

GEE5303 Green and Intelligent Building

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



Introduction



Ir. Dr. Sam C. M. Hui

Faculty of Science and Technology

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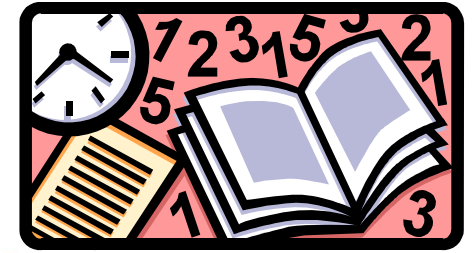
Jul 2016

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- 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

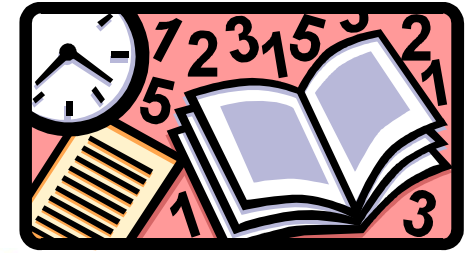
- BEAP = Building Energy Assessment Professional
- BEMP = Building Energy Modeling Professional
- HBDP = High-performance Building Design Professional

- LifeMAEE = Life Member, Association of Energy Engineers

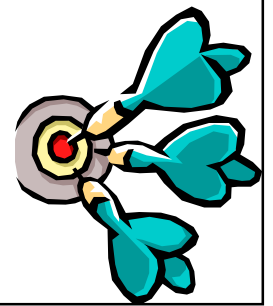
- ASHRAE Distinguished Lecturer (2009-2011)
- 20 yrs. teaching in HKU Departments of Architecture and Mech. Engg.
- Research interests: energy efficiency in buildings and sustainable building technologies



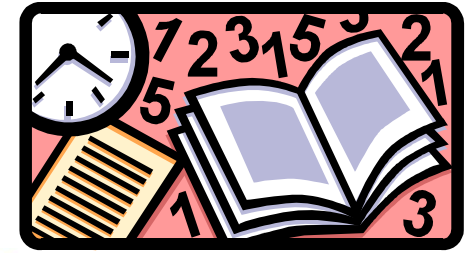
Background



- 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**.

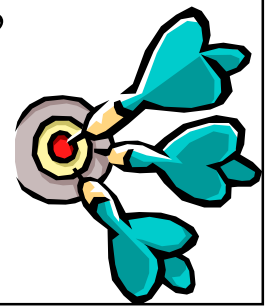


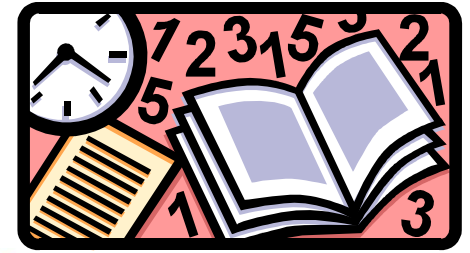
Background



- Learning Outcomes:

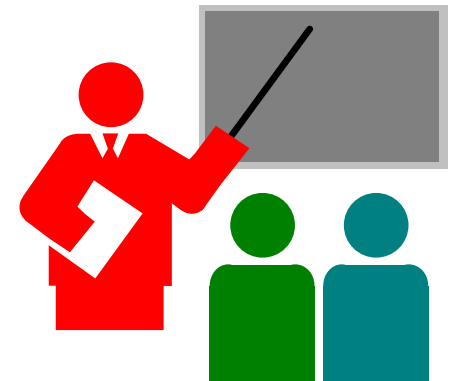
- 1. evaluate the appropriateness of adoption in Hong Kong the different green labelling systems and building environment assessment schemes in the Asia Pacific regions;
- 2. evaluate the benefits and costs and the feasibility of greening schemes adopted in new or existing buildings; and
- 3. propose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



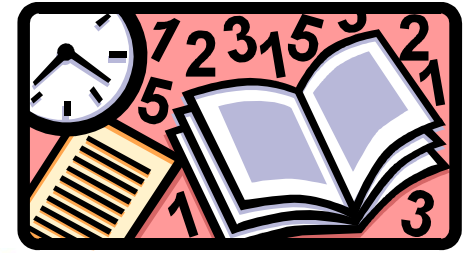


Background

- Lecturers:
 - Ir. Dr. Sam C. M. Hui (cmhui@vtc.edu.hk)
 - Ir. Prof. K. P. Cheung (kpcheung@vtc.edu.hk)
- 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/>



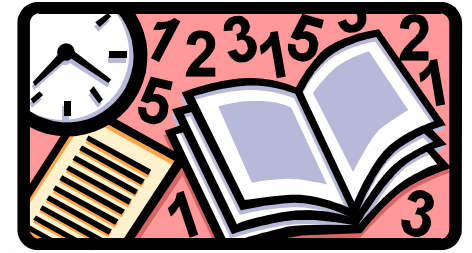
Good news: No
written examination.



