

GEE5303 Green and Intelligent Building

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



Introduction

Thei

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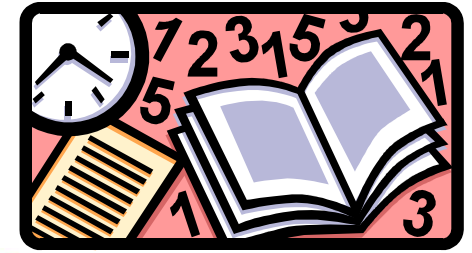
Aug 2017

Contents



- Background
- Why study green building?
- Sustainable development
- Built environment





Background

- ***Ir. Dr. Sam C. M. Hui*** (*Building Services Engineer*)

- PhD, BEng(Hons), CEng, CEM, BEAP, BEMP, HBDP, MASHRAE, MCIBSE, MHKIE, MIESNA, LifeMAEE, AssocAIA

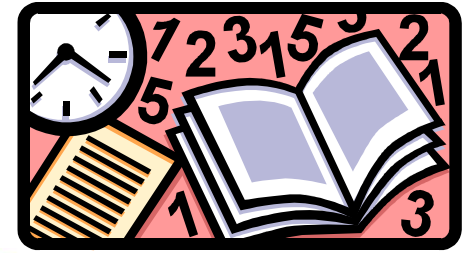


- CEng = Chartered Engineer
- CEM = Certified Energy Manager

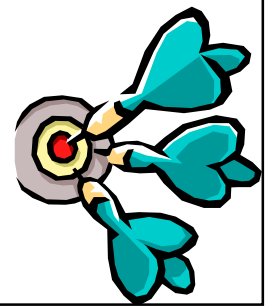
- BEAP = Building Energy Assessment Professional
- BEMP = Building Energy Modeling Professional
- HBDP = High-performance Building Design Professional

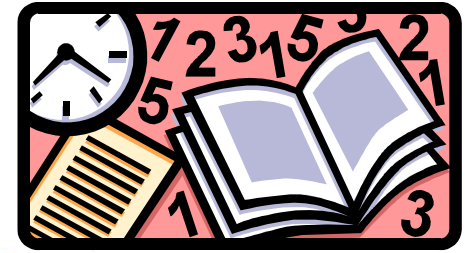
- LifeMAEE = Life Member, Association of Energy Engineers
- ASHRAE Distinguished Lecturer (2009-2011)
- 20 yrs. teaching in HKU Departments of Architecture and Mech. Engg.
- Research interests: energy efficiency in buildings and sustainable building technologies

Background



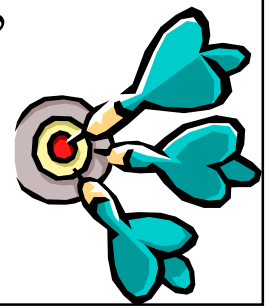
- Module Aims:
 - The module aims to introduce the latest advancements in the provision of **green and intelligent buildings** and enabling technologies.
 - It enhances students' understanding of the development and advocacy of **green lifestyle** elements in developed economies as well as in Hong Kong and the Asia Pacific regions.
 - The module also aims to nurture **green and sustainable citizenship**.

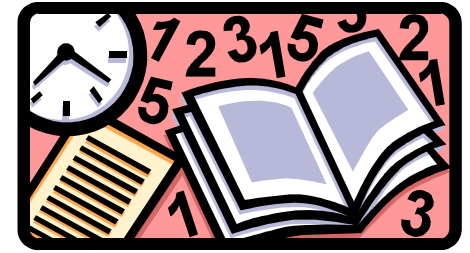




Background

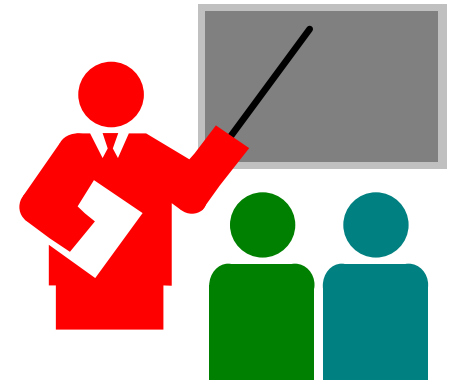
- Learning Outcomes:
 - 1. evaluate the appropriateness of adoption in Hong Kong the different green labelling systems and building environment assessment schemes in the Asia Pacific regions;
 - 2. evaluate the benefits and costs and the feasibility of greening schemes adopted in new or existing buildings; and
 - 3. propose green initiatives to enhance building efficiency.



