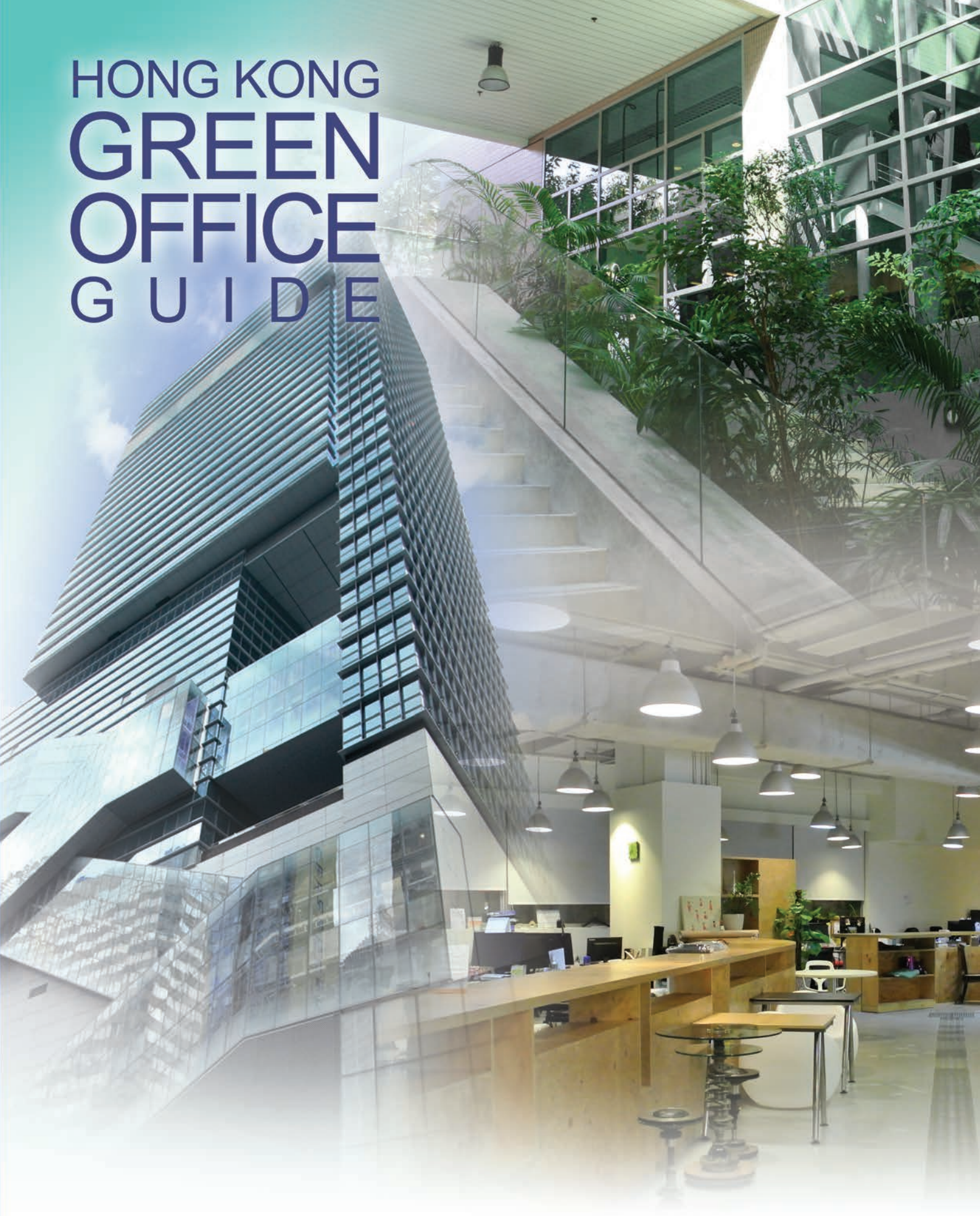
HONG KONG GREEN OFFICE GUIDE



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HONG KONG GREEN OFFICE GUIDE

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About Hong Kong Green Building Council Limited

The Hong Kong Green Building Council Limited (HKGBC) is a non-profit, member led organisation established in 2009 with the vision to help save the planet and improve the wellbeing of the people of Hong Kong by transforming the city into a greener built environment. The Founding Members of HKGBC include the Construction Industry Council (CIC), the Business Environment Council (BEC), the BEAM Society Limited (BSL) and the Professional Green Building Council (PGBC). Its mission is to lead market transformation by advocating green policies to the Government; introducing green building practices to all stakeholders; setting design, construction and management standards for the building profession; and promoting green living to the people of Hong Kong.

Our vision

To help save the planet and improve the wellbeing of the people of Hong Kong by transforming the city into a greener built environment.

Our mission

To lead market transformation by advocating green policies to the Government; introducing green building practices to all stakeholders; setting design, construction and management standards for the building profession; and promoting green living to the people of Hong Kong.

CONTENT

Message from

Secretary for the Environment

When it comes to global climate change, transformation to low carbon approach would be the main focus of sustainable development. With the Paris Agreement now in force, governments, enterprises and citizens around the world shall take actions in energy saving and waste reduction to mitigate climate change. Buildings in Hong Kong take up about 90% of Hong Kong's annual electricity consumption, which accounts for about 60% of our total carbon emissions. As an international commercial centre, commercial buildings in Hong Kong take up the biggest proportion of energy consumption. Therefore, advocating "green commercial building" and "green office" is of significant importance.

Generally, a "green building" requires considerations on many aspects, including building design, choice of building materials, construction plan, environmental impact as well as building operation and management, in order to achieve energy and water conservation, waste reduction, and wise use of material resources in a sustainable manner. This not only helps lower carbon emissions but also provides a healthy and pleasant working environment, which in turn enhances employees' productivity.

The Hong Kong Green Office Guide ("the Guide"), introduced by the Hong Kong Green Building Council (HKGBC), provides guidance and green practices to building owners, property facility managers, tenants and occupants of office premises pertaining to the potential opportunities, benefits and improvements gained from a green office building. The Guide outlines the steps to a green office building starting from design stage to operation and management stage. Stakeholders can take all these recommendations into consideration when designing, operating and managing an office premises, enhancing property quality and recurring cost benefits.

I wish to express my appreciation to the HKGBC for its every effort in promoting the sustainable built environment in Hong Kong. The Government initiates a number of green measures including the gradual implementation of "Energy Saving Plan for Hong Kong's Built Environment 2015~2025+" in tackling climate change, in order to strike a balance between environmental, social and economic aspects. The Hong Kong Green Office Guide is indeed a timely publication in driving the society towards sustainable development.

Mr WONG Kam-sing, GBS, JP

Secretary for the Environment

Foreword from

Chairman of Hong Kong Green Building Council

On behalf of the Hong Kong Green Building Council Limited (HKGBC), we take great pleasure in presenting our Hong Kong Green Office Guide (the Guide), which introduces measures to enhance environmental performance of office buildings and units.

Founded in 2009, the HKGBC is committed to introducing and promoting green building practices to a variety of stakeholders, such as construction industry practitioners, schools, shopping mall operators, retail tenants and the general public. To this end, the HKGBC published a number of guidebooks over the years. As the first of its kind, the Green School Guide was published in 2013 to provide comprehensive guidance on how schools can go green. Thereafter, the HKGBC spread the green message to a wider community and published the Hong Kong Green Shop Guide and Green Tenancy Driver for Office Buildings respectively in 2014. To cater for the needs of landlords, property managers and office occupants, the HKGBC sustains its efforts to compile the Hong Kong Green Office Guide, which provides recommendations on how green features can be implemented at both design stage and operational stage.

The Guide features a five-step roadmap, which comprises various key green elements of an office building, namely Planning and Design, Indoor Environmental Quality, Energy Efficiency and Water Saving, Operation and Maintenance as well as Landlords and Tenants. To help landlords, property managers and office occupants implement green measures that suit their needs, the Guide provides easy-to-understand guidance on green strategies with the aid of case studies of local office units and buildings. In this way, we hope readers will find it easy to put knowledge into practice and take actions to go green.

Last but not least, we would like to take this opportunity to express our sincere gratitude to the HKGBC Hong Kong Green Office Guide Steering Committee for their contribution to the development of the Guide. Our heartfelt appreciation also goes to those organisations who have contributed their case studies to the Guide and have shared with us their valuable views when we were compiling the Guide. Moreover, we would like to thank the Construction Industry Council (CIC) for its funding support to this project.

We hope this Guide is not only informative but also contains practicable guidance for office owners and occupants to make a contribution to creating a green and sustainable built environment. A sustainable city for our future generation would be a long way to go but every little effort from individuals helps. Let's strive for a more sustainable workplace and make Hong Kong a more liveable city.

Sr WONG Bay

Chairman, Hong Kong Green Building Council

DESIGN STAGE

OPERATION AND MANAGEMENT STAGE

chapter 3.2

Indoor environmental quality affects the health, well-being and productivity of users. Important strategies include:

- Thermal comfort
- Adequate ventilation
- Natural daylight
- Glare Control
- Good acoustic environment
- Indoor air quality (IAQ)
- Indoor greenery
- Low VOC materials
- Possibility of IAQ certification

STEP 2
Indoor Environmental Quality

STEP 1
Planning and Design

A green building starts from a holistic approach to planning and design. Starting from the earliest stage, every decision can have an impact over the building's lifetime performance.

Proper planning and design of office buildings and office units includes:

- Location selection
- Design
- Materials use
- Indoor environmental quality
- Energy efficiency and water saving
- Construction noise and pollution control

Important consideration:

Review possibility of certification for green building or green interiors and get professional advice at this stage.

chapter 3.1

STEP 3
Energy Efficiency and Water Saving

Design of a sustainable building services system helps to improve the building performance. Important strategies include:

Energy aspects:

- Energy saving technology
- Renewable energy

Water aspects:

- Reduce water use
- Water recycling

chapter 3.3

chapter 4.1

Even the best green building can have a poor performance without proper operation and maintenance.

Green operation and maintenance involves both the facility management team as well as landlord, tenants and occupants. Important strategies include:

- Intelligent building management system
- Waste management
- Green education and support
- Occupants' behaviour
- Maintain efficiency
- Energy audit
- Monitoring and benchmarking
- Pest control
- Post occupancy survey

STEP 4
Operation and Maintenance

chapter 4.2

Collaboration between landlord and tenant is important to reach the goal of creating greener offices. Important strategies include:

- Incentives for landlord and tenants
- Landlord support
- Green lease
- Guidelines for tenants
- Collective bargaining for green products
- Performance monitoring

STEP 5
Landlords and Tenants

INTRODUCTION

The Hong Kong Green Office Guide aims at providing guidance and introducing best practices to stakeholders, including the owners, property facility managers, tenants and occupants of office premises, regarding the constraints, opportunities and benefits arising from different environmental aspects of the building and facilities for office premises, and how the potential opportunities, benefits and improvements can best be realised.

Key Figures:

Hong Kong being one of the world's largest commercial centres, the total stock of private offices at the end of 2014 amounted to 11 million m^2, that is about the size of 1500 standard football pitches.

(Source: Hong Kong Property Review 2015 by HKRVD)

Hong Kong office workers spend 1/3 of their working days in offices. On a five day 9-6 working basis, office workers spend about 2000 hours per year per person in offices excluding the overtime hours which are excessive compared to London (1740 hours) and New York City (1847 hours).

(Source: Prices and Earnings 2015. Report. UBS Wealth Management, 2015. Accessed February 29, 2016.)

It is vital to have a pleasant working environment that does not have any adverse effect on their health and wellbeing. This will also help to improve workers satisfaction, and increase productivity.

In 2014, 62 tonnes of office paper is disposed of to landfills everyday[1]. This paper should have gone into recycling bins or being reused. It takes 17 trees and 1500 litres of oil to make one tonne of paper.[2] This means more than 1000 trees needs to be cut down for the 62 tonnes of paper we throw away every day.

Offices consume 300kWh/m^2/yr energy in Hong Kong. Offices have a high energy consumption, especially when compared with residential buildings, which consume 100kWh/m^2/yr in Hong Kong. There is a high potential for improving energy efficiency in offices.

(Source: Research on HK's Climate Change Strategy published by Arup)

Occupants and Tenants are increasingly demanding a sustainable work environment of higher standards.

Owners are aiming for a higher performance standard for their new office developments.

Figure 1.1 Benefits of Green office

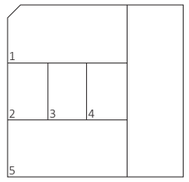
1. Monitoring Of Solid Waste In Hong Kong Waste Statistics for 2014 published by Environmental Protection Department
2. "Waste Reduction Website." Green Office. Accessed November 20, 2015. https://www.wastereduction.gov.hk/en/workplace/tips_green_office.htm.

EXECUTIVE SUMMARY

In Hong Kong, 90% of our annual electricity is consumed in buildings, 60% of which is used in commercial buildings, which are in operation over 8 hours a day. Office practices and the adoption of green features have become of increasing concern for sustainability in the built environment. While it is a worldwide trend to pursue development in sustainability, more office management tends to encourage their office stakeholders to implement green building features and sustainable practices during their operations.

This guide book includes a portfolio of detailed case studies of green features (both passive and active design) which have already been implemented and made operational for new and existing office premises in Hong Kong. Some of these existing office premises are certified under BEAM/BEAM Plus New Buildings/Existing Buildings/ Interiors schemes.

The guide book is divided into two main parts. The first part showcases the design considerations for green office buildings and office units illustrated with appropriate case studies. The second part describes how operation and management can contribute to green buildings. For each consideration, you may find the upper half of the page for benefits and green strategies for office buildings and the lower half of the page for that of office units.



