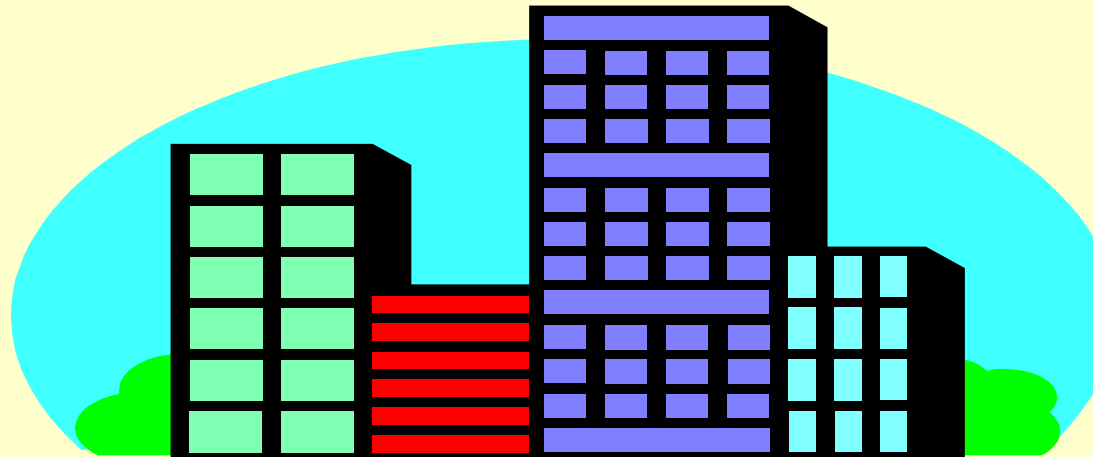


MECH3422 Building Services Engineering I

<http://me.hku.hk/bse/MECH3422/>

Introduction to Building Services Engineering (BSE)



Dr. Sam C. M. Hui

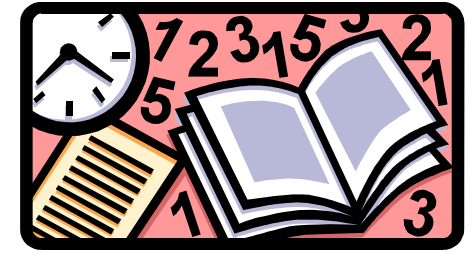
Department of Mechanical Engineering

The University of Hong Kong

E-mail: cmhui@hku.hk

Aug 2015

BSE Courses



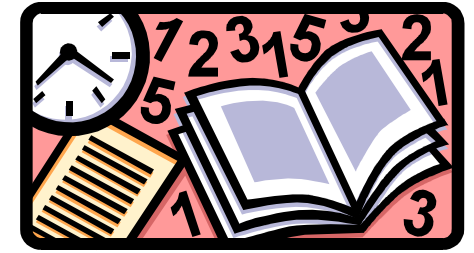
- **Level 3 (4-year curriculum)**

- *MECH3422 Building Services Engineering I (6 credits)*
- MECH3423 Building Services Engineering II (6)
- MECH3428 Research Experience for Undergraduates [on BSE topic] (6)

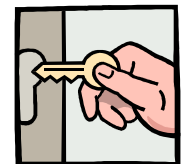
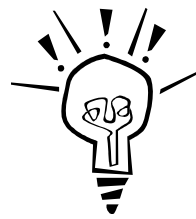
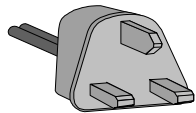
- **Level 4 (4-year curriculum)**

- BBSE4409 Project Management and Engineering Economics (6)
- MECH4423 Building Energy Management and Control Systems (6)
- MECH4429 Integrated Capstone Experience [on BSE topic] (12 credits)

MECH3422 BSE-I

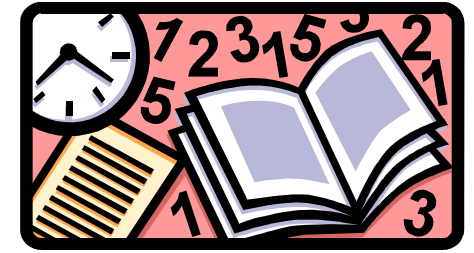


• Educational Objectives



- To introduce the engineering concepts, design procedures, practical applications and related codes and regulations of the **plumbing and drainage, electrical services, lighting, lifts, escalators and security systems**.
- To develop a basic understanding of the objectives, methods and codes/standards for effective design, operation and management of these systems.
- To enable students to design and analyse these systems for modern buildings complying with local statutory regulations and achieving effective and efficient design solutions.

MECH3422 BSE-I



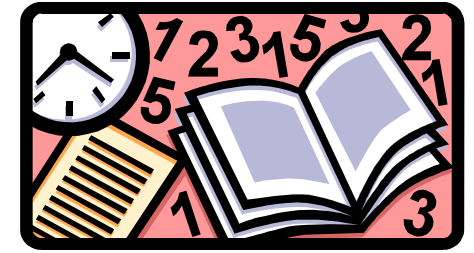
- **Learning Outcomes**

- Explain the engineering concepts and design methods of plumbing and drainage, electrical services, lighting, lifts, escalators and security systems.
- Understand the characteristics and engineering design of these systems.
- Design these systems and achieve effective and efficient design solutions.