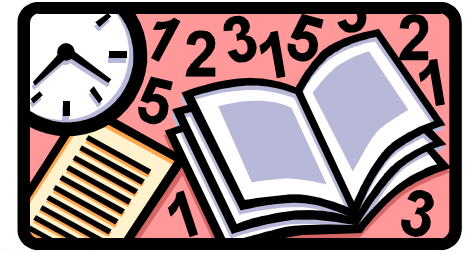


Background

- Lecturers:
 - Ir. Dr. Sam C. M. Hui (cmhui@vtc.edu.hk)
 - Dr. PAN Yan, Penny
- Assessment Methods:
 - Individual Assignment (20%)
 - Quiz (30%)
 - Group Project (50%)
- Course Website: (with links and resources)
 - <http://ibse.hk/GEE5303/>
- VTC Moodle system
 - <http://moodle.vtc.edu.hk/>



Good news:
No written examination.

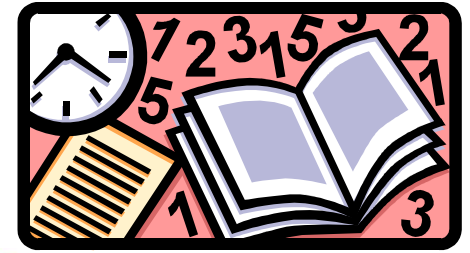


Background

- Assessment Components:
 - Individual Assignment (20%)
 - Comparative essays
 - Not more than 20 nos. A4 pages
 - Quiz (30%)
 - 30 nos. multiple choice questions
 - Test of your understanding and critical thinking
 - Group Project (50%)
 - 5 to 6 students in each group
 - Apply the knowledge to investigate real world problems
 - Submission: Group project report (≤ 50 presentation slides)



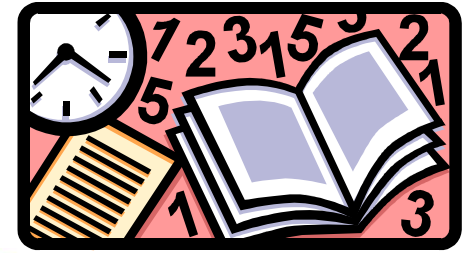
Background



- Study topics:

- Introduction
- Green building basic concepts
- Green building design strategies
- Energy efficiency in buildings
- Renewable energy systems
- Building environmental assessment
- Green roof systems and technology
- Intelligent buildings
- Green buildings in Hong Kong
- BEAM Plus Assessment
- Case studies
- (+ Technical visit: To be confirmed)





Background

- Learning Methods:
 - Lectures + Further Reading
 - Individual Assignment
 - Discussions
 - During lectures
 - When doing the group project
 - Technical Visit
- Resources:
 - Video presentations
 - Web links + References



Why study green building?



Why study green building?



- Why you study this course? (give 2 reasons)
- Ans: 1.
- 2.

- What do you expect from it? (give 2 items)
- Ans: 1.
- 2.

Please set up the targets for your learning.

Why study green building?

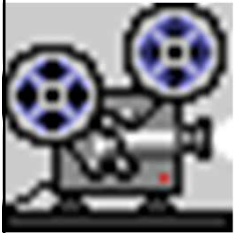


- **Environmental** reasons:
 - The growth and development of our world has a large impact on the **natural environment**
 - Manufacturing, design, construction, and operation of the buildings in which we live and work are responsible for the consumption of many of the **natural resources**
- **Personal** reasons:
 - “I want to be a **Green Building Professional.**”
 - Green building jobs and market are **red hot.**

Why study green building?