1 *Figure 1.2 Office Buildings in Hong Kong*
(Source: Hysan Development Limited)

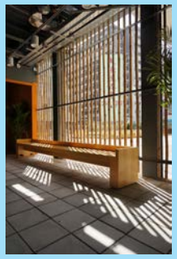
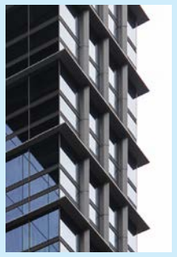
2 *Figure 1.3 China Resources Building*
(Source: China Resources Property Limited)

3 *Figure 1.4 Genesis*
(Source: Barrie Ho Architecture Interiors Ltd)

4 *Figure 1.5 Hysan Place*

5 *Figure 1.6 One Island East*
(Source: Swire Properties Limited)

Office BUILDING

Considerations	Strategies	Benefits
Planning and Design  The creation of green offices needs to start with planning and design. Appropriate use of green planning and design can help to reduce operational and maintenance costs as well as create a comfortable and healthy work environment which can help to increase productivity. More detail will be discussed in CH. 3.1.	• Sustainable Architectural Design • Consideration of Impact on the Neighbourhood • Exterior Landscape • Exterior Envelope Insulation • Considerations for Tenant Use • Provision for Tenant Exhaust • Provision for Tenant Drainage and Water Point • Convenient Public Transportation • Connectivity to Nearby Amenities • Green Building Materials • Reuse of Materials • Construction Noise and Pollution Control • Construction Waste Reduction	• Lower initial investment costs by having proper planning • Enhance ease of modification to suit tenants' needs by considering their use during design stage • Lower energy consumption by adopting passive design • Lower operational and maintenance costs with passive design
Indoor Environmental Quality  Poor indoor environmental quality may result in sick building syndrome and affect the well-being of occupants and productivity of the office workers. Simple measures carried out by different parties can have a significant impact on occupants' health. More detail will be discussed in CH. 3.2.	• Thermal Comfort • Adequate Ventilation • Natural Daylight • Glare Control • Quality Views • Good Acoustic Environment • Indoor Air Quality • Indoor Greenery • Low-VOC Emitting Material • Seperation of Printing Room • Seperation of Server Room • The Indoor Air Quality Certification Scheme	• Increase productivity • Fewer lost work days and better business • Enhance physical and mental health
Energy Efficiency and Water Saving  Resources are limited on Earth, including energy, water and materials. We should use them wisely through reduction, reuse and recycling. Also innovative technology may be adopted to save resources. More detail will be discussed in CH. 3.3.	• Sustainable Building Services System • Renewable Energy • Energy Saving Technology • Reduce Water Use • Water Recycling	• Increase efficiency of the appliances • Retain operational efficiency of building services system • Lower the chance of system failure and increase energy efficiency • Good reputation with customers on environmental sustainability

Considerations	Strategies	Benefits
Planning and Design  By planning ahead, office units can enable workers and visitors to enjoy the benefits of a more convenient neighbourhood and healthy work environment. A good construction plan can also create a more pleasant interior space. More detail will be discussed in CH. 3.1.	• Office Layout and Design • Convenient Public Transportation • Connectivity to Nearby Amenities • Green Building Materials • Reuse of Materials • Construction Noise and Pollution Control • Construction Waste Reduction	• Enhance occupants' health and well-being • Enhance office productivity
Indoor Environmental Quality  There is a wide variety of evidence showing the implications of office design on health, well-being and productivity. How an office can serve its basic purpose of providing a comfortable and healthy environment is the key focus. More detail will be discussed in CH. 3.2.	• Thermal Comfort • Adequate Ventilation • Natural Daylight • Glare Control • Quality Views • Good Acoustic Environment • Indoor Air Quality • Indoor Greenery • Low-VOC Emitting Material • Separation of Printing Room • Separation of Server Room • The Indoor Air Quality Certification Scheme	• Increase well-being, less fatigue • Increase job satisfaction • Easier to concentrate • More ergonomic postural changes • Fewer errors, increase accuracy • Alleviate mental stress and illness
Energy Efficiency and Water Saving  Due to the growth of business in Hong Kong, the total energy consumption for office buildings is still an increasing trend despite the Government's efforts. For a green office, different energy saving approaches can be considered within the office life cycle. More detail will be discussed in CH. 3.3.	• Energy Saving Technology • Reduce Water Use • Water Recycling	• Improve the well-being of occupants by certain behavioural changes • Reduce energy bills

Office UNIT

Office BUILDING

Considerations	Strategies	Benefits
Operation and Maintenance  Well-planned operational, maintenance and management practices and procedures for green office buildings are critical for long-term implementation and achievement throughout the whole process in maintaining the green office environment. Even if an office building or premises are designed and constructed as a green office, in spite of a good foundation for a green office environment, the benefits of a green office may be reduced or nullified if not properly maintained or managed. More detail will be discussed in CH. 4.1 Operation Maintenance and Management.	• Green Operation and Management • Intelligent Building Management System • Waste Management • Green Education and Support • Occupant's Behaviour • Maintain Efficiency • Energy Audit • Monitoring and Benchmarking • Pest Control • Post Occupancy Survey	• Establish energy saving strategies for the building owner • Reduce operational costs • Increase efficiency and saves time in monitoring and measuring power use
Landlord and Tenant  Participation and support of both landlords and tenants are important in contributing to the success of green offices. Landlord and tenants need to be aware of the benefits of the green office. Having a green fitting out guide can be an effective tool for education and promotion purposes for green practices. More detail will be discussed in CH. 4.2 Landlord and Tenant.	• Landlord and Tenant Consideration • Incentive for Landlord and Tenant • Landlord's Support • Green Lease • Guidelines for Tenants • Collective Bargaining for Green Product • Performance Monitoring	• Bring long term economic payback • Premium rental value and occupancy rate • Enhance social responsibility, reduce regulatory, market and weather-related risks • Increase business network of tenants • Recognition as an industry leader • Improve working environments for employees

Increase the Green Value of
OFFICE BUILDING

Considerations	Strategies	Benefits
Operation and Maintenance  Operation, maintenance and management of the office building and premises require a team effort. Green strategies need to be adopted to maintain the building system and overall building. This will help to reduce operational costs and maintain green and healthy office buildings and premises. More detail will be discussed in CH. 4.1.	• Green Operation and Management • Waste Management • Green Education and Support • Occupant Behaviour • Green Housekeeping • Maintain Efficiency • Energy Audit • Monitoring and Benchmarking • Pest Control	• Enhance well-being and satisfaction of the office environment • Provide better environmental comfort by having better control

Increase the Green Value of
OFFICE UNIT

Office UNIT

DESIGN

Planning and Design

Green office minimises its impact on the environment while achieving the required purposes and comfort levels for which the building is intended. There are many aspects that need to be considered. Green design, location, resources conservation and green construction, planning and design are the key concerns. Adopting a sustainable design from the start and considering each aspect of a building in an integrated and holistic manner help to save on costs of building operation and maintenance, create a healthy and comfortable working environment and minimise the impact on the environment. The discussion in this guide includes designing of new office buildings as well as retrofitting of office interior space.

Office BUILDING

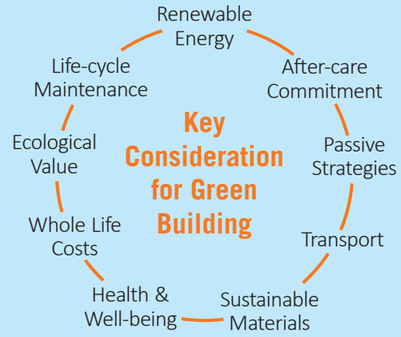
Sustainable Architectural Design

Overview for Office Building

Sustainable architectural design helps to provide building strategies to achieve a green office building and premise and reduce the need for costly building services equipment.

A passive design approach through careful consideration of the building's location, relationship to the environment, and climate etc. can help to achieve sustainability from the start. Below are some examples of passive design which are easy to achieve and have fewer cost implications:

- Orientate the building so that the largest area faces north and south in order to minimise amount of heat via direct sunshine going into the building
- Provide appropriate solar shading and low-e glass to reduce solar heat gain and glare for west facing windows
- Maximise daylight and views through architectural design to enhance indoor environmental quality for the offices
- Incorporate greenery and landscape areas as part of the design to enhance the exterior environmental quality for the office building as well as the neighbourhood and to provide an amenity for the office workers as well as reduce the heat island effect on the neighbourhood
- Openings that function as 'urban windows' can be designed in the office towers to carve out openings in the building to provide the opportunity for a sky garden and enhance air ventilation for the neighbourhood
- Consider natural ventilation as a design strategy to assist in reduction of energy consumption, improve human comfort and indoor air quality
- Choose a light colour for the interior to reduce energy use for lighting
- Use Building Information Modelling (BIM) as a tool to help avoid abortive work and calculate the right amount of building materials, etc



Benefits of Green Office Building

- Reduce the cost of building service equipment like air-conditioning and electrical systems
- Reduce energy consumption by using daylight to offset the amount of electric lighting needed
- Lower operational costs
- Reduce solar heat gain and glare
- Enhance indoor environmental quality of the offices
- Enhance occupant's work performance due to improved indoor air quality
- Reduce heat island effect on the neighbourhood
- Enhance air ventilation for the neighbourhood

Green Strategies for Office Building

- Sustainable Master Layout Plan (case example on p.19)
- Building Disposition and Orientation
- Building Information Modelling (BIM)
- Greenery
- Building Shape
- Building Height (optimum floor to floor height) and Roof Geometry
- External Building Projection
- Window/Door Sizes and Locations
- Natural Ventilation (case example on p.20, p.21)
- Daylight (case example on p.21)
- Shading (case example on p.21)
- View
- Floor Layout

Office BUILDING

Case study of Hong Kong Science and Technology Park:

Sustainable Master Layout Plan

- optimise building disposition, orientation, separation and layout to reduce air-conditioning loads
- enhance air ventilation at pedestrian zones, with an average 1.5m/s breeze
- extend landscaping to 40% of site area helps to minimise the urban heat island (UHI) effect
- optimise natural lighting using courtyards to help to reduce internal artificial lighting demand

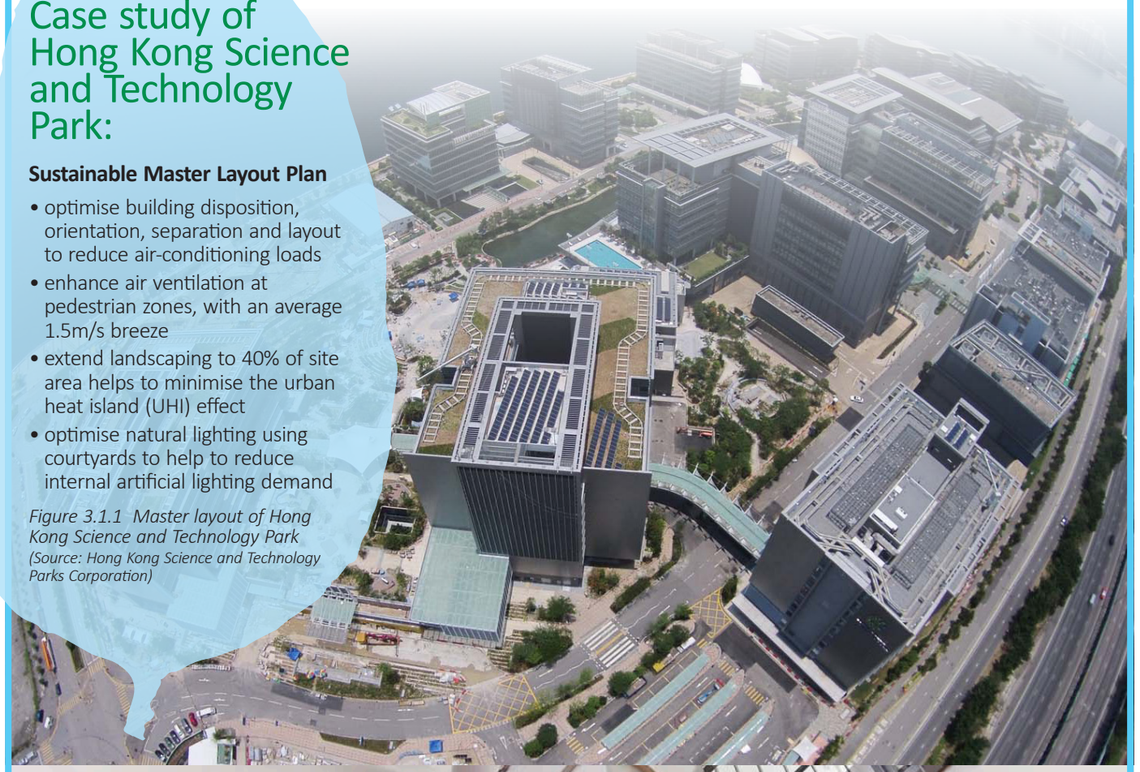
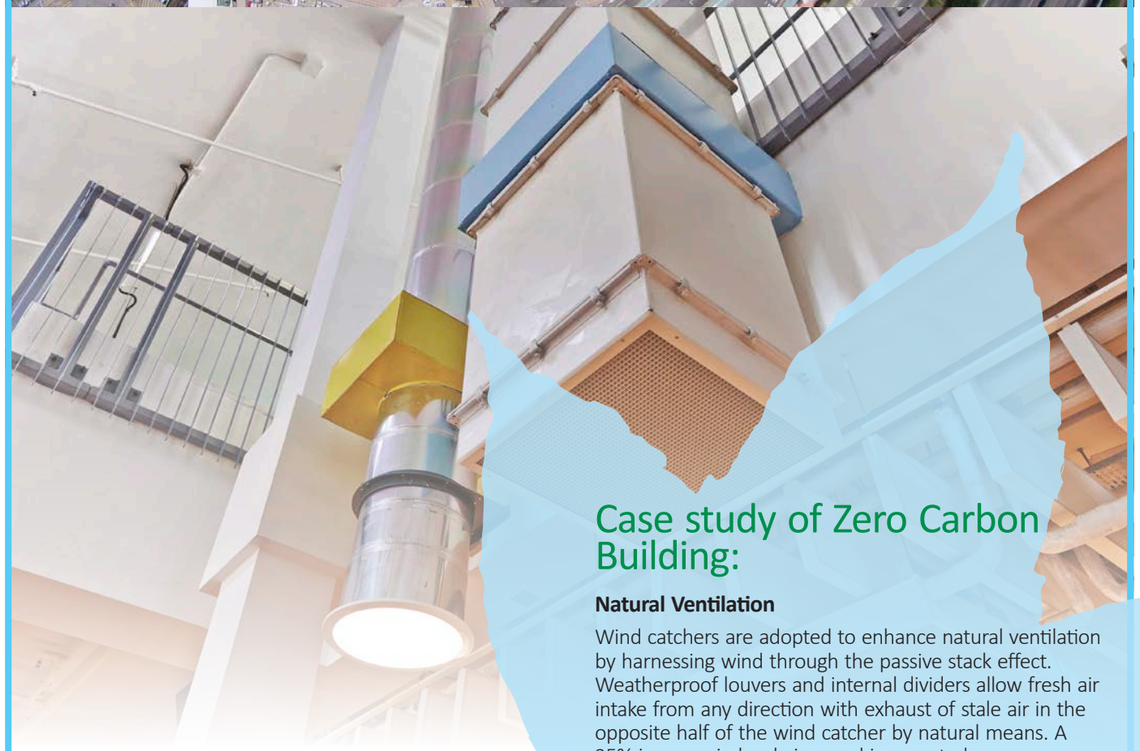


Figure 3.1.1 Master layout of Hong Kong Science and Technology Park
(Source: Hong Kong Science and Technology Parks Corporation)



Case study of Zero Carbon Building:

Natural Ventilation

Wind catchers are adopted to enhance natural ventilation by harnessing wind through the passive stack effect. Weatherproof louvers and internal dividers allow fresh air intake from any direction with exhaust of stale air in the opposite half of the wind catcher by natural means. A 25% increase in local air speed is expected.

