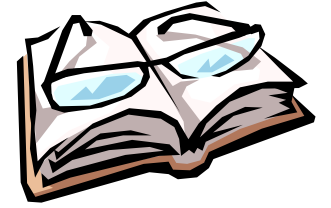


# Basic principles



- 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

# Basic principles

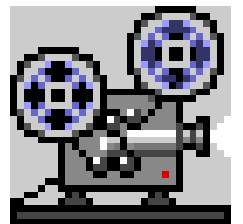


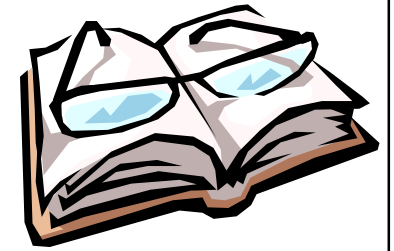
- Major concerns
  - Conserve non-renewable energy & scarce materials
  - Minimise life-cycle ecological impact
  - Use renewable energy and materials that are sustainably harvested
  - Protect & restore local air, water, soils, flora and fauna
  - Support pedestrians, bicycles and mass transit
  - Reduce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



# Examples

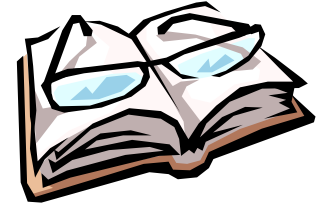
- Design of **new buildings**
  - MCMC Green Building (Malaysia) (5:04)
    - <http://youtu.be/mHq-oI8UijQ>
- Operation & maintenance of **existing buildings**
  - Taipei 101: Tallest green building (3:43)
    - <http://youtu.be/b7ShsogLZ7I>
  - Empire State Building: Leadership in American Progress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





# Further reading

- What is a Green Building?
  - <http://www.conserve-energy-future.com/green-building.php>
- World Green Building Week
  - <http://www.worldgreenbuildingweek.org/>
- Hong Kong Green Building Week (HKGBW)
  - <http://www.hkgbc.org.hk/eng/gbw.aspx>



# 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