- Important trends in the world:
 - Green Building: Jobs of the Future (11:59)
 - <http://www.youtube.com/watch?v=rr0IAWO9lnk>
 - Green building assessment, e.g. LEED rating system by U.S. Green Building Council
 - Video: What is green building? (1:16)
<http://www.youtube.com/watch?v=MyIOtsx3wDs>
 - Video: Introducing LEED v4 (1:34)
<http://www.youtube.com/watch?v=UJzdnykumTU>



Why study green building?



- Going “Green” is the “right thing”
 - Reduce resources consumption
 - Decrease carbon or green house gas emissions
 - Enable energy independence
 - Encourage community growth and enhancement
 - Preserve and protect natural systems
 - Achieve “sustainable development (可持續發展)”





What is

A photograph of two white swans with black and orange beaks, facing each other in a pond. The background is a blurred green field. A yellow rectangular box is overlaid on the lower half of the image, containing the text 'Sustainable Development?'.

**Sustainable
Development?**

OUR COMMON FUTURE

THE WORLD COMMISSION
ON ENVIRONMENT
AND DEVELOPMENT

Have you heard of this
report before?

The Brundtland Report
defines
“Sustainable Development”



Full text of the report:

<http://www.un-documents.net/wced-ocf.htm>



Sustainable development

- The Brundtland Report (*Our Common Future*)
 - “...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.
- Two important concepts 「無後為大」 – 孔子
 - Needs – maintain an acceptable life standard
 - Limits – within the carrying capacity of supporting ecosystems and resource base

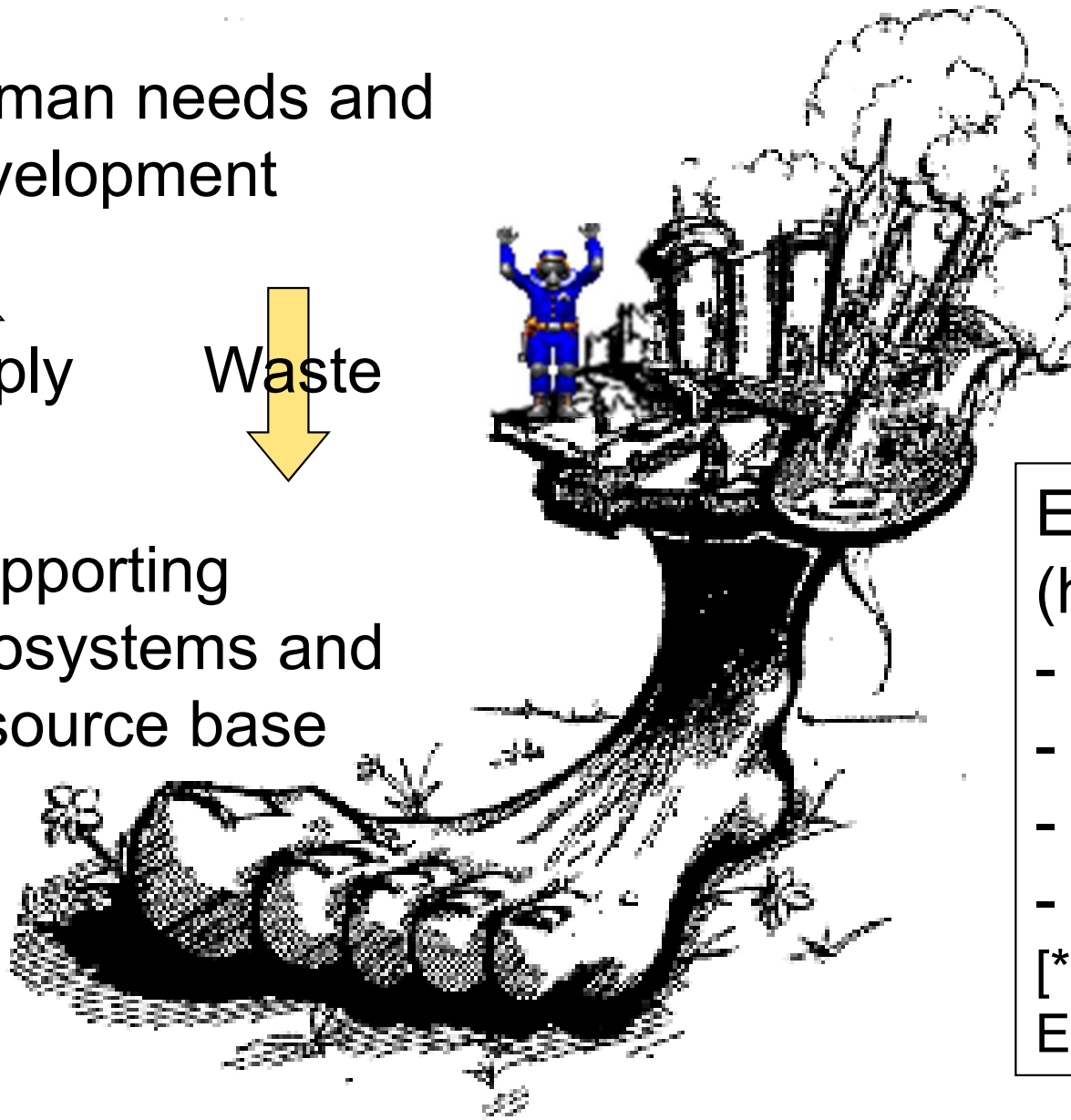
Carrying capacity and ecological footprint