Figure 3.1.2 Sustainable design of Zero Carbon Building
(Source: Hong Kong Construction Industry Council)

Office BUILDING

Case study of Energizing Kowloon East Office:

Natural Ventilation

Perforated external walls in the form of a bamboo trellis were installed to capture cool breezes to the courtyard area. Windows were installed on opposite sides of the office areas and in the Information Kiosk to facilitate cross ventilation.

Daylight

To enhance daylighting, the underside of the Kwun Tong Bypass, painted in light colour, is used as a light-reflector to reflect daylight, making the central courtyard well-lit throughout the day without artificial lighting.

Shading

The building disposition was carefully planned such that around 80% of the roof area is covered by the Highways structure above (Kwun Tong Bypass) to minimise solar heat gain.

Figure 3.1.3 Perforated external wall
(Source: Energizing Kowloon East Office)

Office BUILDING

Consideration of Impact on Neighbourhood

Overview for Office Building

Design, construction and management of the office buildings and premises should aim at providing a positive impact on the neighbourhood.

Some examples of positive impact on the neighbourhood:

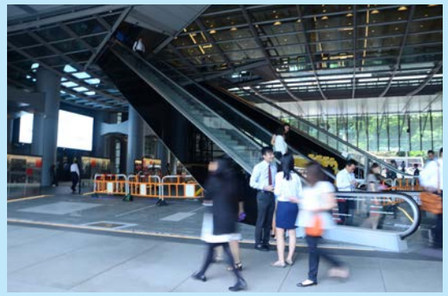


Figure 3.1.4 Ground Connection at HSBC Headquarter

- Provide covered walkways and canopies to help enhance weather protection for pedestrians
- Provide connection to public transportation such as the mass transit railway integrated with the office building's circulation to enhance connectivity to public transportation for office workers, visitors and the neighbourhood
- Ensure exhausts are not facing sensitive areas in the neighbourhood to avoid causing a nuisance to the neighbours
- Provide greenery and landscape areas to enhance the environment as an amenity for the office workers and the neighbours and to help reduce the heat island effect at the same time
- Consider the provision of an air ventilation path to help air ventilation of the neighbourhood
- Avoid using highly reflective glass walls which may cause glare to neighbours due to the reflection of sunlight
- Avoid using extensive external façade lighting which can cause a nuisance to the neighbours
- Minimise the impact of buildings to ecologically important sites in the neighbourhood during the planning stage
- Adopt a bird-friendly façade design to avoid casualties from accidental collisions. (Read more at: Bird-friendly Urban Design Guidelines by The City of Calgary; Land Use Planning and Policy available at http://fonhs.org/bird_friendly_design_guidelines.pdf)
- Have stakeholder engagement and consultation to ensure the design is fit for purpose

Benefits of Green Office Building

- Greenery can help to reduce heat gain and decrease energy consumption.
- Avoid the use of excessive façade lighting can reduce the demand for electricity and cut down the initial investment cost.
- Enhance weather protection for pedestrians
- Enhance connectivity to public transportation for office workers, visitors and the neighborhood
- Enhance air ventilation and improve visual permeability in the neighbourhood
- Reduce heat island effect
- Subject building also benefits from a good neighbourhood, e.g. community amenities

Green Strategies for Office Building

- Building massing and height (case example on p.23)
- Building disposition and configuration to align with prevailing wind
- Provide urban windows to enhance air ventilation and visual permeability in the neighbourhood (case example on p.24)
- Use of wind guide to enhance ventilation in the neighbourhood (case example on p.25)
- Podium design to enhance ventilation, and avoid large coverage (particularly on extensive and wall-like buildings) to promote permeability (case example on p.25)
- Set back of buildings to provide air path to facilitate ventilation
- Covered Walkway
- Connectivity to public transportation
- Greenery as amenity which helps to reduce heat island effect
- Avoid use of highly reflective glass wall
- Avoid extensive use of external façade lighting
- Minimise noise from construction, renovation and demolition

Office BUILDING

Case study of 18 King Wah Road:

Building Massing and Building Height Studies

Building massing and building height studies were carried out at the design stage to achieve an optimal design that is in harmony with the local environment.

Figure 3.1.5 18 King Wah Road
(Source: Henderson Land Development Company Limited)

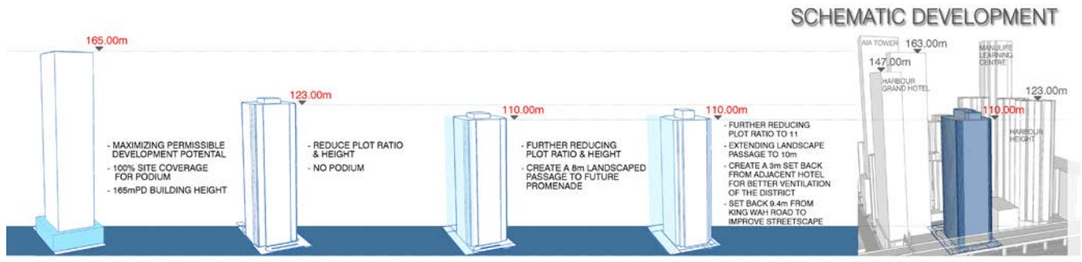


Figure 3.1.6 Schematic Development
(Source: Henderson Land Development Company Limited)

Office BUILDING

Case study of Hysan Place:

Urban Window

Several large openings are designed at lower levels of the building and act as 'urban windows' to enhance natural air ventilation and improve the micro-climate in the neighbourhood. They will also lessen the wall effect and help retain good visual permeability. Some openings also provide green spaces to mitigate the heat island effect.

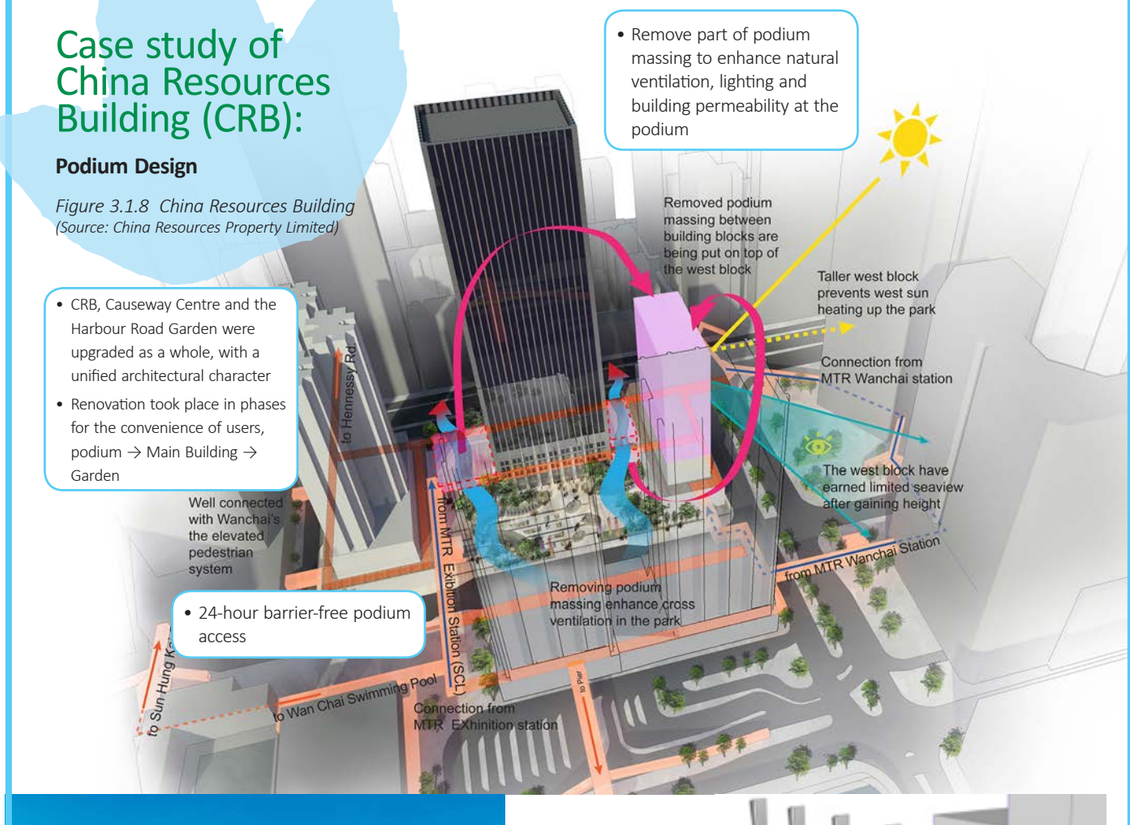
Figure 3.1.7 Urban window of Hysan Place
(Source: Hysan Development Company Limited)

Office BUILDING

Case study of China Resources Building (CRB):

Podium Design

Figure 3.1.8 China Resources Building
(Source: China Resources Property Limited)



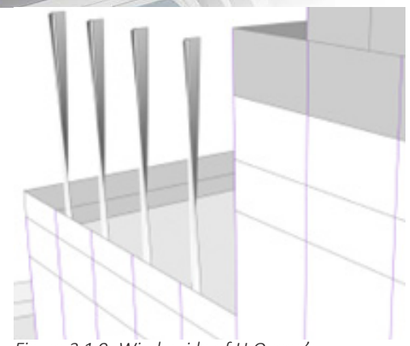


Figure 3.1.9 Wind guide of H Queen's
(Source: Henderson Land Development Company Limited)

Case study of H Queen's:

Wind Guide

To bring in breeze for the open zone, wind guides are introduced to divert prevailing wind from Queen's Road Central and Pottinger Street to the 3/F flat roof and to redirect the potential kitchen exhaust to the flat roof. Extensive computational fluid dynamic (CFD) modelling has been carried out to help to achieve this.

Figure 3.1.10 Exterior view of H Queen's
(Source: Henderson Land Development Company Limited)

Office BUILDING

Exterior Landscape

Overview for Office Building

Design of the outdoor green space should be integrated with the building design of the office building and the functional needs of the office building and the office spaces. One of the key factors to be considered is the plant size and suitability of the plant species ("Right species for right place" principle) for long term sustainable growth.

The following greenery methods are commonly adopted:

- Ground greenery
- Green roof/sky garden
- Vertical green wall

Provision of an outdoor green space brings benefits to both the building as well as to the surrounding environment. Outdoor greenery helps reduce the heat island effect and create a more pleasant environment around the office building.

Lighting design reference: "Guidelines on industry best practices for External Lighting Installations" released in June 2015 by Environmental Bureau, Environmental Protection Department and Electrical and Mechanical Services Department

BEAM Plus NB V1.2 SA P1

Appropriate planting shall be provided on site equivalent to at least 20% of the site area.

Benefits of Green Office Building

- Protect against heat build-up and control ambient temperatures at a macro level
- Create a more habitable space for people and animals thereby promoting biodiversity
- Reduce runoff, provide natural rain water filtration, and alleviate storm drainage pressure
- Cool the air in summer by a process called evapotranspiration, reducing the need to cool the building
- Green roofs can last two or even three times longer than conventional roofs hence it reduces the material waste from re-roofing and induces lower costs over time
- Green roofs can reduce building heat gain, and also mitigate urban heat island effect
- Green roofs also provide insulation and acoustic dampening
- Tree planting at pedestrian level is very effective in moderating urban climate and in promoting human thermal comfort as tree canopy not only cools the air space at pedestrian level, but also provides shading and thus lowers direct radiation from the sun
- Vertical greening not only reduces heat transmission into the building, especially if installed on the east and west façades but also protects the façade from weathering
- Outdoor greenery can provide a quality view for another building, creating a pleasant view for staff working in an office building
- Landscape is believed to affect human beings in many ways, including aesthetic appreciation, health and well-being
- Experience of nature can improve working experience, mood and happiness

Green Strategies for Office Building

- Consider the ease of maintenance, tolerance to pollution and vandalism and public safety when selecting plant species
- Native species should be widely used as a priority
- Enhance biodiversity by increasing the diversity of plants and the structure of vegetation provided, as well as establishing connected habitats for wildlife
- At grade tree-planting can be introduced at suitable locations to provide shade for the buildings and pedestrians
- Location to enhance natural ventilation and reduce glare and heat gain (create shading)
- Establishment of connected green corridors and lines of trees to provide more shaded routes for pedestrians
- Vertical green wall can be adopted to lower building heat transmission and prevent weathering of building façade (case example on p.28)
- Green roof to provide thermal insulation (case example on p.29)
- Participatory farming (case example on p.29)

Read more at:
1. "Use of Native Plant Species in Public Works Projects." Greening - Accessed February 28, 2016. https://www.greening.gov.hk/filemanager/content/pdf/knowledge_database/GuidelinesonUseofNativeSpecies-Textversionforwebsite_e.pdf.
2. A photographic Guide to Common Urban Trees of Hong Kong. Accessed December 13, 2016. http://herbarium.gov.hk/PublicationsPreface.aspx?BookNameId=8

Office BUILDING

Green Roof

Hong Kong has used less than 25% of land for development. 66% of land in Hong Kong carries vegetation, ranking 3rd in major cities in the world for average green space per person[1]. However, as the green area is mainly located in suburban areas, and there is only limited access to greenery in urban areas, there is a need to explore greening opportunities beyond ground level in urban areas.

Green roof has been shown to significantly reduce surface temperatures of roof. It is also a communal space for building occupants which enhances well-being of tenants. Green roof can be classified into extensive green roof and intensive green roof.