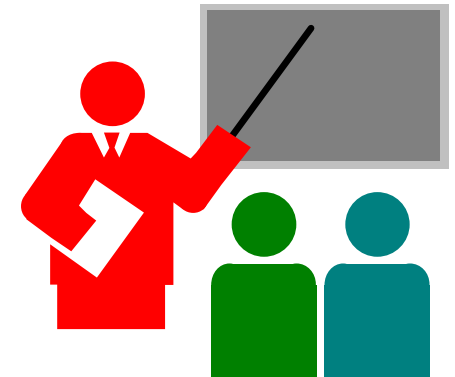
- **Assessment**

- Examination (65%), In-course assessment (20%), Practical work (15%)

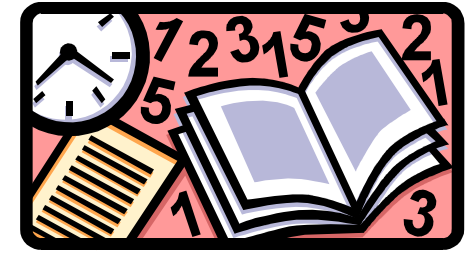
MECH3422 BSE-I



- Prerequisite:
 - Engineering fundamentals on fluid mechanics and electrical engineering
- Related courses:
 - MECH3423 Building Services Engineering II
 - Industrial training (your working experience)
- Course Website:
 - <http://me.hku.hk/bse/MECH3422/>



MECH3422 BSE-I



- Study topics of MECH3422:
 - Introduction to BSE
 - Cold water supply
 - Hot water supply
 - Sanitation and drainage

 - Electrical services systems
 - Lighting systems
 - Lift and escalators
 - Security systems



Dr. Benjamin Ho

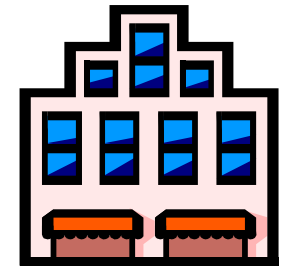


Dr. Sam Hui

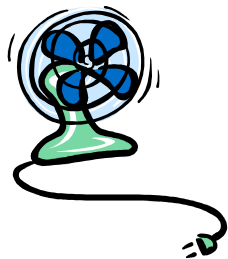
What is Building Services Engineering (BSE)?



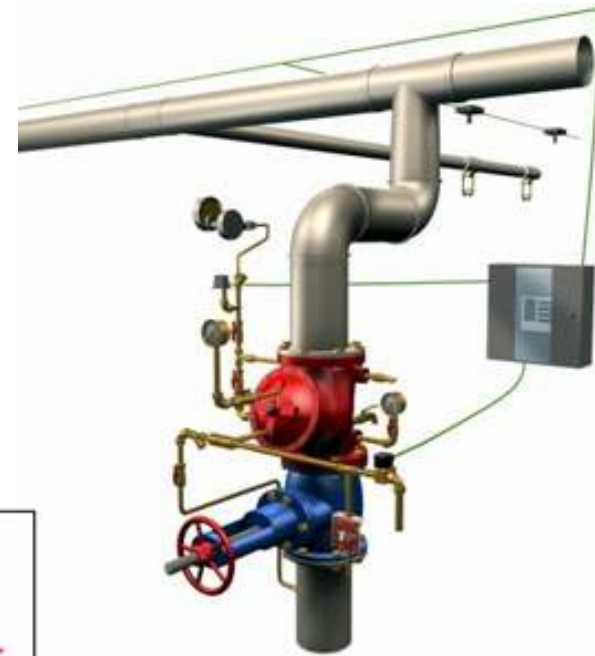
Building Services Engg.



- Building Services Engineering (**BSE**)
 - It is about designing, installing & servicing everything that is needed to make buildings comfortable, safe & convenient
 - Concern with the design, manufacturing, installation, commissioning and maintenance of mechanical and electrical services in buildings



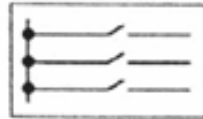
Major Building Services Systems and Components



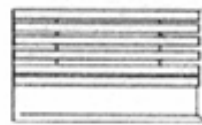
風 火
水 電



More ...