Human needs and development

Supply

Waste

Supporting ecosystems and resource base



Ecological footprint (hectares/person) *:

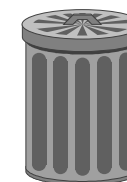
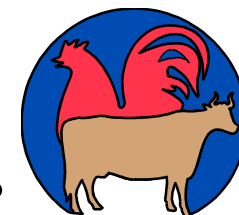
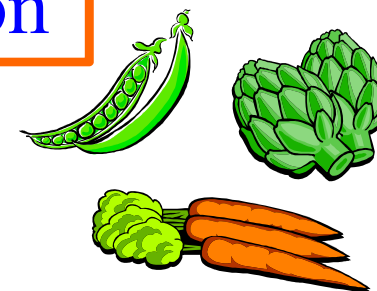
- world average = 2.3
- USA = 10.3
- **Hong Kong = 6.0**
- China = 1.2

[* Source: Friends of the Earth (HK)]

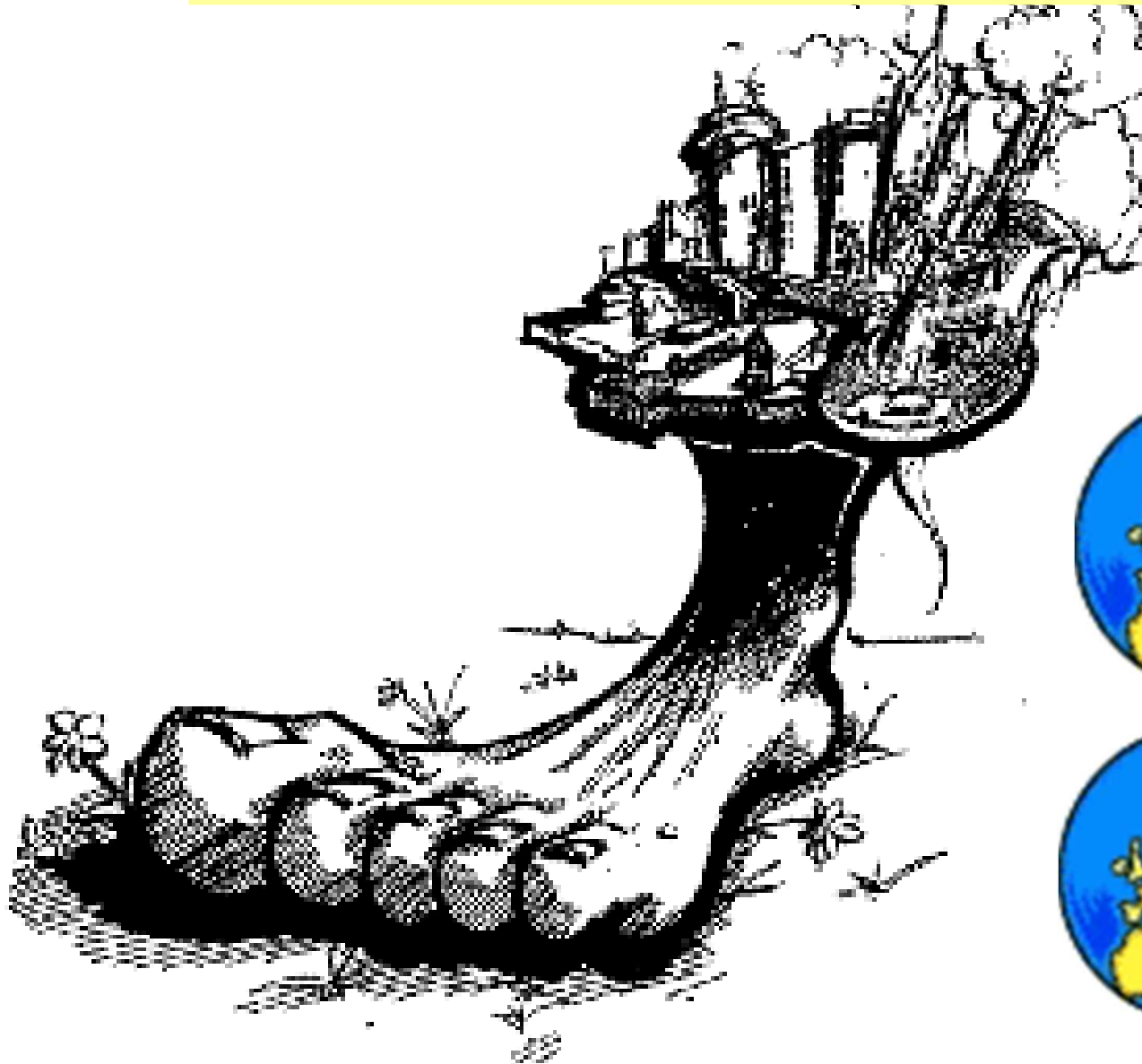
Sustainable development