Extensive green roof:

- Shallow soil bases
- Low maintenance
- Do not need built-in maintenance systems
- Mostly not accessible for public use

Intensive green roof:

- Accessible for public use
- Known as roof garden
- Deeper soil base
- Include trees, palms, shrubs and turfing
- Designed with walkway, water features, seats and irrigation system
- Require regular maintenance

(Source: Building Planning and Massing, Building and Construction Authority)

Ground Greenery

Greenery absorbs heat and cools the area through evapotranspiration. It is an important factor in creating a sustainable environment. Below are some common ways to incorporate greenery into the development:

- Identify trees that can be protected and conserved. Leave them intact or remove and transplant back
- Provide as many trees as possible within the development since trees provide the most protection against solar exposure when compared with other plants
- Densely planted shrubs, palms and small trees can act as an alternative to fence, boundary walls, etc
- Open grid paving allows surface rainwater runoff to filter into the ground, and reduces heat build-up in the hard surface

(Source: Building Planning and Massing, Building and Construction Authority)

Vertical Greenery

There are two main ways to install a vertical greenery system:

Support System:

- Grown directly from ground adjacent to the façade
- Plants climb on specially designed support structures
- Lower initial investment cost
- Time is needed for desirable coverage
- Easier maintenance

Carrier System (Living Wall System):

- Consist of pre-vegetated panels that are fixed vertically to a wall structure
- Support a great diversity and density of plants
- Irrigation system needs to be built into the green wall
- Higher maintenance cost

(Source: Building Planning and Massing, Building and Construction Authority)

Figure 3.1.11 Roof garden of Hysan Place
(Source: Hysan Development Company Limited)

Read more at:
1. Ng, Kathy. Greening in Hong Kong – Looking Ahead. Lecture, Hong Kong, July 2014. Accessed 15 November 2016: http://hkihs.org/legacy/urban_tree_seminar2014/1_Greening_in_Hong_Kong-Looking_Ahead_KathyNg.pdf

DESIGN STAGE 3.1.3 Exterior Landscape

Office BUILDING

Case study of International Commerce Centre:

Ground Greenery

Plants and flowers are grown in the outdoor planters, providing a green environment for the building itself and also for the community. Furthermore, besides providing visual enjoyment of the environment, the plants also help to enhance the air-quality of the surrounding areas.

Figure 3.1.12 Outdoor greenery of ICC
(Source: Kai Shing Management Services Limited)

Case Study of the Government Headquarters

Ground Greenery

There is a landscaped pedestrian passage linking the local area to the promenade for the benefit of the community.

Figure 3.1.13 Landscaped Passage Towards Promenade

Office BUILDING

Vertical Greenery at Hysan Place

Figure 3.1.14 Vertical greening wall
(Source: Hysan Development Company Limited)

Figure 3.1.15 Intensive green roof at Hong Kong Science and Technology Park

Green Roof

High solar reflectance and green roofs reduce heat gain on upper floors and the urban heat island effect. Moreover, vegetated roofs can also contribute other environmental benefits e.g. sustainable storm water management, biodiversity, as well as other social and psychological benefits to the community as a whole.

Participatory Farming

"SPARK Farm" organic urban farming programme for tenants of the Hong Kong Science and Technology Park in the 2,000 sqft Phase 3 "Green Pad"

Exterior Envelope Insulation

Overview for Office Building

Better insulation of the external envelope can help to reduce heat gain during summer months and reduce the demand for air-conditioning, which will help to reduce energy use. During winter, heat loss through the external envelope is also reduced, which helps to reduce demand for heating of the interior space.

The main component of the external envelope is the solid wall and the glass area. Here are some examples of how better insulation of the external envelope can be achieved[1]:

- Window to wall ratio
- Glass properties
- Envelope material

Figure 3.1.16 Sunshading
(Source: Hong Kong Science and Technology Parks Corporation)

Benefits of Green Office Building

- A good building envelope will save on energy consumption and reduce investment costs
- Lower initial investment cost of air-conditioning systems
- Reduce heat gain during summer months and reduce the demand for air-conditioning
- During winter, heat loss through the external envelope is also reduced, which helps to reduce demand for heating of the interior space
- Higher thermal comfort because of warmer surface temperatures on the interior surfaces in winter and lower temperatures in summer. This also results in a lower risk of mold growth on internal surfaces

Green Strategies for Office Building

- Better insulation of exterior wall reduces heat gain and heat loss and reduces demand for air-conditioning and heating (case example on p.32)
- Use of double glazing or an integrated glass unit (IGU) helps to provide better insulation in glass areas and window areas (case example on p.34)
- Adopt/effective use of sun-shading devices (case example on p.32, p.33)
- Window to wall ratio in the external envelope during the design stage (case example on p.32, p.33)
- Motorised sun louvres (case example on p.33)

Figure 3.1.17 Exterior Envelope

1. Building Planning and Massing. Singapore: Centre for Sustainable Buildings and Construction, Building and Construction Authority, 2010.

Office BUILDING

Window to Wall Ratio

- Opaque walls generally resist heat transfer better than glass. Lowering the window to wall ratio can reduce the amount of outside heat being transferred to the interior
- Balance the view and daylighting requirement, glazing should only be placed where appropriate
- The north facing façade should have the largest glazing area since it receives the least solar heat gain

Glass Properties

Office buildings often have large glazing areas. Glass properties affect insulation performance. With high performance glazing, thermal insulation can be significantly increased. Solar heat gain in the summer will be reduced, so that less energy is consumed by air-conditioning. Heat loss in winter will be reduced so that less energy is needed for heating.

The glass properties are quantified by the following factors:

- Shading coefficient (SC) can portray how well a product blocks heat caused by sunlight. The lower the glazing's SC, the less solar heat it transmits into a building
- Visible light transmittance (VLT) is an optical property which indicates the amount of visible light transmitted through the glass
- External reflectance measures how much light from an external source is reflected by the glazing product

	U-Value ($W/m^2{}^oC$)	SC
Window	Fixed: Max. 6.93 Operable: Max. 7.21	Min. 0.25
Skylight	Max. 7.72	Min. 0.25
Wall	Max. 3.3	NA
Roof	Max. 0.39	NA

Table 1 Inputs for reference building envelope
(Source: Guidelines on Performance-based Building Energy Code by EMSD p.22)

Measure	Advantage	Disadvantage
Use double-glazed units	Lower U-value compared to single glazing Less heat transmission through conduction	Increase cost and structural loads
Use glass with lower Shading Coefficient	Less solar heat gain	Usually darker appearance Less opportunity for day lighting
Specify different glass according to function and orientation	Balanced budget – spend on high performance glass where it is most beneficial	More difficult to keep track of various glass types for a single façade or window unit

Table 2 Advantages and disadvantages of various measures to improve glazing performance (Building Planning and Massing. Singapore: Centre for Sustainable Buildings and Construction, Building and Construction Authority, 2010.)

Envelope Material

Good insulating material installed on the roof and façade improves the overall performance of the building. The insulating property is measured by U-value. Material with a lower U-value has better insulating properties and has a great impact on heat gain inside the building. Having a building with enough insulation is like a person wearing a ski jacket in cold weather, and having an umbrella on a hot sunny day.

Solar Reflectance Index (SRI) is an indicator of the material's ability to retain solar radiation by measuring the solar reflectance and emissivity. A standard black roof is defined as having an SRI of 0 while a standard white roof is 100. A cool roof usually has a higher number.

When not taking emissivity into account, the measure used is albedo, which is the proportion of incident radiation reflected by a system. A perfect absorber has an albedo of 0 while a perfect reflector has an albedo of 1.

Criteria	Basic Requirements
Thermal Insulation Performance	Single Glazing U-value: ≤ $5.8W/m^2K$ Double or triple glazing U-value: ≤ $3.3W/m^2K$
Shading Coefficient (SC)	Shading Coefficient: ≤ 0.90 Solar heat gain coefficient: ≤0.78
Visible Light Transmittance (VLT)	VLT ≥50%
External Reflectance (ER)	External Reflectance: ≤20%

Table 3 Hong Kong Green Building Council HK G-PASS Assessment Standard for Glazing (version 1.0)
(Source: http://hkgpass.hkgbc.org.hk/download/AS/HKGBC_Glazing_v1.0.pdf)

DESIGN STAGE 3.1.4 Exterior Envelope Insulation

Office BUILDING

Case study of Zero Carbon Building:

Optimise Window to Wall Ratio (WWR)

To optimise natural ventilation and control of heat gain/glare/daylight, appropriate ratios of window to wall areas are achieved. For north-west and south-east façades of the office area, a high WWR is obtained with fritted glass, external shades, and large operable windows for cross ventilation.

High Performance Glass Wall System

The two main window systems for the office area are a high performance glazing system incorporating low-emissivity coated glass panels, and actuator controlled operable windows. A reduction in energy consumption is expected from lower cooling loads and reliance on artificial lighting due to good thermal and optical performance. Energy use for dehumidification would be reduced by good air-tightness.

External Solar Shading

Vertical shading fins on the north-west façade maximise the penetration of natural daylight and blocks low angled sun in the late afternoon. Solar heat gain is reduced with better glare control.

Figure 3.1.18 Exterior of Zero Carbon Building
(Source: Hong Kong Construction Industry Council)

Case study of Hysan Place:

Solar-shading devices

Angled vertical fins were added to the west façade to block the late afternoon summer sun, and were angled, slightly pointing northwest to better block direct sunlight and avoid blocking views to the harbour. The horizontal fins in addition to the vertical fins were also found to improve the overall shading, especially on summer days. The horizontal fins also added to the internal illumination of the west side, functioning as external light shelves.

Low-emissivity double-glazing

Allows sufficient visible light to enter the building while reducing unwanted solar heat gain and exterior noise at the same time.

Daylighting Glazing	Vision Glazing
CSG-8 FVR 1-59 + 12A + 8C	CSG- 8 CEF 11-38 + 12A + 8C
VLT: 55%	VLT: 42%
Ref: 30%	Ref: 34%
SC: 0.42	SC: 0.35

Figure 3.1.19 Solar-shading devices
(Source: Hysan Development Company Limited)

Office BUILDING

Case study of Hong Kong Science and Technology Park:

Low Energy Façades

- high performance low-E double glazing allows daylight to enter whilst controlling solar heat gains
- optimise window to wall ratio (40%) to balance views, visibility and daylighting whilst reducing solar gains
- external solar shading devices reduce cooling demand by controlling the penetration of heat from the sun
- highly insulated façades minimise heat gains through walls

Motorised Sun Louvres

- solar tracking louvres automatically adjust to minimise solar gains to the entry lobbies

Figure 3.1.20 Smart louvers
(Source: Hong Kong Science and Technology Parks Corporation)

Case study of Energizing Kowloon East Office:

Window to Wall Ratio

Reduce cooling demand via:

- Optimise window to wall ratio (~20%) to reduce solar heat gain
- Insulate envelope using rock wool (U-value of wall: 0.83 vs EMSD's reference input 3.3, i.e. 75% reduction in thermal transmission)

Figure 3.1.21 Elevation of Energizing Kowloon East Office
(Source: Energizing Kowloon East Office)

Office BUILDING

Case study of H Queen's:

High Performance Façade

To achieve this iconic building, high performance façade plays an important role. Laminated insulated glass unit (IGU) façade system with low-e coating on low-iron glass substrate and two layers of translucent ceramic fritted pattern is used. The excellent thermal properties (U-value) of the façade system reduce cooling load of the Mechanical, Engineering and Plumbing (MEP) system. The fritted pattern helps to diffuse unwanted direct solar radiation, reducing solar heat gain while enhancing the building's outlook and indoor daylighting.

The curtain wall façade with slide-open modules on each floor is designed to enhance cross ventilation in spaces and for the ease of artwork delivery. A glass lift was introduced for a better social connection within the building.

Figure 3.1.22 H Queen's Exterior
(Source: Henderson Land Development Company Limited)

Office layout and design

Overview for Office Unit

Layout and arrangement of office spaces have a significant impact on boosting office productivity.

- A break-out space can be incorporated in the office layout by having an area that is separated from the usual working area. This break-out space can be placed where staff can hold their informal meetings, eat their lunch, relax and socialise.
- Appropriate choice and use of interior layout, spatial design, furniture and finishes, colour, lighting and artwork etc. help to create a pleasant work environment to enhance productivity and well-being of office workers

Figure 3.1.23 Office Unit of the Good Lab
(Source: The Goodlab)

Benefits of Green Office Unit

- Give employees a break from their usual work station
- Boost creativity and productivity
- Improve occupants' mood
- Create a calming ambience where staff can work more efficiently
- Furniture can be reused to minimise waste and reduce cost of renovation

Green Strategies for Office Unit

- Open plan layout that enables better views and ventilation
- Flexible space use such as areas that can be converted into meeting rooms or a large meeting room to be converted to 3 meeting rooms
- Create break-out space
- Bright and comfortable space
- Paint the room in colours that promotes comfort and productivity
- Comfortable furniture
- Incorporate ergonomics into design considerations to ensure the workspace is healthy and safe for staff
- Integrate artwork into interior design to enhance the working environment, such as paintings, sculptures, etc.

Figure 3.1.24 Break out space of the Goodlab
(Source: The Goodlab)

Office UNIT

Consideration of Tenant Use

Overview for Office Building

It is important to consider a tenant's use of the office space and facilities.

Flexibility needs to be provided in the planning and design of office buildings and premises to enhance ease of modification to suit different tenants' needs. This will help to reduce construction waste at the time of renovation for each new tenant. With such consideration, space can be sufficiently adaptable to working, focusing, collaborating and renting as needed.

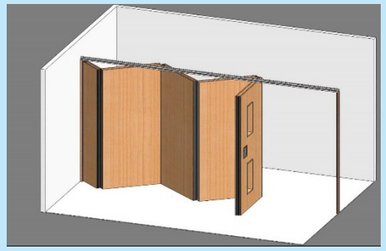


Figure 3.1.25 Flexibility in building

- Modular design can be adopted to provide standardisation for easier adaptation for different tenants
- Building services should also allow flexibility for future renovation and adaptation by different tenants
- Structural design can also include consideration of flexibility to suit the use of different tenants

BEAM Plus EB V2.0 MAN 11

A user guide can be provided to encourage and promote environmentally friendly activities.

Benefits of Green Office Building

- Flexibility in building services design can reduce the construction waste during the fitting out stage
- Reduce construction waste at the time of renovation for each new tenant
- Enhance ease of modification to suit tenants' needs
- Provide standardisation for easier adaptation for different tenants
- Reduce the time spent on office renovation as modification of the as-built building services systems is not required

Green Strategies for Office Building

- Flexibility in planning and design to consider use by different tenants
- Flexibility in building services to consider use by different tenants
- Flexibility in structural design to consider use by different tenants
- Modular design
- Reduce construction waste due to renovation by different tenants
- Leave space for recycling on each floor

Tenant Provisions

Overview for Office Building

Apart from the air pollutants generated by human beings, some airborne contaminants are emitted by normal office activities. For example, dust and fumes can be emitted by the printing machine, while vapour and smell from hot drinks and the re-heating of food may disperse throughout the office space.

Source control is considered as one of the effective ways to tackle the air quality problem. It can be achieved by provision of a dedicated tenant exhaust system. Printing and cooking can be confined to the printing room and pantry respectively, while the exhaust system can be provided to maintain negative pressure in these rooms.