Electrical installation



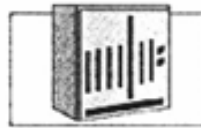
Blinds and shutters



Ventilation



Air conditioning



Switchgear and controlgear

Building Services Systems



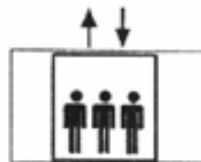
Heating



Stand-by power supply



Cooling



Elevator



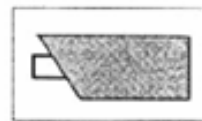
Sanitation



Security



Lighting



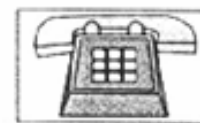
Video



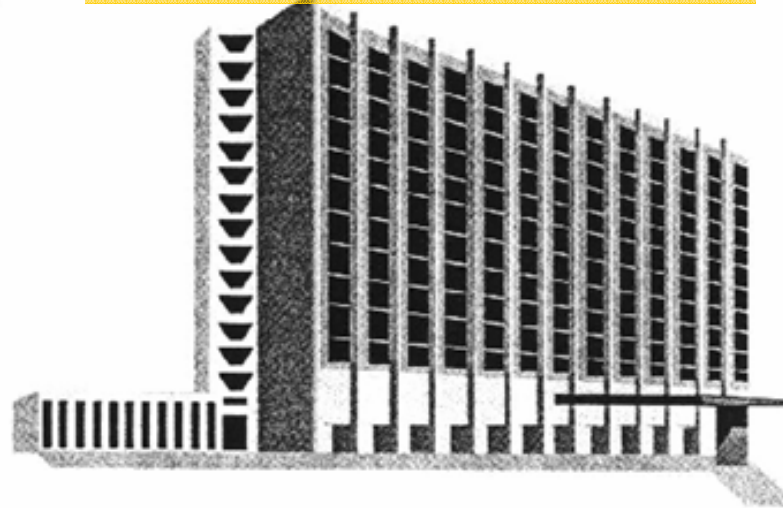
Waste disposal



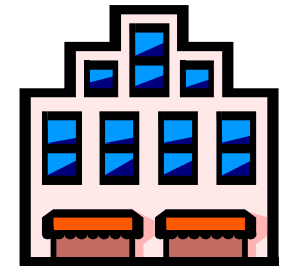
Office and data systems technology



Telephone



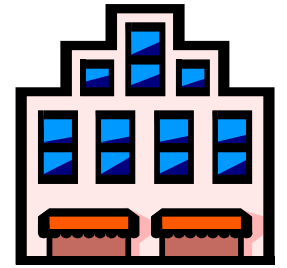
Building Services Engg.



- Related areas/disciplines
 - HVAC+R (heating, ventilating & air-conditioning + refrigeration)
 - Fire services
 - Water supply & drainage
 - Electrical services
 - Lighting systems
 - Security & communication
 - Lifts & escalators

BSE

Building Services Engg.



- Related areas/disciplines (cont'd)
 - Building management & control system
 - Gas & steam supply
 - Acoustics and noise control
 - Facade engineering
 - Refuse disposal system
 - Building energy efficiency
 - Sustainable building design