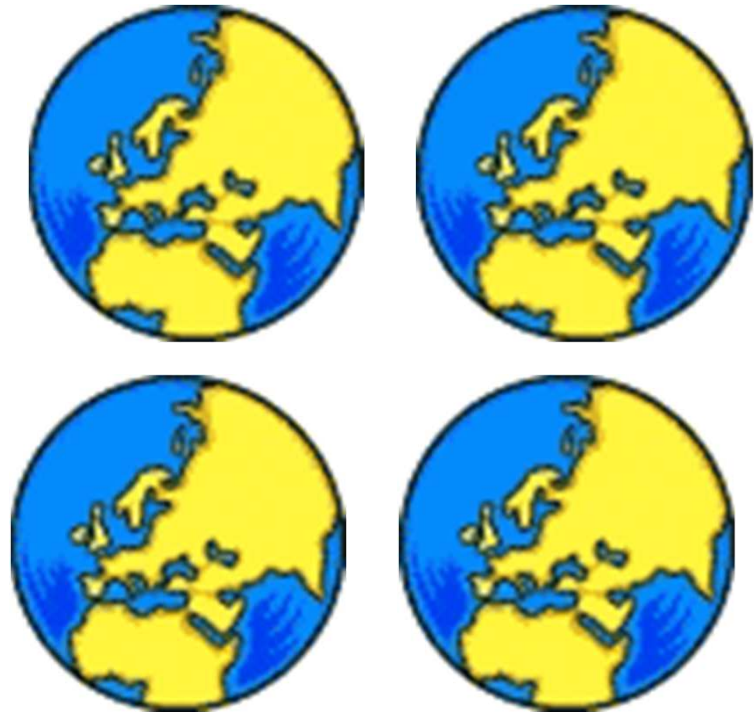
- One day in HK (population = 7 million) [2007]
 - Fresh water consumption = 374 litre/person
 - Electricity consumption = 17.4 kWh/person
 - Food consumption:
 - Vegetables 1,780 tonnes; fruits 1,460 tonnes
 - Live pigs 4,860 heads; live cattle 120 heads
 - Live poultry 80 tonnes; fresh eggs 230 tonnes
 - Freshwater fish 100 tonnes; marine fish 210 tonnes
 - Solid waste production = 13,901 tonnes



Sustain-able Future?