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 nos. A4 pages)

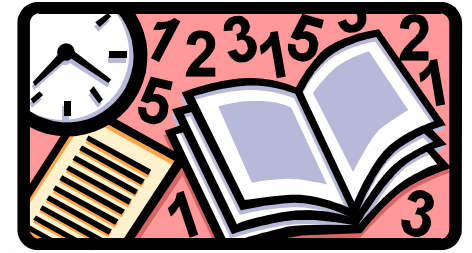




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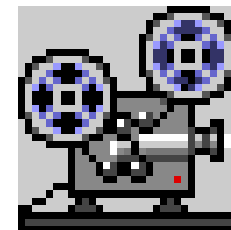
- Study topics:
 - Introduction
 - Green building basic concepts
 - Green building design strategies
 - Energy efficiency in buildings
 - Renewable energy systems
 - Building environmental assessment
 - Green roof systems and technology
 - Intelligent buildings
 - Case studies
 - (+ Technical visit: Zero Carbon Building)





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.

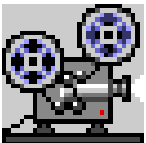
- What do you expect from it? (give 2 items)
- Ans: 1.
- 2.

Please set up the targets for your learning.

Why study green building?



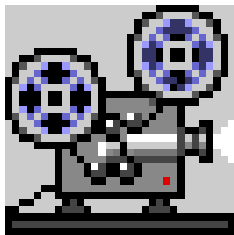
- **Environmental** reasons:
 - The growth and development of our world has a large impact on the **natural environment**
 - Manufacturing, design, construction, and operation of the buildings in which we live and work are responsible for the consumption of many of the **natural resources**
- **Personal**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



Why study green building?



- Important trends:
 - 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>
 - Video: What is a LEED professional credential? (1:13)
<http://www.youtube.com/watch?v=hwSl6Hub7lQ>
 - Green building + Green living lifestyle (Hong Kong)
 - 【2015.09.02】香港綠色建築週2015啟動禮 HKGBW2015 Launching Ceremony (4:02)
<http://www.youtube.com/watch?v=Re0OPFMy4Xg>



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 in a pond, facing each other with their heads tilted towards the center. The background is a blurred green and blue, suggesting water and vegetation. The text 'What is Sustainable Development?' is overlaid on the image. The word 'What is' is at the top, and 'Sustainable Development?' is in a yellow box in the center.