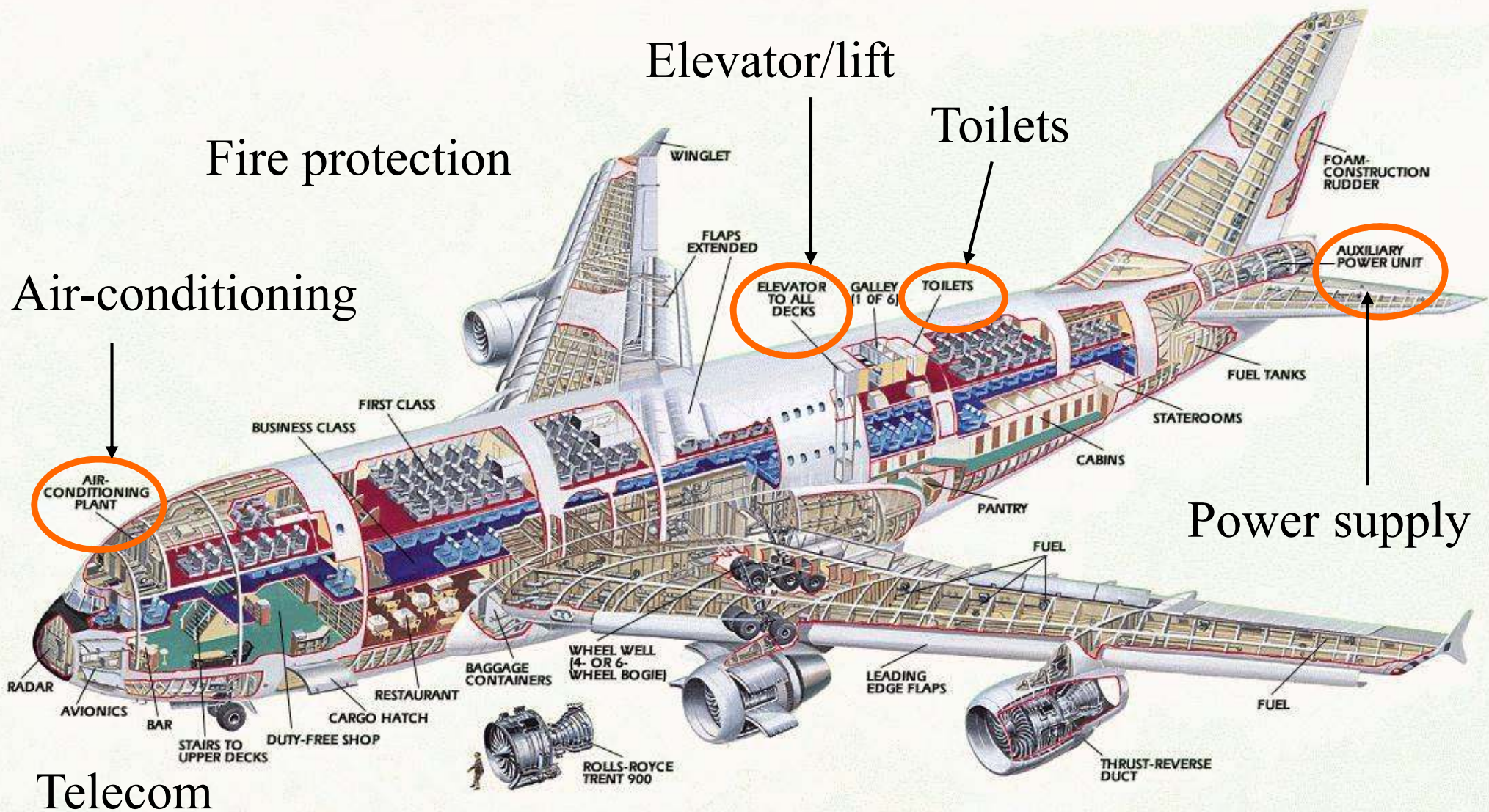
BSE

Every building requires Building Services



A ferry boat also needs Building Services.

Airbus A380 also needs Building Services.



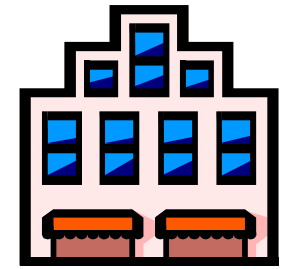
But they are not normal building services systems ...

Hong Kong 香港

An aerial photograph of Hong Kong, showing a dense urban landscape with numerous skyscrapers and residential buildings. The city is built on a hilly terrain, with the sea visible on the right side. The image is used as a background for the text.

What will happen if no electricity, no water, no air-conditioning?

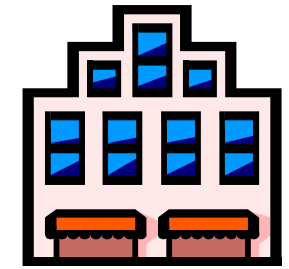
Building Services Engg.



- Terminology
 - Building Services
 - M/E (mechanical/electrical) or E/M
 - MEP (mechanical, electrical, plumbing)
 - (Building) Environmental Engineering
 - Building Engineering
 - Architectural Engineering/Technology
 - Public Health Engineering
 - Utility Services

屋宇裝備 / 屋宇設備 /
建築設備 / 機電工程



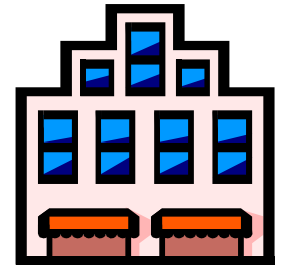


Building Services Engg.

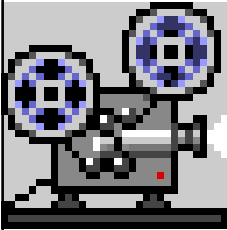
- Utility Services 公共設備
 - “Utility” = a service used by the public
 - For example
 - Electricity
 - Water supply & drainage
 - Gas supply
 - Telephone services
- Also read “Hong Kong: the Facts: Water, Power and Gas Supplies”

http://www.gov.hk/en/about/abouthk/factsheets/docs/wp%26g_supplies.pdf

Building Services Engg.



- Video presentation:
 - Sally Biddlecombe - mechanical building services engineer at Arup [TomorrowsEngineers] (1:33)
<http://youtu.be/OJcX1bvLoY>
 - SummitSkills -- Building Services Engineering (11:09) <http://youtu.be/-ybZYik8bhY>



Why Building Services are important to us?



Significance of BSE



- Significance of BSE
 - Building services systems are all the internal systems that make a building function
 - It is important for every building & the society
 - It affects people's comfort, health, productivity & safety
- Building Services Systems
 - Essential provisions for every building
 - Account for 30-60% of total building cost