The Factor Four concept*



(*See also <http://www.gdrc.org/sustdev/concepts/12-f4.html>)

Sustainable development



- Sustainability (可持續發展, 永續性)
 - The endurance of systems and processes
 - Improves the quality of human life while living within the carrying capacity of supporting eco-systems



- Video Presentation:

- Sustainability explained through animation (2:00)

<http://youtu.be/B5NiTN0chj0>

- What is Sustainability? (1:51)

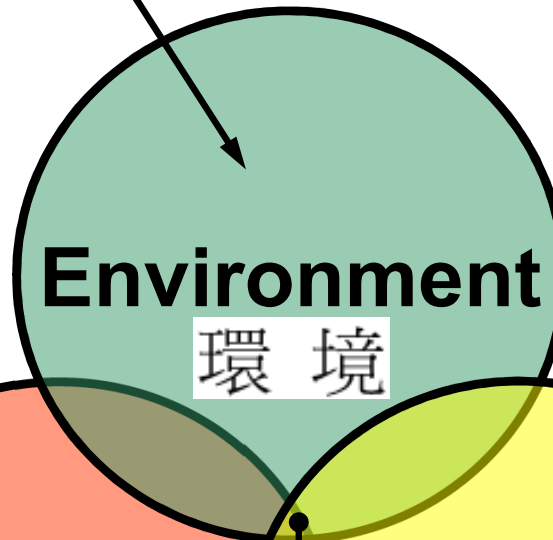
<http://youtu.be/hH109q5kk0k>



Three dimensions of sustainability

Environmental Sustainability

Ecosystem integrity
Carrying capacity
Biodiversity

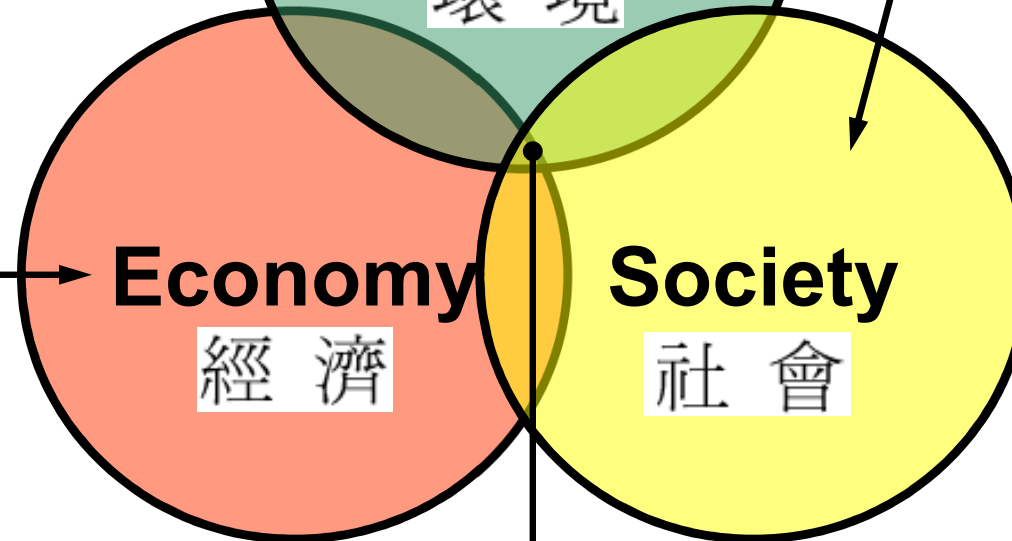


Social Sustainability

Cultural Identity
Empowerment
Accessibility
Stability
Equity

Economic Sustainability

Growth
Development
Productivity
Trickle-down



Human Well Being



Application of Sustainability in Buildings

Pre-Design

- Material Selection
- Building Program
- Project Budget
- Team Selection
- Partnering
- Project Schedule
- Laws, Codes & Standards
- Research
- Site Selection

On-Site

- Site Analysis & Assessment
- Site Development & Layout
- Watershed Management & Conservation
- Site Material & Equipment