**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

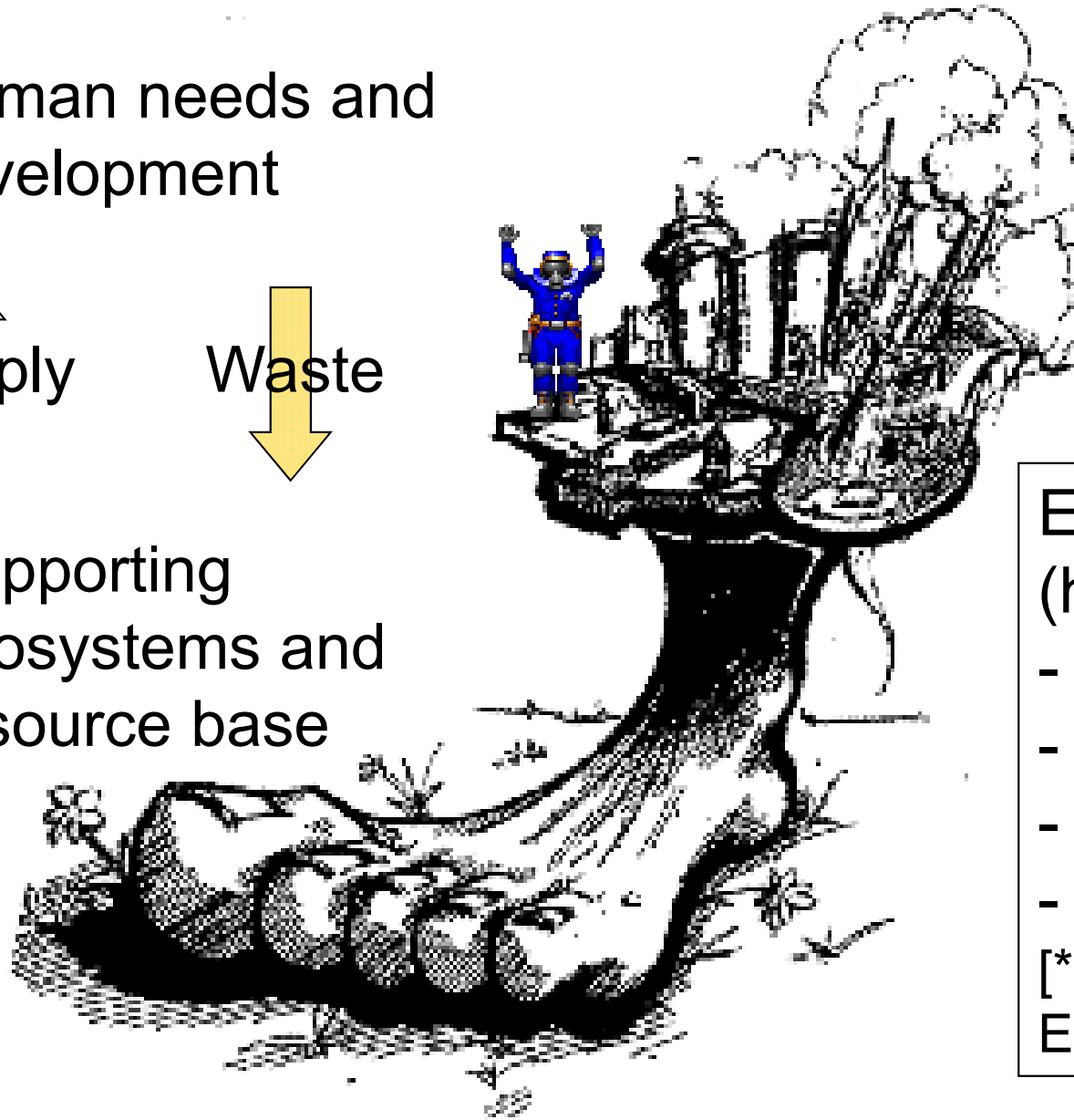
Carrying capacity and ecological footprint

Human needs and development

Supply

Waste

Supporting ecosystems and resource base



Ecological footprint (hectares/person) *:

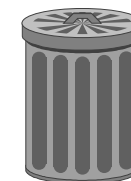
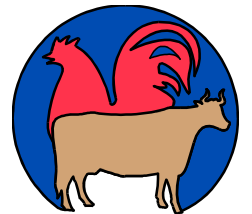
- world average = 2.3
- USA = 10.3
- **Hong Kong = 6.0**
- China = 1.2