Building Systems

Human Body

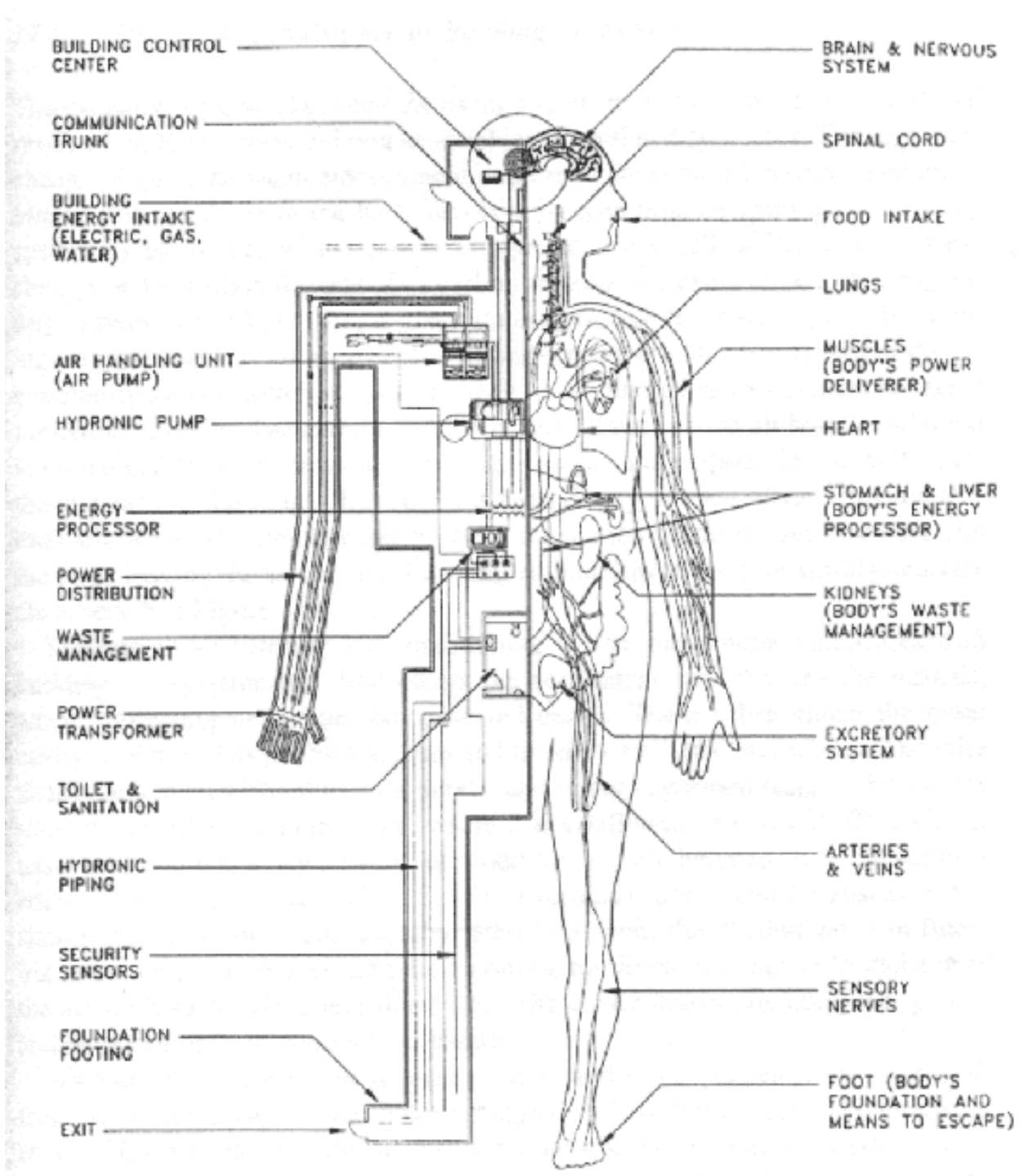


Figure 14.4 Body-building system integration.

(Source: Ahuja, A., 1997. Integrated M/E Design: Building Systems Engineering, Chapman & Hall, New York.)

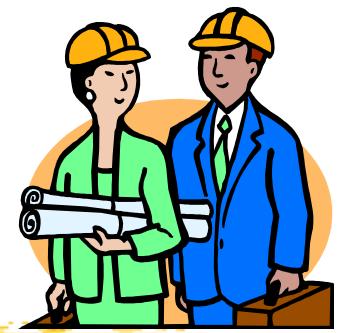
Significance of BSE



- Important issues of BSE:
 - Energy efficiency in buildings
 - Indoor air quality
 - Intelligent buildings
 - Sustainable/green building
- Developments in Hong Kong:
 - The new Buildings Energy Efficiency Ordinance
 - Green building design and assessment
 - Need to control indoor air pollution