Design

- Passive Solar Design
- Materials & Specification
- Indoor Air Quality

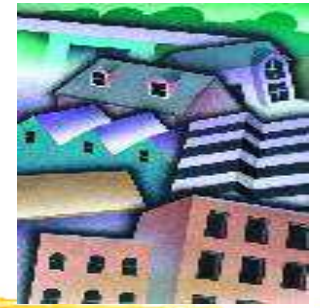
Construction

- Environmentally Conscious Construction
- Preservation of Features & Vegetation
- Waste Mgmt
- IAQ Issues
- Source Control Practices

O&M

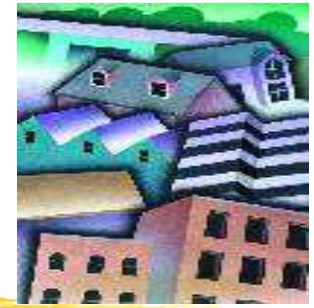
- Maintenance Plans
 - Indoor Quality
 - Energy Efficiency
 - Resource Efficiency
 - Renovation
 - Housekeeping & Custodial Practices
- (O&M: operation and maintenance)

Built environment



- Built environment is everything that has been made by humans to modify the spaces in which we live and work
 - Ranges from the large-scale civic surroundings to the personal places
 - May be residential, commercial, industrial, schools, parks, roads and highways
 - Include architectural design, building engineering, interior design, landscape design, town planning and urban design

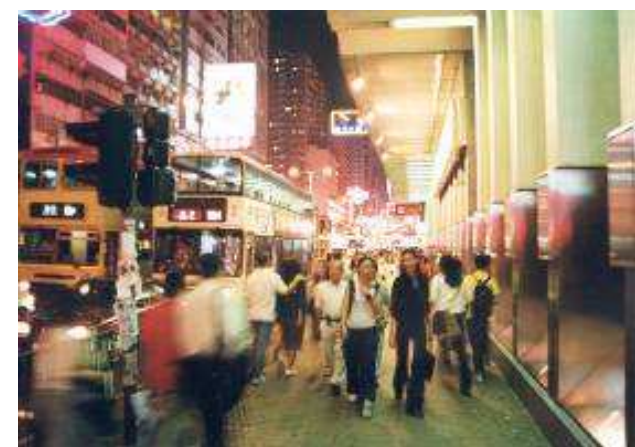
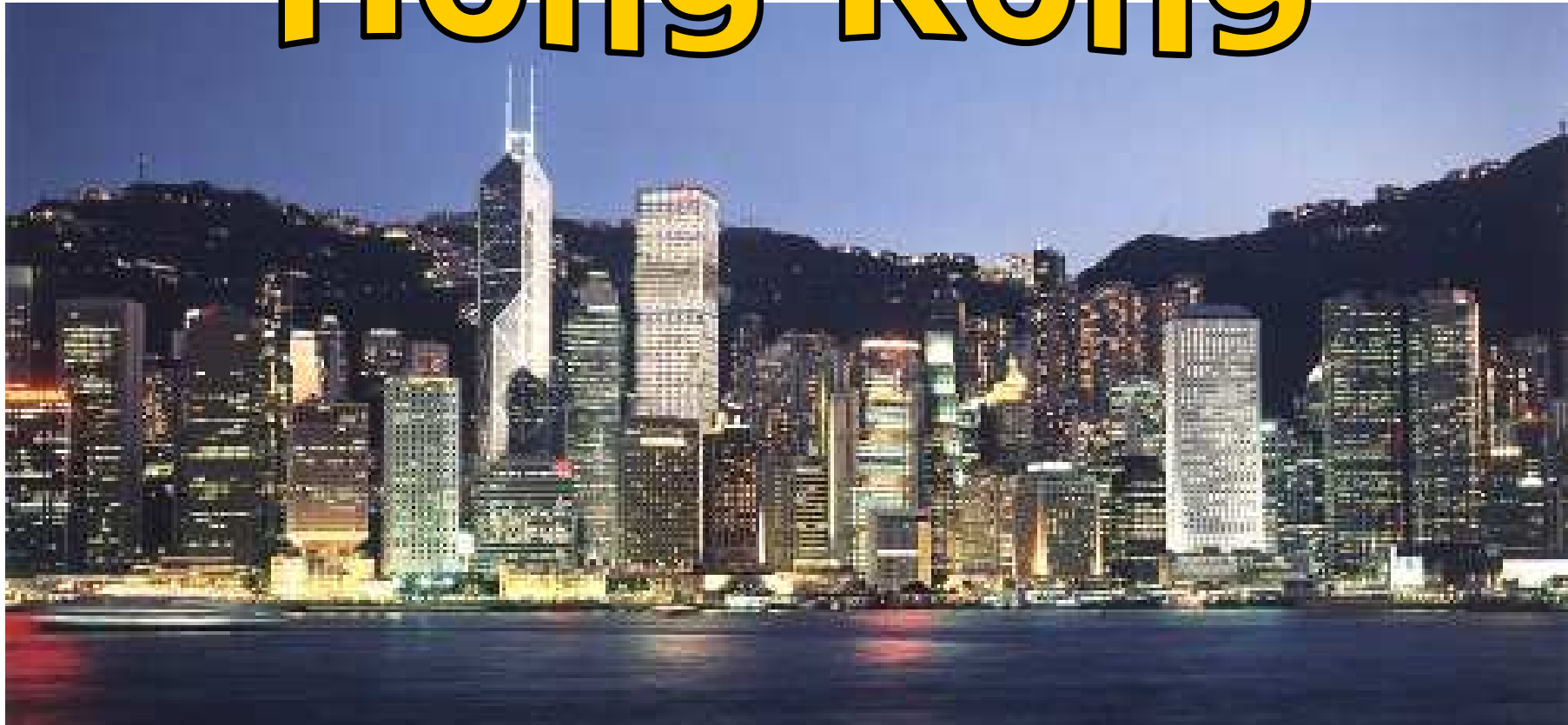
Built environment