The modern office is commonly fitted out with various ancillary facilities to improve the working environment. Some of these ancillary facilities, such as pantries and breastfeeding rooms etc., may require water and drainage.

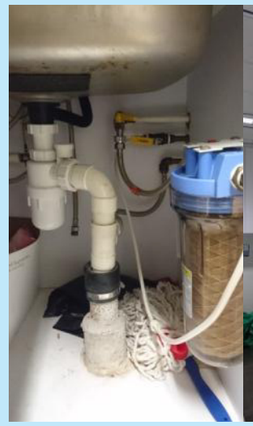


Figure 3.1.26 Provision of drainage and water point for tenant in office.

Figure 3.1.27 Tenant exhaust for copiers in office.

Therefore, a new building should consider providing tenant drainage and watering points to cope with the tenants' needs. The provision of water points can also allow tenants to use bottle-less drinking fountains to save on plastic bottles.

Benefits of Green Office Building

The provision of tenant exhaust systems in office building design can help to improve the indoor air quality and the thermal comfort as the air pollutants and excessive heat from office appliances such as copiers and printers can be taken away from the office area.

Benefits from the tenant exhaust system are:

- Reduce odour caused by certain materials, cleaning products and human beings
- Enhance the well-being of tenants
- Increase productivity of employees

Provision of tenant drainage and water points can encourage tenants to install drinking fountains or pantries, which provide a better working environment for staff

Reduction in the use of plastic bottles by installing drinking fountains can reduce waste.

It also reduces the time spent on office renovation as modification of the plumbing and drainage system is not required

Green Strategies for Office Building

- Flexibility in planning and design to consider use by different tenants
- Flexibility in building services to consider use by different tenants
- Flexibility in structural design to consider use by different tenants
- Modular design
- Provide tenant drainage and water points in the new building design
- Reduce the use of plastic drinking bottles by adopting drinking fountains

Office BUILDING

Benefits for Office Building

- Increase the marketability of the office building
- Since it encourages more people to use public transportation, it results in better air quality
- Noise and air pollution can also be better controlled

Green Strategies for Office Building

- Link the office buildings with all-weather pedestrian bridges
- Have direct indoor connections to MTR station, bus terminus, mini-bus or shuttle bus stops
- Promote carpooling by reserving parking spaces for carpool vehicles
- Develop an incentive programme for building occupants that adopt sustainable commuting methods

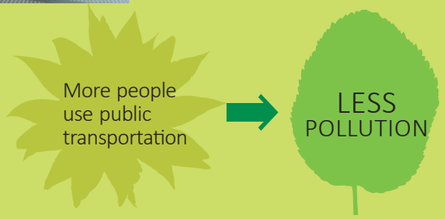
Convenient Public Transportation

Overview

For the development of a new office building, it is important, where possible, to choose a site that is close to the public transportation system such as the Mass Transit Railway or a bus terminus. Where public transport is not nearby, provision of a shuttle bus service provides workers with a convenient means of transportation.

The convenience of public transport or a shuttle bus service reduces trips by private vehicles, thus reducing traffic congestion around the office as well as the time spent by staff travelling to and from work. This also reduces the level of air and noise pollution caused by private vehicles.

Figure 3.1.28 MTR entrance is directly connected to the office buildings nearby in Central.



Benefits for Office Unit

- Motivate employees to work, and increase productivity of staff
- When more employees use public transportation, air quality can be improved
- Reduce traffic congestion and save workers' time commuting from home to office
- Enhance overall well-being

Green Strategies for Office Unit

- Choose site with high accessibility to public transportation
- Provide shuttle bus service if office is not close to public transport

Office UNIT

Office BUILDING

Benefits for Office Building

- Increase the marketability of the office building
- Promote usage of existing infrastructure
- Provision of a missing service to the neighbourhood
- Motivate employees to work, and increase productivity of staff

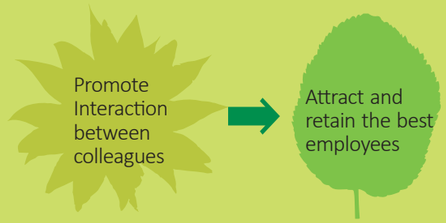
Green Strategies for Office Building

- Locate in a BEAM Plus Neighbourhood
- Provide bicycle parking to encourage cycling
- On-foot access to fitness and leisure facilities
- Provision of charging facilities for electric vehicles
- Provide sufficient parking facilities
- Loading/unloading bay should be located below ground level if structurally possible in order to ease the traffic flow near the building
- Provision of walking tracks, relaxation and exercising areas

Connectivity to Nearby Amenities

Overview

The amenities and services available to office workers now rank fourth[1] on the list of location decision-making priorities for office occupants. With the provision of appropriate amenities, the productivity can be greatly improved. Moreover it can promote interaction with colleagues, attract and retain the best employees.



Benefits for Office Unit

- Facilitate walkable access to nearby amenities to improve productivity of building occupants by reducing the time spent driving and finding a parking space
- Improve employees' health by increasing the level of physical fitness with the provision of exercise related amenities

Green Strategies for Office Unit

- Locate in a BEAM Plus Neighbourhood or place with access to nearby amenities
- Access to green space
- Make healthy and sustainable food choices by managing onsite canteen facilities

1. Gensler and ULI (2011) Open Space: An asset without a champion? Available: http://www.gensler.com/uploads/document/220/file/Open_Space_03_08_2011.pdf

Office UNIT

Office BUILDING

Benefits for Office Building

- Promote better indoor air quality for building occupants by using green building materials in construction
- Lower the energy consumption and greenhouse gas emissions from extraction, transportation and manufacturing by using green building material
- Lower expenditure on shipping and transport of building materials by using regional materials
- Help the community and gain a good reputation
- Increase the variety of styles used hence enhancing building marketability

Green Strategies for Office Building

- Use recycled content
- Use rapidly renewable materials
- Use regional materials
- Use certified wood products
- Use material with reduced PVC content
- Use low-emitting materials

Green Building Materials

Overview

When selecting materials for office buildings and office areas, owners and tenants should consider aesthetics, function, maintenance and financial issues. However, environmentally friendly materials selection is also important as this contributes to occupants' health, a building's sustainability, as well as the sustainability of the enviroment.

Design for easy disassembling by using fewer parts and avoiding glues can make it easier for a product to be repaired, upgraded and reused. How the product can be disassembled is the key factor to its afterlife.

BEAM Plus BI V1.0 MA 5

At least 50% of the newly installed elements in the project should be easily disassembled elements.

- HKGBC Green Product Accreditation and Standards (HK G-PASS) (since Jan 2015); the Scheme provides a practical and recognised green building products standard promoting green business opportunities and use of green building products to the industry practitioners and end users.
- Green Specifications Database (since 2000) – developed by the Environmental Protection Department, is a tool to help you select goods and services that are better for the environment compared with conventional products. You can search the green specifications of 150 procurement items with the item filter or keyword search function. (http://www.epd.gov.hk/epd/english/how_help/green_procure/green_procure1.html)
- **Eco-Product Directory** (since Jul 2013); the service provides a user-friendly online platform to link manufacturers and suppliers of green building products to building professionals (http://epdir.hkgbc.org.hk/index.php)

Benefits for Office Unit

- Promote heath and the well-being of staff by using green building materials
- With better indoor air quality there will be less discomfort caused by indoor air. This can boost morale and increase productivity to a large extent

Green Strategies for Office Unit

- Use durable, recyclable materials, such as metal to replace timber used in formwork
- Use low-emitting material
- Purchase products with high recycled content (case example on p.42, p.43)
- Use system furniture (case example on p.42)
- Use rapidly renewable materials, e.g. FSC wood (case example on p.44)
- Refer to HK G-PASS for green building materials

Office UNIT

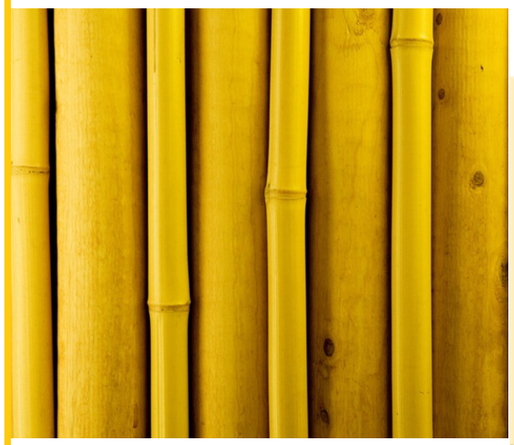


Figure 3.1.29 Bamboo
(Source: Hong Kong Green Building Council)

Bamboo is usually considered as a sustainable resource for its renewability and carbon footprint.

Bamboo grows significantly faster than hardwood trees, reaching over 60 feet in just a few months. Although they are fast growing, they are very strong and flexible compared with other timber building materials. So they are very cost-effective, attractive and unique.

Every acre of bamboo can embed up to 40 tons of CO_2, making it a very effective solution to global warming.

Bamboo is the fastest-growing plant in the world. It is a renewable resource and is more resistant to water and heat because of its engineered structure.

Cork is an inherently sustainable resource, being both biodegradable and renewable.

As a raw material, cork is mainly small microscopic pockets of air encapsulated by the cork fiber lignin. This cellular structure gives cork products tremendous thermal and acoustic properties, as the air acts as "insulation".

Laser-cut cork panels can be a feature on the wall.

Figure 3.1.30 Cork Feature Wall of Hong Kong Green Building Council Office
(Source: Hong Kong Green Building Council)

Figure 3.1.31 FSC plywood
(Source: Hong Kong Green Building Council)

The FSC label and HK G-PASS provide credible links between responsible production and consumption of forest products, enabling purchasing decisions that benefit people and the environment as well as providing ongoing business value.

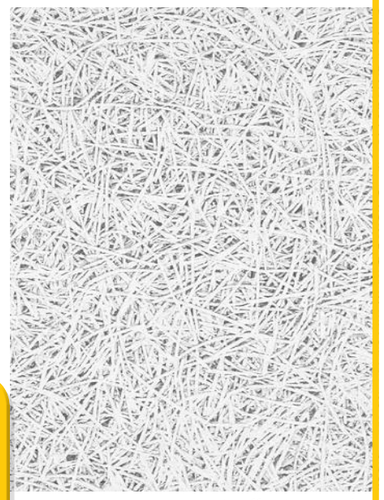


Figure 3.1.32 Acoustic effective panel
(Source: Hong Kong Gren Building Council)

The decorative panels are acoustically effective as a wall covering in conference rooms.

The permeable structure of the product is beneficial to the regulation of the indoor climate and it is recommended for ecological building designs for its recyclable content.

Office UNIT

Case study of Hong Kong Green Building Council Office:

Materials with High Recycled Content

Figure 3.1.33 Gypsum block wall
(Source: Hong Kong Green Building Council)

Gypsum Block

The gypsum blocks are made from recycled waste from power plants.

In future, when the wall is demolished, the gypsum can also be recycled for other uses.

Figure 3.1.34 Movable partition
(Source: Hong Kong Green Building Council)

High Recycled Content Partition

Movable partitions used in a conference room could contribute to BEAM Plus certification credits. The product contains a high percentage of post-industrial and consumer recycled materials.

Figure 3.1.35 System furniture in Hong Kong Green Building Council office
(Source: Hong Kong Green Building Council)

System Furniture

System furniture used allows standard size factory built and assembled components to be used. It could also benefit both quality and environmental costs.

Chair with Recycled Content

- 50% recycled contents
- Perforated back, feel cool

Case study of Conservation International Office - Green Sky:

Materials with High Recycled Content

Green Sky uses “green” carpet that contributes to less waste, cleaner seas, and income for fishermen. The carpet face is 100% recycled nylon yarn, including nylon from discarded fishing nets, and the carpet backing contains 98% recycled content. The carpet manufacturer pays small fishing communities in the Philippines to collect these nets, which helps protect marine life while supplementing local incomes. Furthermore, the carpet can be sent back for reuse as raw material in new carpet tiles.

Figure 3.1.36 Green carpet
(Source: Conservation International Hong Kong)

Case study of The Good Lab:

Materials with High Recycled Content

Good Lab uses Kokoboard as one of the major materials for building their office spaces including the walling of the front desk and pantry area, and in the making of book shelves, lockers and pigeon holes at Good Lab. Kokoboard is made of agricultural waste from Thailand consisting of rice straw board, vetiver grass board, coco dust board and other agricultural fiberboards. It is insulating, moisture tolerant and environmentally friendly, does not contain any formaldehyde glue, and reduces dependence on wood.

Figure 3.1.37 Kokoboard furniture in Good Lab
(Source: The Good Lab)

Case study of Jones Lang LaSalle Pacific Place Office:

Renewable Material

Use of green materials e.g., renewable wood materials/FSC certified wood.

Decorative wall of reception counter.

Figure 3.1.38 Decorative Wall of Jones Lang LaSalle Pacific Place Office

Case study of Hong Kong Green Building Council Office:

Renewable Material

Reception counter, pantry cabinets & shelves in the office are made of FSC plywood and covered with bamboo veneer.

Figure 3.1.39 Louvre of Hong Kong Green Building Council
(Source: Hong Kong Green Building Council)

Benefits for Office Building

- Offset cost of construction by salvaging existing materials
- Reduce the demand for virgin materials and in turn lower the cost of extraction and transportation of materials
- Enhance the corporate image of environmental sustainability
- Induce great environmental and economic savings by reusing buildings. It may take 10 to 80 years for a new energy-efficient building to overcome the environmental impacts created by its construction

Green Strategies for Office Building

- Reuse the structure of an existing building (case example on p.47)
- Reuse basement structure
- Adaptive Reuse (case example on p.46)
- Use salvaged brick for walkway (case example on p.48)
- Use second-hand freight container (case example on p.48)

Reuse of Materials

Overview

- During the planning stage of a major renovation and retrofitting of interior fitting-out, materials that can be reused should be selected to minimise wastage and disposal in the event of alterations
- Before demolishing an existing building on the site, consider reusing the structure of the existing building
- Reusing materials is to use the materials in a similar fashion that they were used in their original life. It eliminates the demand for new materials and extends the life span of the old materials

Figure 3.1.40 Make use of the doors from the existing building to make a temporary conference table.
(Source: Hong Kong Green Building Council)

Useful Resources for Materials Reuse:

HK G-Share (since July 2014) – Divided into Building and Construction Resources Sharing Platform and Domestic Resources Sharing Platform:

- Building and Construction Resources Sharing Platform, encourages industry practitioners to reuse construction materials and hence reducing construction and demolition waste
- Domestic Resources Sharing Platform, encourages the public to reuse resources thus enhancing the public awareness of waste reduction and promoting the concept of reuse

Benefits for Office Unit

- Save the cost of buying brand new furniture
- Add value to the item so that it continues to be useful and productive
- Savings on old materials disposal
- Provide items to low-income or disadvantaged people to support the community and help those in need
- Require fewer resources, less energy and less labour when compared with recycling[1]

Green Strategies for Office Unit

- Apart from new purchases, consider reuse of furniture, office equipment and accessories from other premises (case example on p.49)
- Use salvaged wood for flooring, cabinets, desks, etc.
- Reuse partitions from other fitting out projects (case example on p.49)
- Use salvaged construction waste for other purposes (case example on p.48)

1. "Benefits of Reuse." Benefits of Reuse. Accessed February 02, 2016. http://loadingdock.org/redo/Benefits_of_Reuse/body_benefits_of_reuse.html.