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

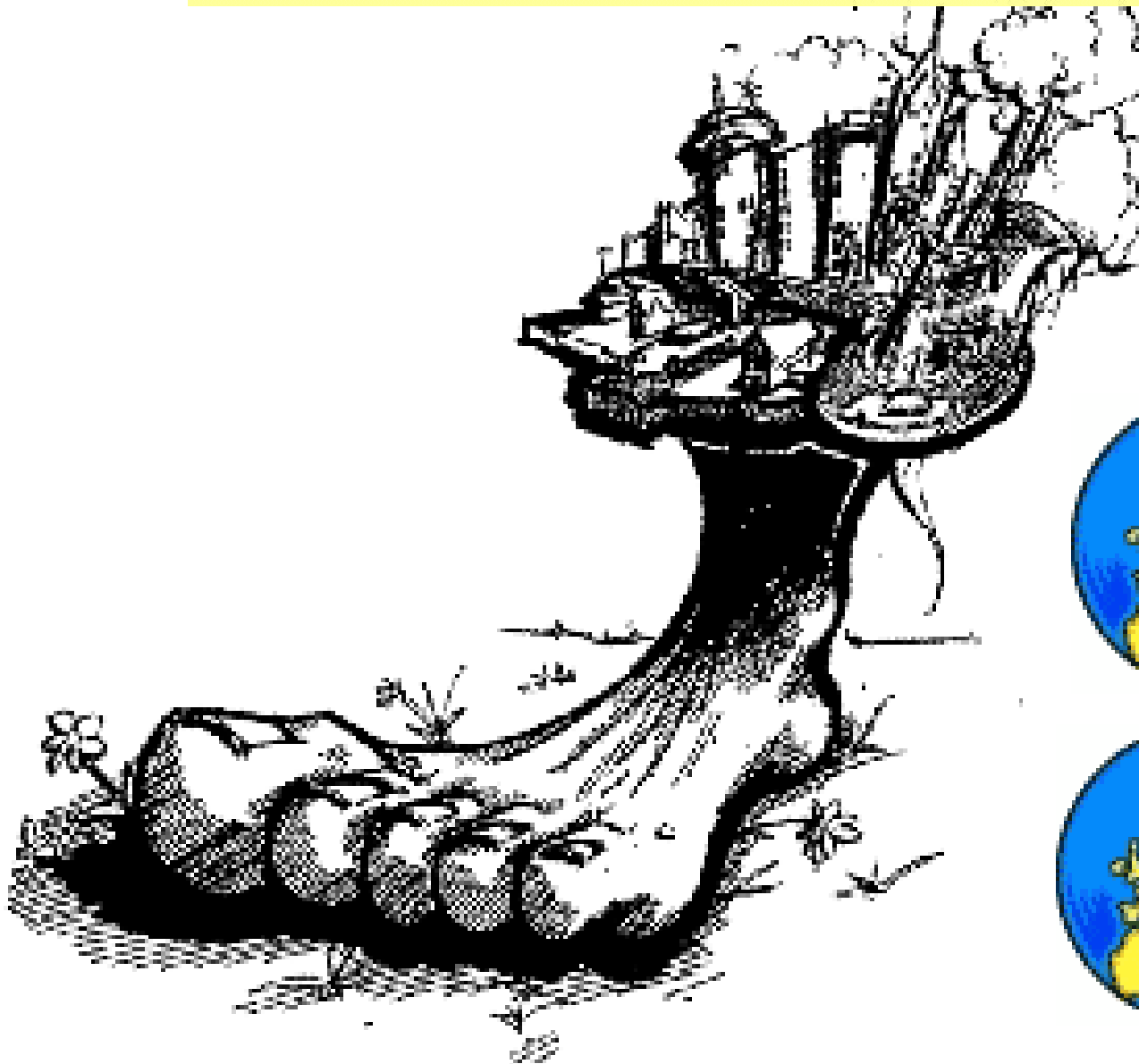


Sustainable development

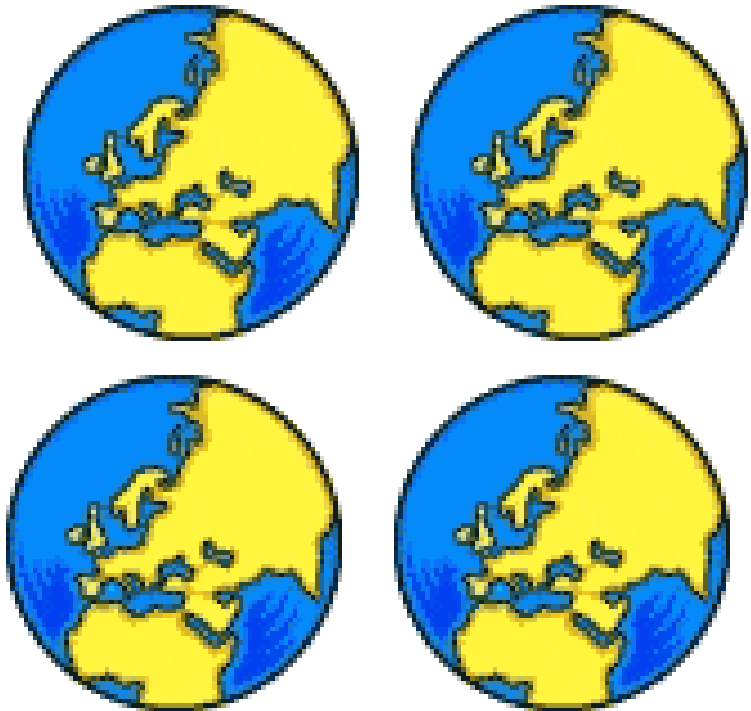
- One day in HK (population = 7 million) [2007]
 - Fresh water consumption = 374 litre/person
 - Electricity consumption = 17.4 kWh/person
 - Food consumption:
 - Vegetables 1,780 tonnes; fruits 1,460 tonnes
 - Live pigs 4,860 heads; live cattle 120 heads
 - Live poultry 80 tonnes; fresh eggs 230 tonnes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



Sustain-able Future?