Construction Industry

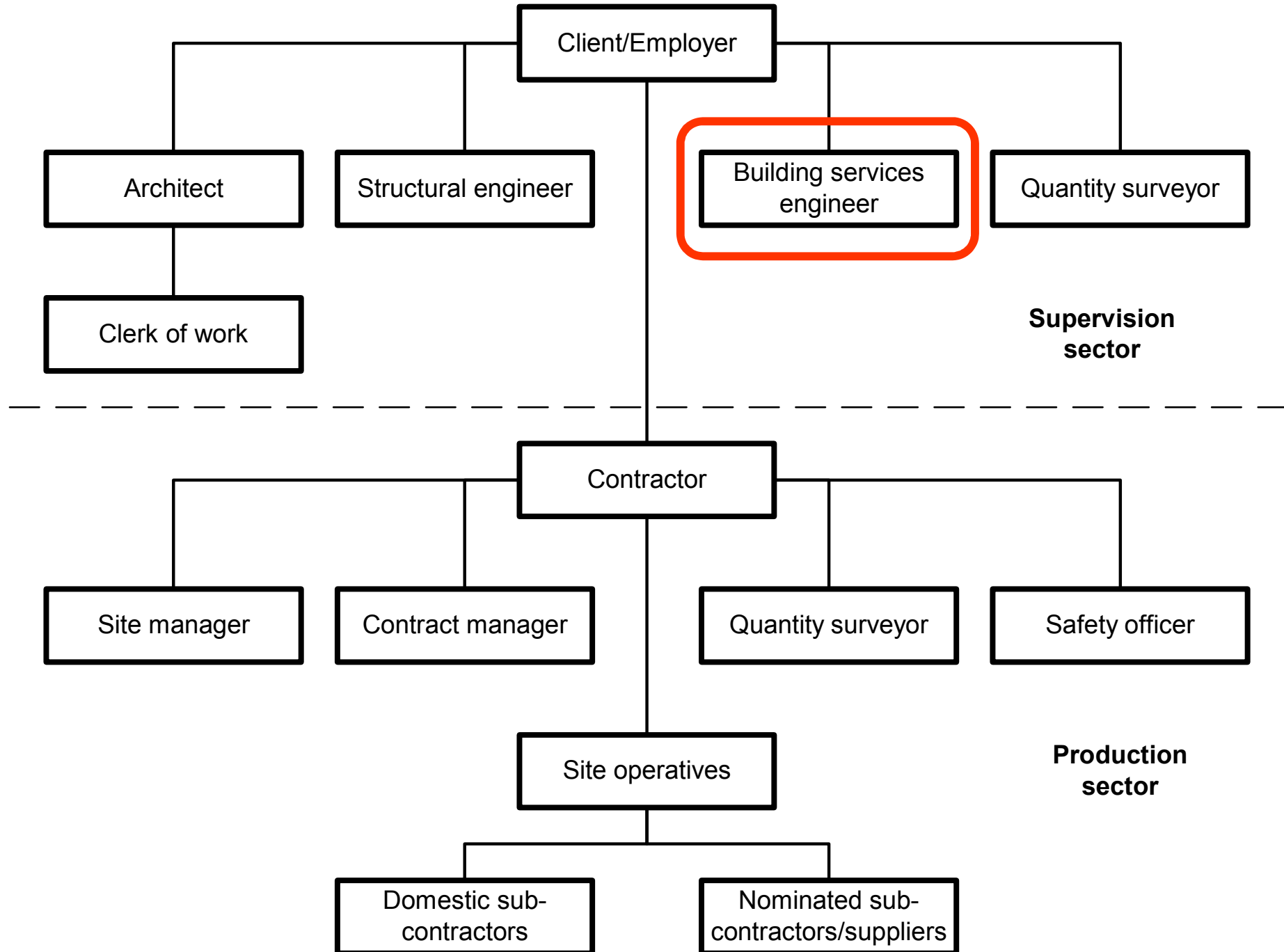


- Building, construction & real estate industry
 - An important sector in every society
 - In Hong Kong, the construction sector accounts for 4% to 5% of GDP and over 40% of total fixed capital formation, employs around 300,000 workers and professionals
- Building services systems
 - Essential provisions for every building
 - Could account for 20-50% of total building cost

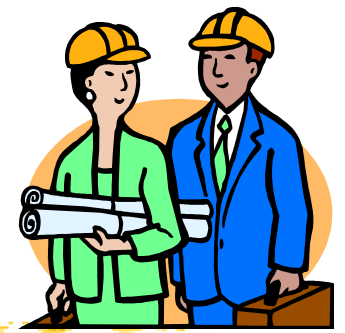


Building design is a team work.