- Scope of the built environment
 - Economy
 - Environment
 - Social
- Possible impacts, such as on
 - Quality of life, economic goals
 - Climate, bio-sphere, global resources
 - Air quality, water and ground pollution
 - Land use, waste, local resources



Hong Kong

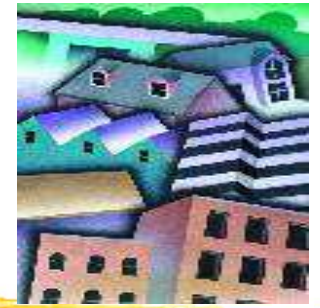


A satellite photograph of a coastal city, likely San Francisco, showing a dense urban area with a grid street pattern, a bay, and surrounding hills. A semi-transparent green rectangular box is overlaid on the center of the image, containing a quote in green text.

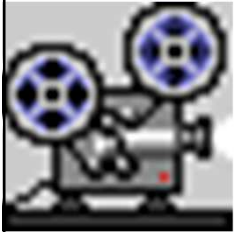
**"We shape our buildings and
thereafter they shape us."
(Winston Churchill)**

Satellite picture from Dr. Remetey Gabor (Hungarian Association for Geo-information)

Built environment



- Hong Kong situation and examples
 - Hong Kong Green Building Week 2017: Hong Kong's green buildings in style (0:30)



- <http://www.youtube.com/watch?v=UKW2lQp04ug>

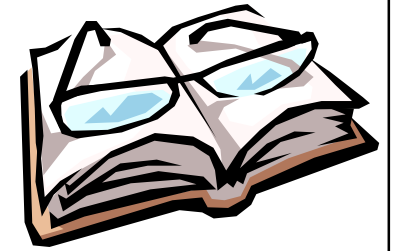
- Liberal Studies: Video: Green Buildings (6:37)

- <http://minisite.proj.hkedcity.net/hkiakit/eng/LS/lesson7.html>



- Green building design
 - Government policy and voluntary guidelines
 - Green label or rating system
 - Green life style

Do you know how to evaluate green buildings?



Further reading

- Green building – Wikipedia
 - http://en.wikipedia.org/wiki/Green_building
- GovHK: Green Buildings
 - <http://www.gov.hk/en/residents/environment/sustainable/buildings.htm>
- Hong Kong: Green Building in Action --- a handy summary of Hong Kong's green building development status
 - http://www.hkgbc.org.hk/eng/HKGB_inforgraphic.aspx