The Factor Four concept*



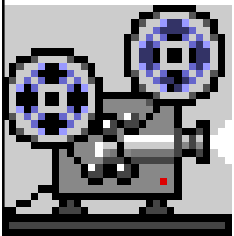
(*See also <http://www.gdrc.org/sustdev/concepts/12-f4.html>)



Sustainable development



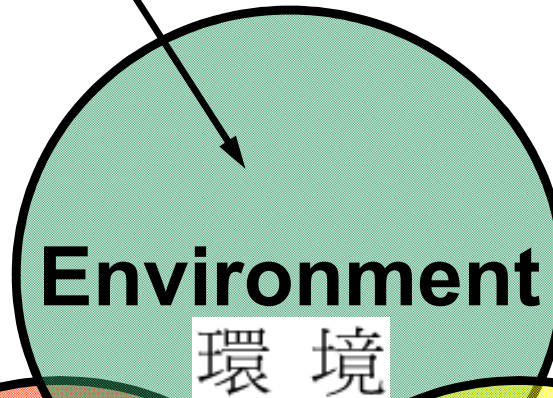
- Sustainability (可持續發展, 永續性)
 - The endurance of systems and processes
 - Improves the quality of human life while living within the carrying capacity of supporting eco-systems
- Video Presentation:
 - Sustainability explained through animation (2:00)
<http://youtu.be/B5NiTN0chj0>
 - What is Sustainability? (1:51)
<http://youtu.be/hH109q5kk0k>