Organisation structure of building projects



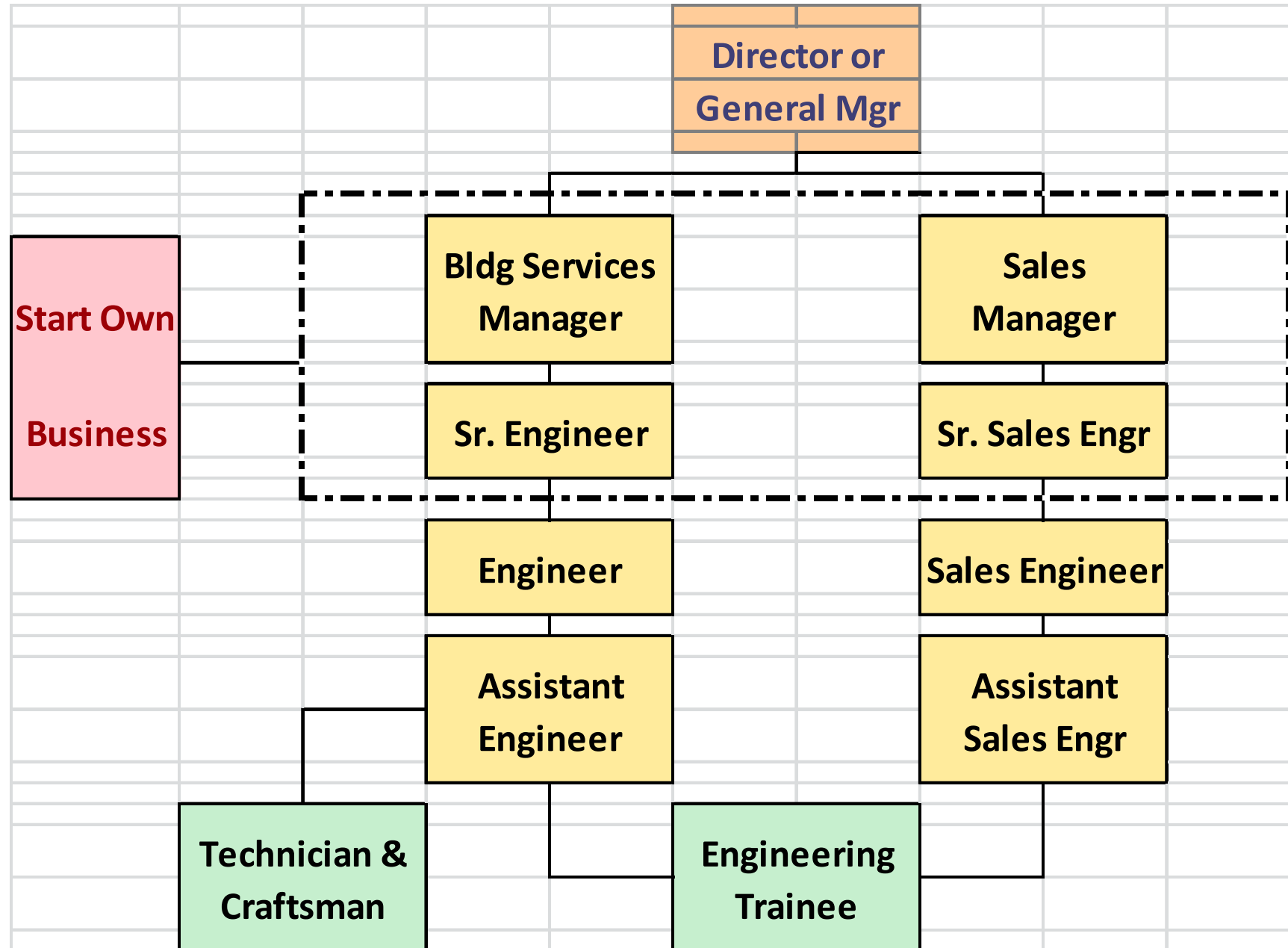
Construction Industry



- BSE jobs:
 - Consulting/design engineer
 - Contracting engineer
 - BS coordinator (main/civil contracting firms)
 - Project manager/engineer (for developers)
 - Government's engineer
 - Engineer for quasi-government bodies (e.g. MTR)
 - Sale engineer of M/E equipment suppliers
 - Facility management or maintenance engineer



BSE Career Path

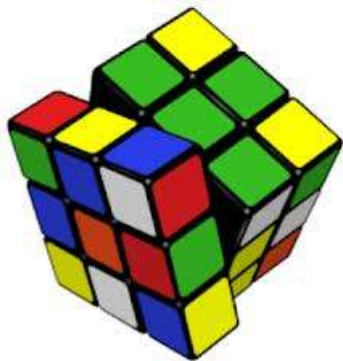


(Source: HKIE Building Services Division)

Building Services Design



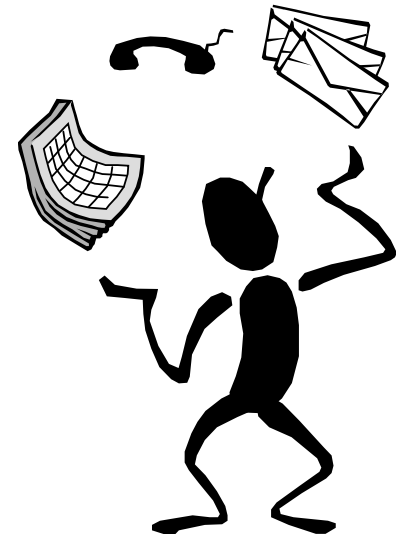
- Main objectives of BSE design
 - Hygiene (prevent disease & ensure health)
 - Safety (protect against risks)
 - Comfort (physio- & psycho- well-beings)
 - Convenience (efficiency & productivity)



Building Services Design



- Environmental factors:
 - Climate & local resources (like water & energy)
 - Urban setting & site conditions
- Human factors:
 - Thermal, visual & acoustic comfort
 - Occupants' needs & behaviour
- Market factors:
 - Local practices & tradition
 - Government codes & regulations



Building Services Design



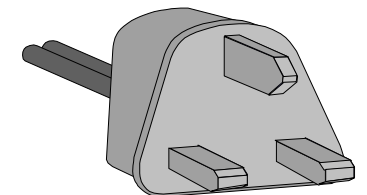
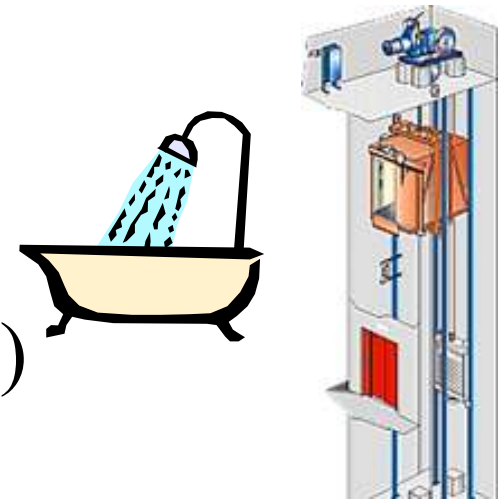
- Design objectives and criteria