Office BUILDING

Case study of The Genesis:

Wholesale Conversion of Industrial Building

Under an initiative of the Development Bureau to facilitate wholesale conversion of industrial buildings, the project aims to revitalise an abandoned industrial building into a contemporary vertical artists' village in Hong Kong Island South.

Figure 3.1.42 The Genesis
(Source: Barrie Ho Architecture Interiors Limited)

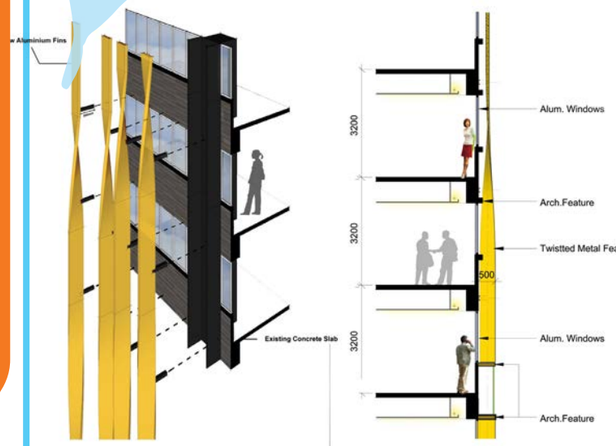


Figure 3.1.41 Illustration of the construction method of The Genesis
(Source: Barrie Ho Architecture Interiors Limited)

Adaptive Reuse: Industrial Building Revitalisation

In 2009, the Government released the potential of over 1000 old industrial buildings to encourage the redevelopment or conversion of industrial buildings by owners. Many owners are turning industrial buildings into office buildings to fulfil the need of the market.

The environmental benefits from rehabilitation are substantial. Reuse of recycling materials and reuse of structural elements, with a consequent reduction in the generation of landfill waste, materials are conserved, which further translates into cost advantages to the owner.[2]

Optimising the Use of Industrial Building

The Government has initiated a website discussing the considerations in revitalising industrial building, including green strategies and guidelines in applying BEAM Plus Certification.

http://www.devb.gov.hk/industrialbuildings/eng/going_green/index.html

Read more at:
1. http://www.policyaddress.gov.hk/09-10/eng/p24.html
2. http://works.bepress.com/cgi/viewcontent.cgi?article=1000&context=craig_langston

Office BUILDING

Case study of China Resources Building:

Structure Reuse

To retain the structures of the existing building envelope, a tailor-made semi-unitised curtain wall system was adopted. At the same time, in order to maintain occupancy during construction, an excellent indoor environment had to be maintained. An electrical elevated platform was used and existing windows were removed afterward.

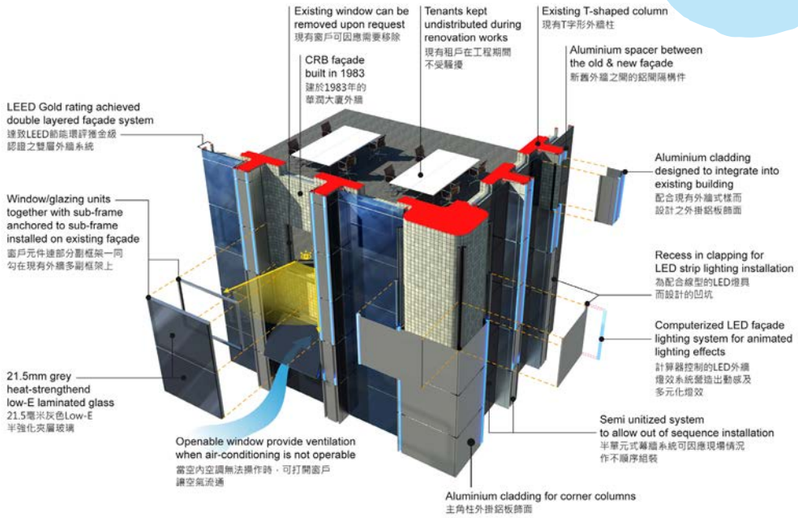
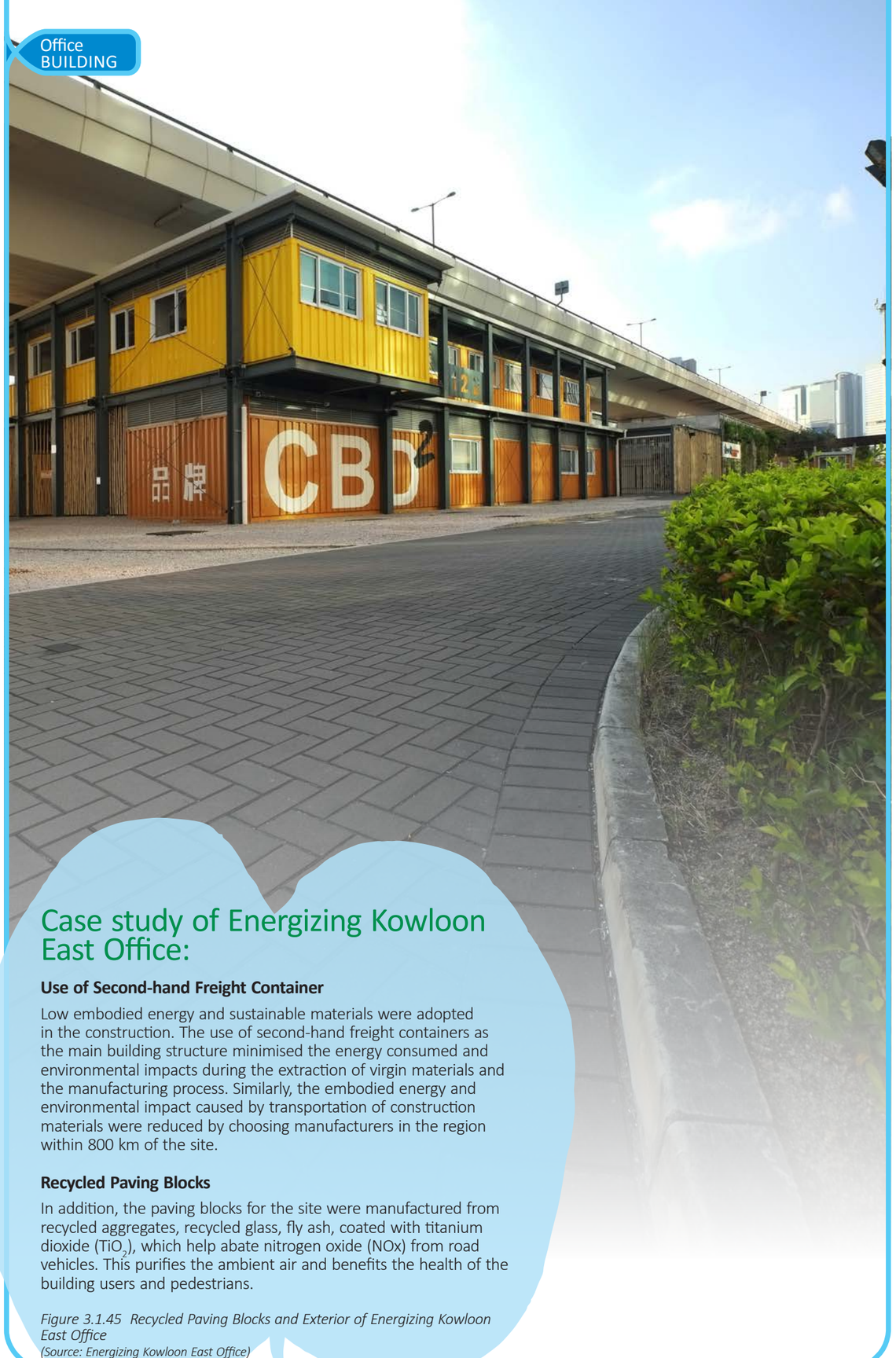


Figure 3.1.43 Illustration of the construction method of China Resources Building
(Source: China Resources Property Limited)

Figure 3.1.44 China Resources Building
(Source: China Resources Property Limited)

Office BUILDING



Case study of Energizing Kowloon East Office:

Use of Second-hand Freight Container

Low embodied energy and sustainable materials were adopted in the construction. The use of second-hand freight containers as the main building structure minimised the energy consumed and environmental impacts during the extraction of virgin materials and the manufacturing process. Similarly, the embodied energy and environmental impact caused by transportation of construction materials were reduced by choosing manufacturers in the region within 800 km of the site.

Recycled Paving Blocks

In addition, the paving blocks for the site were manufactured from recycled aggregates, recycled glass, fly ash, coated with titanium dioxide (TiO_2), which help abate nitrogen oxide (NOx) from road vehicles. This purifies the ambient air and benefits the health of the building users and pedestrians.

Figure 3.1.45 Recycled Paving Blocks and Exterior of Energizing Kowloon East Office
(Source: Energizing Kowloon East Office)

Case study of Conservation International Hong Kong – Green Sky:

Planning Ahead

87% of Green Sky can be easily relocated to a future office space. The Genius Wall, an eco-friendly moveable glass wall partitioning system takes just a few days to install or disassemble. As smaller tenants in Hong Kong are often restricted to only two or three years leases, planning ahead to reuse building materials saves money and reduces construction waste.

Second Hand Furniture

Reuse and Save: 100% of the loose office furniture is second-hand, purchased at only 60% of the cost of new furniture. This freed up funds to invest in other green features such as a real-time energy monitoring display and carbon offsets from Conservation International's Carbon Fund, which offsets Green Sky's carbon emissions by protecting Amazon forests in Peru.

Figure 3.1.46 Movable glass partition wall
(Source: Conservation International Hong Kong)

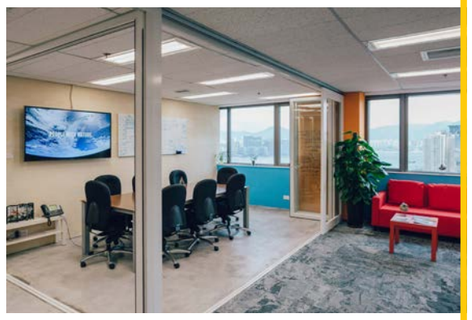


Figure 3.1.47 Second Hand Furniture
(Source: Conservation International Hong Kong)

Case study of Hong Kong Green Building Council Office:

Reused Glass Wall

Two tempered glass panes originally installed at the entrance of the atrium staircase were reutilised to build a conference room, serving as a good example of reducing construction waste. It also reduced material costs in the fitting-out works.

Figure 3.1.48 Reuse of Glass Wall
(Source: Hong Kong Green Building Council)

Office UNIT

Figure 3.1.49 Upcycling in blueprint
(Source: Swire Properties Limited)

Figure 3.1.50 Upcycling in blueprint
(Source: Swire Properties Limited)

Figure 3.1.51 Upcycling in blueprint
(Source: Swire Properties Limited)

Case study of blueprint:

Upcycling

blueprint's office space design objective was to design a flexible space with minimal environmental impact which can adapt to the different needs of its startup community. An open space design utilising a vast amount of upcycled materials, in collaboration with different Swire brands including HUD Shipping, Swire Beverages Coca-Cola and Cathay Pacific Airways. Some of the upcycled features include:

- Pulleys and cables to create folding tables
- Recycled shipping containers as partitions
- Airplane seats and tires being reused as seating
- Airplane wings for table tops
- Timber palettes for modular furniture and coffee tables

The outcome of the fitting out work demonstrates Swire Properties Limited (SPL)'s achievements on creating a unique office space with style and functionality and low carbon footprint.

Office BUILDING

Benefits for Office Building

- Construction noise and dust control helps to minimise the nuisance to the immediate neighbourhood
- Quality is well controlled to avoid potential defects and poor workmanship
- Decrease project costs by having a well-planned schedule

Green Strategies for Office Building

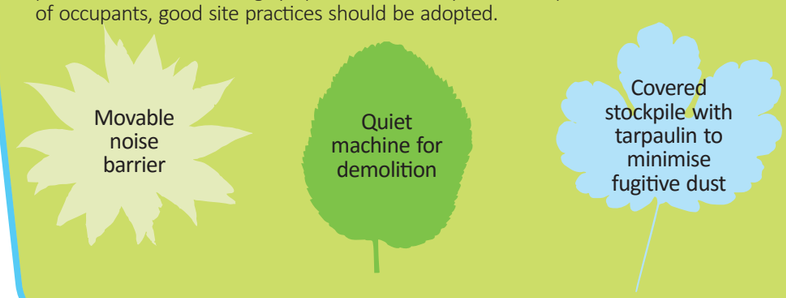
- Use quiet machines like a hydraulic crusher for demolition
- Store cover cement, sand, debris or any other dusty materials stored outside the site or keep them moist
- Spray water before breaking, grinding, polishing or wood cutting operations
- Use electrical elevated platform to allow flexible installation
- Adopt low noise construction and demolition methods, e.g. Core and burst, saw cut, mechanical scissors, etc.
- Minimise impact on the environment

Construction Noise and Pollution Control

Overview

During construction there are always different kinds of nuisances such as noise and dust, in which noise directly affects potential tenants and fellow occupants.

In order to have a good indoor environmental quality and to avoid problems like sick building symptoms which may affect the performance of occupants, good site practices should be adopted.



Benefits for Office Unit

- Airborne dust from construction activity can have both environmental and human health impacts. Fine dust particles enter airways and lungs with ease and have been linked to numerous health problems including asthma, decreased lung function, and breathing difficulties. Having a good construction management plan can have a great positive impact on occupants' health and wellbeing

Green Strategies for Office Unit

- Use noise barriers or absorbers and fit noise mufflers to machines
- Place rubber mats/pads beneath work benches and noisy machines
- Notify the affected tenants and customers of the schedule of noisy work
- Only use windows for fresh air supply. Keep main door closed
- Construction IAQ Management Plan (case example on p.53)
- Low noise demolition methods, e.g. saw cut, mechanical scissors

Office UNIT

Office BUILDING

Case study of China Resources Building:

Construction Noise and Pollution Control

Construction process, technique, building technologies, choice of materials and quality workmanship.