Three dimensions of sustainability

Environmental Sustainability

Ecosystem integrity
Carrying capacity
Biodiversity

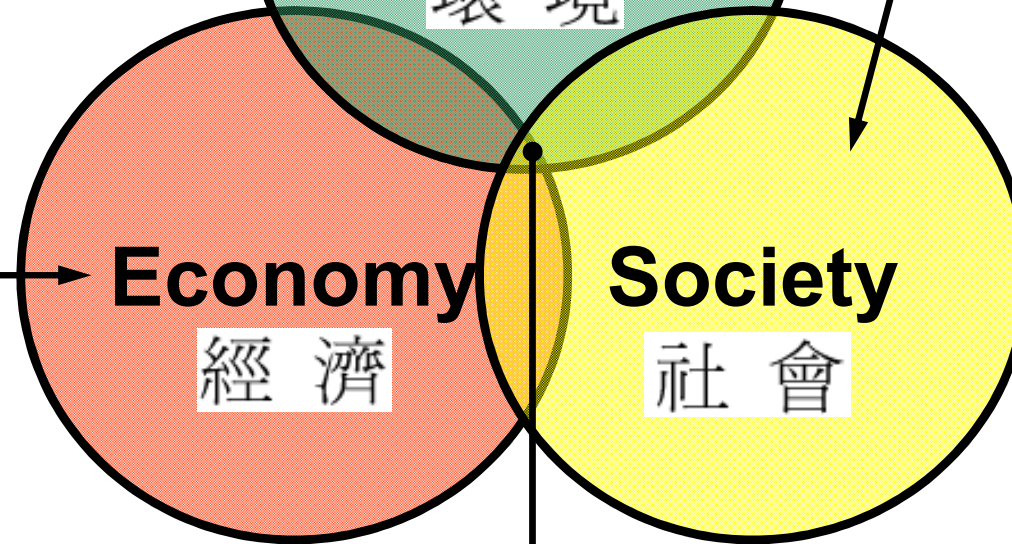


Social Sustainability

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

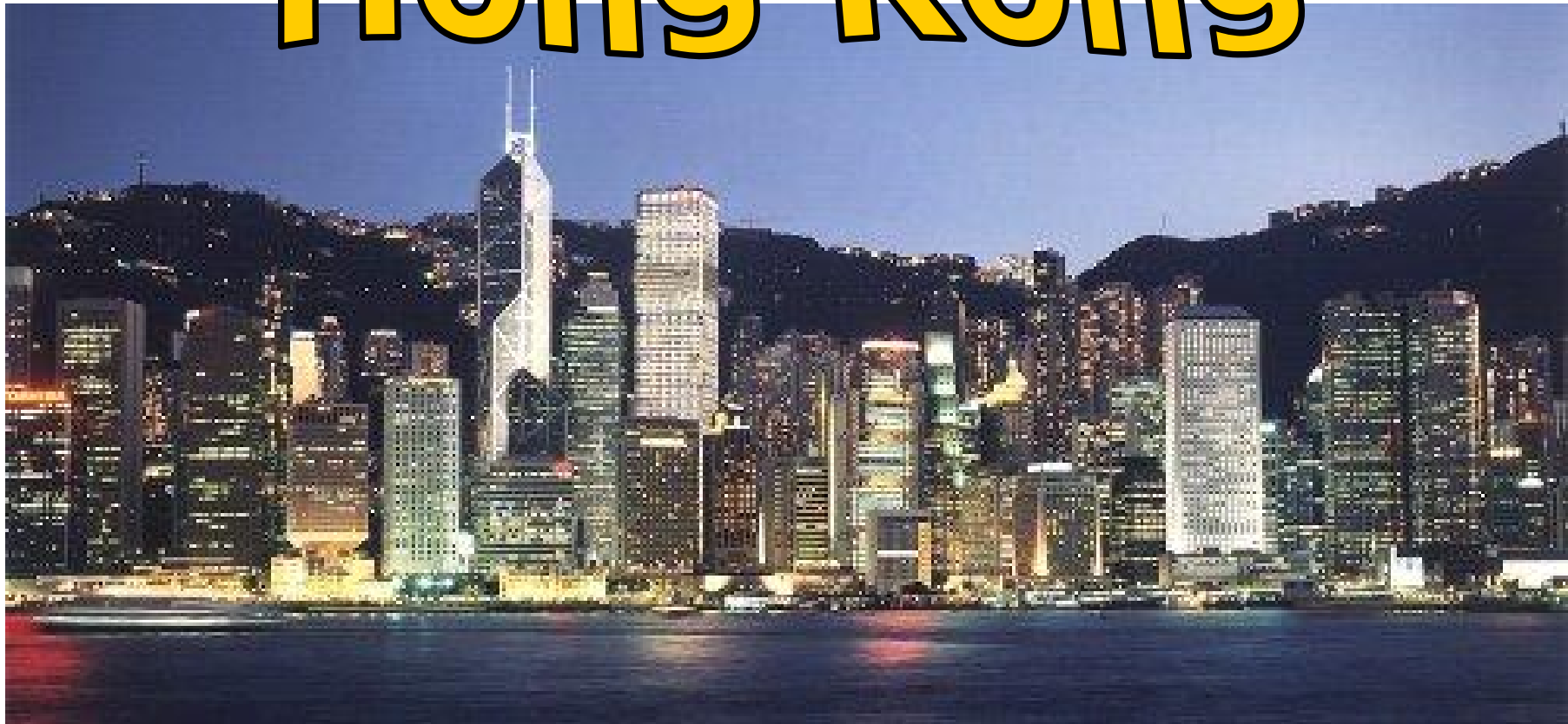
Built environment



- 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-like street pattern, a large bay, and surrounding hills. A semi-transparent green rectangular box is overlaid on the center of the image, containing a quote in bold green text.

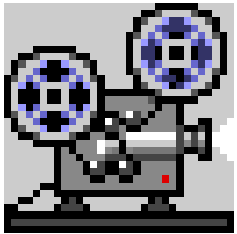
**"We shape our buildings and
thereafter they shape us."
(Winston Churchill)**

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

Built environment



- Hong Kong situation and examples
 - Liberal Studies: Video: Green Buildings (6:37)

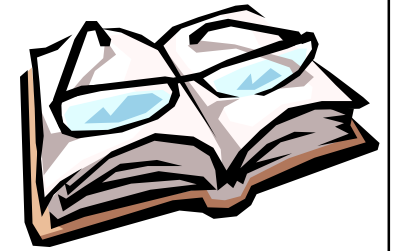


- <http://minisite.proj.hkedcity.net/hkiakit/eng/LS/lesson7.html>

- Green building design
 - Government policy and voluntary guidelines
 - Green label or rating system
 - Examples:
 - Zero Carbon Building (ZCB)
 - Hong Kong Wetland Park
 - Upper Ngau Tau kok Estate
 - 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>
- Video:
 - A Tale of Two Futures: Sustainable Buildings or Unsustainable Climate Change (3:22)
<http://youtu.be/3TioZ2sVL-E>