- Expected quality of service
- Reliability
- Costs \$\$\$



- Other considerations

- Environmental impact (local & global)
- Risk management
- Regulatory issues



Building Services Design



- Government Departments in HK, such as:
 - Architectural Services Department (ArchSD)
 - Buildings Department (BD)
 - Drainage Services Department (DSD)
 - Electrical & Mechanical Services Dept. (EMSD)
 - Environmental Protection Department (EPD)
 - Fire Services Department (FSD)
 - Housing Department (HD)
 - Water Supplies Department (WSD)



Building Services Design



- Utilities companies, such as:

- CLP Power
- Hongkong Electric
- Towngas
- MTRC & KCRC



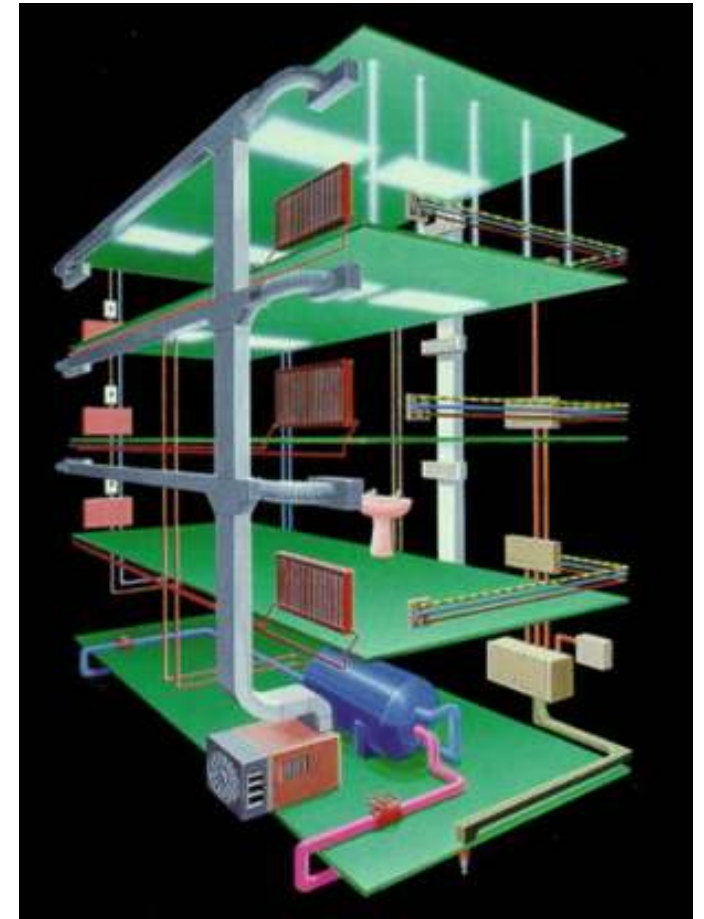
- Professional bodies, such as:

- HKIE (Building Services Division)
- CIBSE Hong Kong Branch
- ASHRAE Hong Kong Chapter

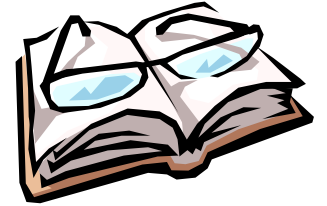
Building Services Design



- Three major elements:
 - Plant (e.g. pumps, transformers)
 - Distribution (e.g. pipes, ducts)
 - Terminals (e.g. fitments, outlets)
- Design information
 - Schematic diagrams
 - System layout
 - System selection & specification



Further Reading



- About Building Services Engineering (BSE)

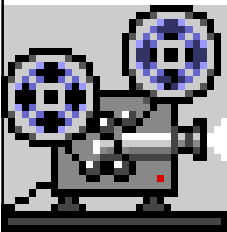
<http://me.hku.hk/bse/about-bse.htm>

- Videos:

- The Building Design Process and Teamwork:
Building Services Engineer [ArchSD] (2:11)

http://www.archsd.gov.hk/archsd/html/teachingkits/TK2/index_En.html?v=v4#

- Are Building Services a necessary evil? [Arup]
(24:45) <http://youtu.be/6bHbM15sBMw>





Useful References

- Chadderton, D. V., 2013. *Building Services Engineering*, 6th ed., Routledge, Abingdon, Oxon and New York, NY. [[696 C432 b93](#)] [[ebook via ebrary](#)]
- Hall, F. and Greeno, R., 2013. *Building Services Handbook*, 7th ed., Routledge, London. [[690 H17](#)] [[ebook via ebrary](#)]
- Hastings, P., 2005. *The Illustrated Guide to Electrical Building Services*, 2nd ed., Building Services Research and Information Association, Bracknell, Berkshire, England. [[621.3 D27](#)]



Web Links

- Student Notes for Building Services Engineering
(<http://www.arca53.dsl.pipex.com/>)
 - Hot & cold water
 - Drainage
 - Electrical
 - Lighting
 - Plant sizing