Figure 3.1.53 Original China Resources Building
(Source: China Resources Property Limited)

Figure 3.1.54 China Resources Building under construction
(Source: China Resources Property Limited)

Process

- Top-down approach in coordination with major structural modification of 49/- 50/F
- Time saving as it allowed time for podium modification

Technique

- Low noise demolition methods, e.g. core and burst, saw cut, mechanical scissors etc.
- Minimise impact on building users

Technologies

- Electrical elevated platform to allow flexible installation
- Time and cost savings as no scaffolding was needed

Choice of materials

- Based on LEED (Leadership in Energy and Environmental Design) requirements
- Maintain existing building structure to minimise use of materials
- Use of regional materials
- Use of materials with recycled contents
- Use of materials with low Volatile Organic Compound (VOC) contents

Quality workmanship

- Quality control team of consultants and contractors representatives
- They were dedicated to high-risk management, e.g. curtain wall panel production

Figure 3.1.55 China Resources Building after renovation
(Source: China Resources Property Limited)

HVAC (Heating, Ventilation and Air-conditioning) System Protection

- When performing construction activities that produce dust such as drywall sanding, concrete cutting, masonry work, wood sawing or adding insulation, seal off the supply diffusers and return air system openings completely for the duration of the task
- Shut down and/or seal off the supply diffusers and return air ducts during any demolition operations
- Perform duct inspections upon completion; if the ducts become contaminated due to inadequate protection, clean the ducts professionally

Figure 3.1.56A Protection to existing air duct

Pathway Interruption

- Provide dust curtains or temporary enclosures to prevent dust from migrating to other areas where applicable
- The edge of the temporary barrier would be taped continuously
- Provide temporary walk-off mats and floor protection to prevent pollutants from tracking into other adjacent occupied spaces
- Locate pollutant sources as far away as possible from supply ducts and areas occupied by workers when feasible. Supply and exhaust systems would be shut down or isolated during such activity

Figure 3.1.56B

- During construction, isolate areas of work to prevent contamination to clean or occupied areas. Pressure differentials would be utilised to prevent contaminated air from entering clean areas
- Depending on weather, exhaust contaminated air directly to the outside during installation of VOC emitting materials

Contaminant source control

- Use low VOC products to reduce potential problems
- Also exhaust pollution sources to the outside with portable fan system. Prevent exhaust from the building re-circulating back
- Keep wet products in closed containers. Cover or seal containers of waste materials that can release odour or dust

Figure 3.1.56C

- Protect stores on-site or installed absorptive building materials from weather and moisture; wrap with plastic and seal tight to prevent moisture absorption
- All finish materials (such as carpet, tiles, paint, etc.) to be covered or contained before and after installation. All waste materials have to be covered or contained

Scheduling

- Schedule high pollution activities that utilise high VOC level products to take place prior to the installation of highly absorbent materials (such as gypsum wall board, fabric furnishings, carpet and insulation, for example)
- These materials will act as 'sinks' for VOCs, odours and other contaminants, and release them later after occupancy

Case study of Hong Kong Green Building Council Office:

Construction IAQ Management Plan

The Construction IAQ Management plan is a proposed measure which ensures indoor air quality (IAQ) will not be affected due to construction work.

The objectives of this plan is to:

- Minimise exposure of construction workers to air pollutants
- Prevent air pollutants from collecting in building systems and on building materials
- Prevent air pollutants caused by construction from migrating into adjacent occupied spaces

Figure 3.1.56 A to D Construction IAQ Management Plan
(Source: Hong Kong Green Building Council)

Housekeeping

- Provide regular cleaning concentrating on HVAC equipment and building spaces to remove contaminants from building prior to occupancy
- All coils, air filters, fans and ductwork shall remain clean during installation and, if required, will be cleaned prior to performing the testing, adjusting and balancing of the systems
- Suppress and minimise dust with wetting agents to sweep compounds. Utilise efficient and effective dust collecting methods such as a damp cloth, wet mop, or vacuum with particulate filters, or wet scrubber
- Low-odour cleaning agents should be used
- Remove accumulations of water inside the working areas. Protect porous materials such as insulation, gypsum boards, drywall, etc. from exposure to moisture
- Thoroughly clean all interior surfaces prior to replacing filters and running HVAC system for system balancing, commissioning and building flush-out

Figure 3.1.56D

Office UNIT

Office BUILDING

Benefits for Office Building

The substantial building cost due to reduced waste can be lessened, since the need to pay hauliers to dispose of construction and demolition debris is nullified with a proper waste management scheme.

Green Strategies for Office Building

- Sort waste for reuse and recycling
- Use precast building components, such as façade, staircases, semi-precast flooring, mid-landings, slabs and beams, as much as possible
- Reuse excavated spoils or inert waste for backfilling, slope stabilisation and reclamation
- Reuse used timber for formwork on site
- Order the right amount of building materials to be delivered at right time to avoid unnecessary costs
- Send the waste back through a recycling programme
- Development of a waste management plan. Refer to http://www.epd.gov.hk/epd/misc/cdm/guidelines6.htm

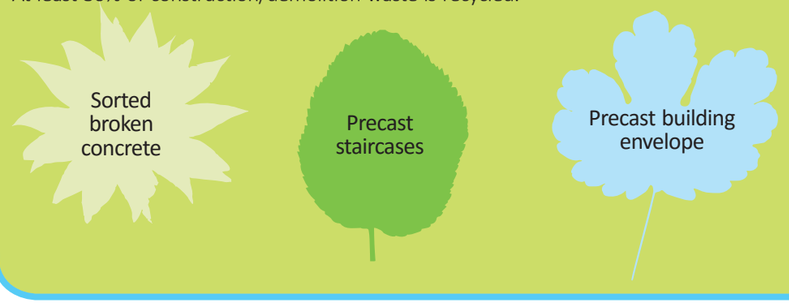
Construction Waste Reduction

Overview

As waste generation by the construction industry has always been a problem of treatment and management, strategies on waste reduction should be well planned. During planning stage, a waste management plan which includes sorting recycling, and disposal of demolition & construction waste should be prepared to identify waste types and waste reduction targets.

BEAM Plus NB V1.2 MA 10 & MA 11

At least 30% of construction/demolition waste is recycled.



Benefits for Office Unit

Recycling of construction and demolition waste reduces demand for virgin resources and reduces the environmental impacts associated with resource extraction, processing and transportation.

Green Strategies for Office Unit

- Sort waste for reuse and recycling (case example on p.55)
- Order the right amount of building materials to be delivered at the right time to avoid unnecessary costs
- Development of a waste management plan

Case study of Hong Kong Green Building Council:

Sort Waste for Reuse and Recycling

Construction and demolition waste were sorted for reuse or recycling. Bricks, lighting boxes and conduit were potentially reused in the new office. Other waste e.g. paper, metals, wood and plastic were collected for recycling.

In addition, 31.8% (by weight) of all building materials were recycled, and more than 68% of construction waste was sorted and diverted from landfills.

% of construction waste being reused/recycled:

(Total Weight of Construction Waste being Reused/Total Weight of Construction Waste) X 100%.

= (1777.22 kg/5589.62 kg) X 100%

= 31.8%

Figure 3.1.60 Construction and demolition waste were sorted
(Source: Hong Kong Green Building Council)

INDOOR ENVIRONMENTAL QUALITY

Office BUILDING

Benefits for Office Building

Office buildings with good thermal control design help to lower the energy consumption of the air-conditioning system and allow future tenants to provide a comfortable indoor thermal environment within their own office units.

Green Strategies for Office Building

- Install thermometers to monitor the room temperature to avoid excessive cooling. Avoid setting air conditioning temperature below 23°C in summer months
- Clean dust filters and air-side system regularly. Remove obstructions at air inlets and outlets of the air conditioning and ventilation units
- Conduct regular occupancy surveys and air temperature and humidity monitoring

Thermal Comfort

Overview

Thermal comfort means that a person wearing a normal amount of clothing feels neither too cold nor too warm. It is important for both one's well-being and productivity.

Some offices spaces set their air conditioning at very low temperatures (often below 20˚C) with the intention of providing a comfortably cool indoor environment for their customers. However, a decrease in indoor temperature is not the only factor ensuring a comfortable environment. Humidity, air speed, clothing and nature of the activity are also factors that affect human comfort.

BEAM Plus NB V1.2 IEQ 13a

The air temperature shall be sustained at the design value within ± 1.5˚C.

BEAM Plus BI V1.0 IEQ 7

The air temperature within the project space shall be ± 1.5˚C of the set temperature when the air side system is operating at steady state under normal occupied periods.

Benefits for Office Unit

Good control of thermal comfort in the work place:

- Increase well-being, and lessens fatigue
- Increase job satisfaction
- Improve staff morale
- Staff find it easier to concentrate and make more attempts at solving difficult tasks
- Increase productivity

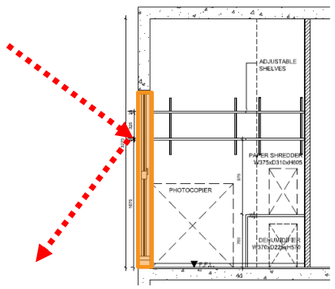
Green Strategies for Office Unit

- Find the obvious places where air can sneak into your office, then make repairs to plug the leaks by caulking, weather stripping and using plastic covers
- Switch off lighting and heat-producing appliances that are not in use to reduce air conditioning load
- If necessary, use fans to enhance the cooling effect by increasing cool air circulation
- Place thermometers and hygrometers in conspicuous locations to monitor the comfort level (air temperature and relative humidity) for the room occupants
- Dress light to minimise the use of air conditioning
- Set the fan coil to low fan speed as the normal setting. Use a high fan speed rather than lowering the temperature setting to cater for increased cooling demand
- Zoning of the office to allow user to set the temperature
- Solar control film applied to glass panels to reduce energy use for cooling
- Relative humidity is recommended to be less than 70%; Recommended room temperature is 24˚C-26˚C

Office UNIT

Case study of Hong Kong Green Building Council Office:

Passive design: Heat gain reduction



Solar Control Film

Solar control film is applied to east and west glass panes to cut IR and UV rays and the use of reflective roller blind reduces the energy needed for cooling.

Figure 3.2.1 Illustration of the effect of solar control film and reflective roller blind
(Source: Hong Kong Green Building Council)

Furniture

Back pans of all seats adopt a perforated design to facilitate heat dissipation from the human body, thus enabling a higher air conditioning set-point to be set.

Figure 3.2.2 Furniture that facilitate thermal comfort
(Source: Hong Kong Green Building Council)

Electronic Thermostat

An electronic thermostat can display real-time temperatures and allows a higher degree of individual control (i.e. a choice between traditional mode and VAV mode).

Ventilation

Rotating fans are used in some areas to supplement air conditioning in order to achieve a more even air distribution so that the air conditioning set-point can be raised when room air velocity is high.

Figure 3.2.3 Rotating Fans
(Source: Hong Kong Green Building Council)

Figure 3.2.4 Electronic thermostat for individual control
(Source: Hong Kong Green Building Council)

Zoning

Thermostats are placed in each zone to allow users to set the temperature. Installation of lighting zones and air conditioning zones with easily accessible switches for the office provide lighting and air conditioning only when required in the occupied areas, instead of the entire office.

Figure 3.2.5 Lighting zone of the Hong Kong Green Building Council office
(Source: Hong Kong Green Building Council)

Office BUILDING

Benefits for Office Building

Well functioning and adequate ventilation in buildings is necessary to ensure that indoor air is free from pollutants, and that indoor temperatures and moisture levels are sufficiently regulated.

Green Strategies for Office Building

- Schedule regular maintenance of clean air conditioner filters to ensure proper and efficient operation
- Operable vents on the building envelope to allow fresh air in
- Mixed mode ventilation system
- Free cooling system
- Slide open façade

Adequate Ventilation

Overview

The purpose of ventilation is to dilute the level of pollutants in the air. The rate at which outdoor air replaces indoor air is described as the air exchange rate. Generally, the air exchange rate is high and indoor air pollutants are reduced. Although spaces can be ventilated naturally by opening windows and doors, it is less common in Hong Kong due to the climate and human factors. However, a mixed mode ventilation that uses both natural and mechanical ventilation can be adopted.

Everyone working in an indoor environment requires adequate ventilation to produce a healthy working environment. The basics of proper ventilation are an abundant supply of fresh air, adequate circulation of that air and the elimination of temperature fluctuations.

Offices which are poorly ventilated can have high levels of biological contaminants arising from mould growth on damp surfaces. This poor air quality adds to the general discomfort of working in such an office environment, particularly for those with allergic conditions.

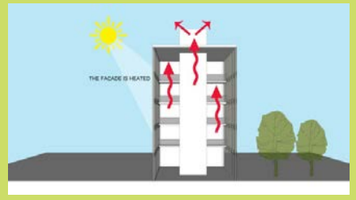


Figure 3.2.6 Principle of stack effect of a solar chimney

Figure 3.2.7 Ceiling Fan
(Source: Zero Carbon Building http://zcb.hkcic.org/Eng/Features/activesystems.aspx)

BEAM Plus NB V1.2 IEQ 9

An outdoor ventilation rate shall exceed ASHRAE 62.1:2007 requirement by at least 30%.

BEAM Plus BI V1.0 IEQ 3

Carbon dioxide level within the project space shall comply with Good Class requirement as stipulated in IAQ Certification Scheme.

Benefits for Office Unit

Concentrations of pollutants found indoors are much higher than those outside and are known to have a significant impact on health. Increased ventilation above the minimum standards improves the indoor air quality (IAQ) and benefits occupants' health and well-being directly.

Green Strategies for Office Unit

- Use fans on the wall of each side of the building to keep fresh air flowing
- Proper layout to enhance cross ventilation

Office BUILDING

Case study of Hysan Place:

Operable Vent

In the right external conditions, occupants can open top and bottom operable vents along the perimeter zones of the office floors, then the combined wind and stack effect will enable occupants to enjoy natural ventilation. The vents provide a healthier and more comfortable environment for staff working after-hours or contractors doing fitting out work. Occupants may enjoy natural ventilation during the transition season or non-office hours according to their own comfort and ventilation requirements.

Figure 3.2.8 Perimeter air vent
(Source: Hysan Development Company Limited)

Figure 3.2.9 Illustration of natural ventilation
(Source: Hysan Development Company Limited)

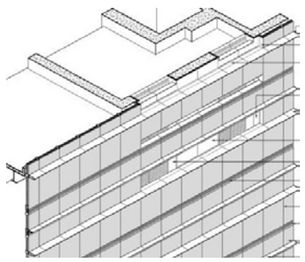
Outdoor Conditions	Operation Mode	Under Automatic Control	
		Operable Vents (except 33/F, 37-38/F)	Air-Handing Units (AHUs)
21°C- 23°C or above	Normal	Close	Normal
16°C- 20°C and Relative Humidity (RH) <75%	Mode 1	Open	• Free Cooling • Variable Air Flow
15°C or below	Mode 2	Open or Partially Open (avoid over-cooling)	• Free Cooling • Variable Air Flow

Mixed Mode Ventilation

Mixed Mode Ventilation combines natural ventilation (via operable vents) and mechanical ventilation/ air conditioning to provide and enhance occupants' comfort on office floors. Once the vents are opened, unnecessary air conditioning to individual perimeter zone will be automatically switched off without wasting energy. The effective area benefiting from natural ventilation would be a 5m deep space behind the façade.

Free Cooling System

Free Cooling System or Economize Cycle uses oversized air handling units and air ducts. Outside fresh air will be used for direct space cooling without using cooling towers during the right outdoor conditions, distributing a higher air volume at faster speed to enhance the thermal comfort level for occupants.



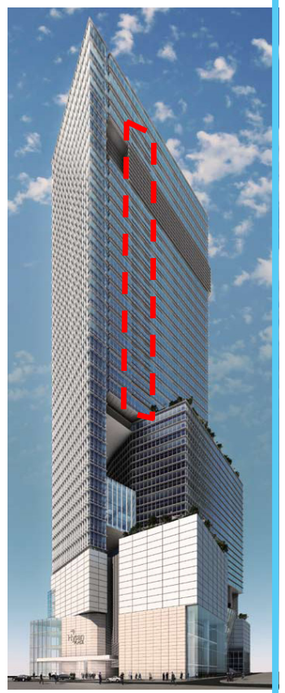


Figure 3.2.10 Mixed mode ventilation
(Source: Hysan Development Company Limited)

Office BUILDING

Case Study of H Queen's:

Slide Open Wall

A curtain wall façade with slide-open modules on each floor is designed to enhance cross ventilation in interior spaces and to facilitate artwork delivery. A glass lift is introduced for better social connections within the building.

Figure 3.2.11 Exterior of H Queen's
(Source: Henderson Land Development Company Limited)

Figure 3.2.12 Slide open wall of H Queen's
(Source: Henderson Land Development Company Limited)

Case study of Hong Kong Green Building Council Office:

Cross Ventilation

Under appropriate weather conditions, it is not necessary to turn on air-conditioners.

As a result, the louvered wall and window allow natural ventilation.

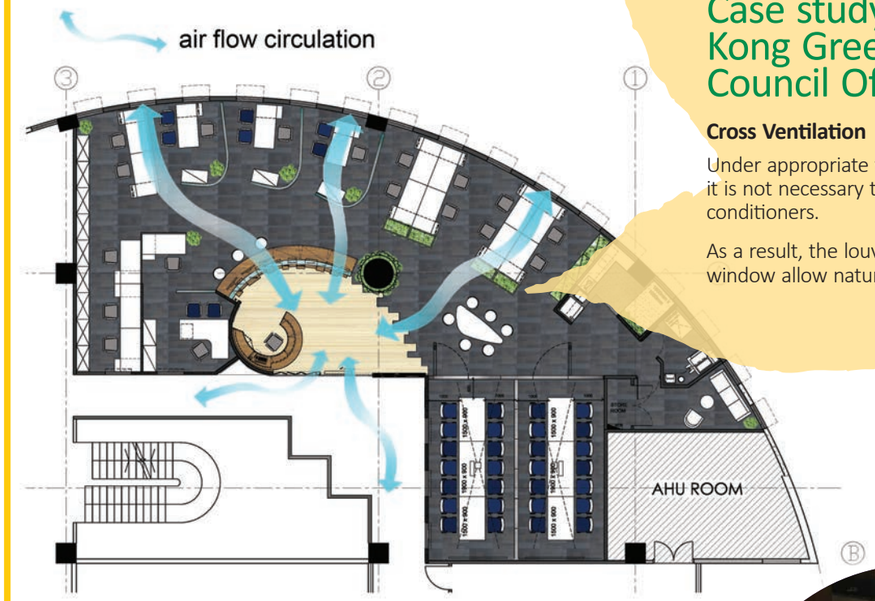


Figure 3.2.13 Illustration of air flow
(Source: Hong Kong Green Building Council)

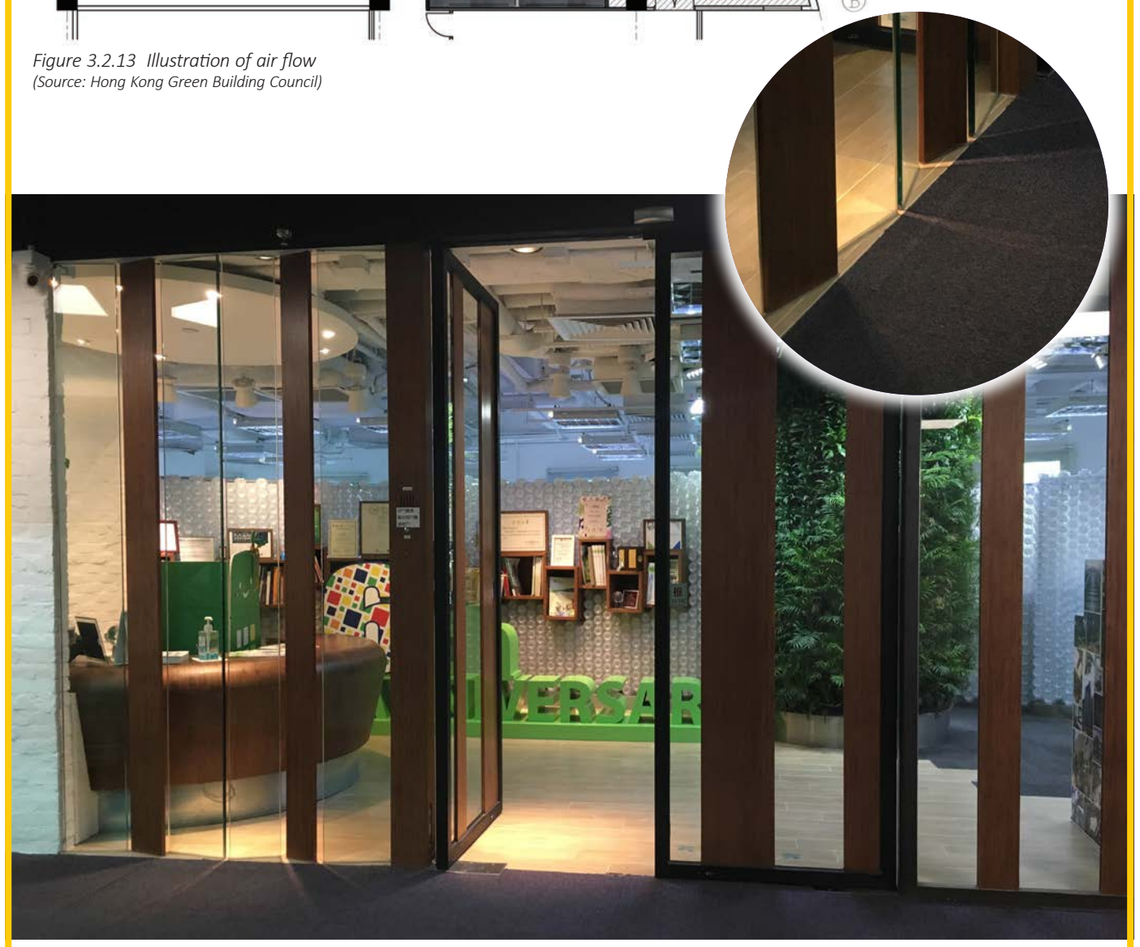


Figure 3.2.14 Louvered wall at main entrance
(Source: Hong Kong Green Building Council)

Benefits for Office Building

Increasing natural lighting in the office can help to reduce the energy consumption of the lighting system. It can also help to lower the energy consumption of the air-conditioning system as the heat dissipation from the lighting system is reduced. Office buildings introducing natural lighting would attract tenants who would like to improve staff's productivity through provision of natural lighting.

Green Strategies for Office Building

- Locate and size windows appropriately to increase the amount of daylight in the office space
- Use clerestory windows, light shelves, and a light color on a matt or rough surface and on furnishings can diffuse the natural light
- Incorporate proper sun shading devices in building design
- Visible Light Transmittance (VLT) of glass not less than 50%
- Install skylights/light tubes in appropriate areas such as corridors
- Use light colour finishes

Natural Lighting

Overview

Office lighting must meet the following needs. We of course need to see the task in front of us, but lighting also affects many other aspects of well-being, including comfort, communications, mood, health, safety and aesthetics.

BEAM Plus BI V1.0 IEQ 9

At least 75% of workstations or seating is located in an area of the floor plan that has a natural light illumination level of 100 lux.

Protect occupants' eyesight over time → General improvement in sleep quality and sleep efficiency[1] → The productivity of office workers is significantly improved

Benefits for Office Unit

Many fluorescent lights are only concentrated in the yellow-green portion of the spectrum to obtain the most lumens per watt; this unbalanced, narrow spectrum limits the blue in the source, which leads to improper functioning of the eye. Therefore, the superior spectral content of natural light makes it the best light for the eye.

Studies have shown that proximity to windows has a positive effect on staff productivity. It can be partly due to the effect of views, but the positive impact of light on health and well-being is undeniable. Exposure to light, during the day, particularly in the morning, is beneficial to your health via its effects on mood, alertness and metabolism.[2] Moreover, it also reinforces circadian rhythms.

Green Strategies for Office Unit

- Locate private offices toward the building core and siting cubicles at the perimeter brings daylight into a large area
- Low cubicle and glass partitions allow daylight to travel to the core spaces to ensure a natural light illuminance level of 100lux.[3]
- Use of light tubes for better utilisation of daylight for office spaces and amenities
- Use of light color finishes

Read more at:
1. Chueng I.(2013). Impact of workplace daylight exposure on sleep, physical activity, and quality of life. American Academy of Sleep Medicine 36.
2. Edwards, L. and Torcellini, P. (2002). A Literature Review of the Effects of Natural Lights on Building Occupants. Natural Renewable Energy Laboratory. Accessed 17/11/2016. http://www.nrel.gov/docs/fy02osti/30769.pdf
3. Northwestern University. "Natural light in office boosts health." ScienceDaily. www.sciencedaily.com/releases/2014/08/140808124010.htm (accessed 10/12/2015).
4. http://www.beamsociety.org.hk/files/Manual/BEAM%20Plus%20Interiors%20Manual.pdf

Office BUILDING

Case study of Hysan Place:

Light Shelves

Careful considerations were made to obtain a balance between optimal views and best use of natural light on the one hand and to keep energy consumption low on the other, thus it can reduce the HVAC and lighting energy consumption and enhance the thermal comfort level of the occupants in the perimeter zone.

Custom-designed 'Light Shelves' with a profiled reflective ceiling reflect daylight deep into the interior of each office while offering a magnificent panorama of the harbour along the north side of each office floor. The light shelves reduce glare and excessive lighting in the perimeter zone of the office, whilst reducing contrast with the interior.

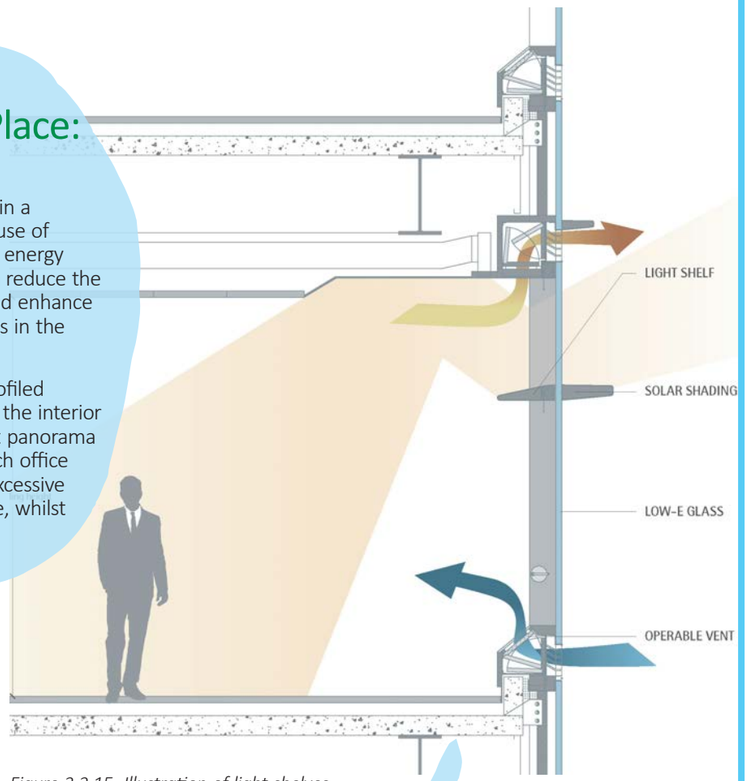
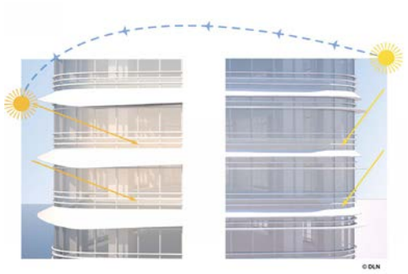
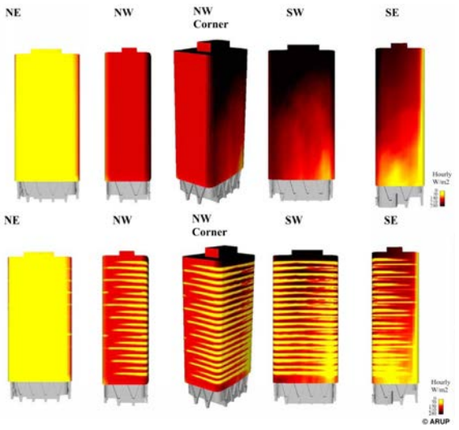


Figure 3.2.15 Illustration of light shelves
(Source: Hysan Development Company Limited)





Case study of 18 King Wah Road:

Sun Shading Device

Sun shading tackles the low angle of the afternoon sun. The sun shade extends outwards but also downwards to help mitigate the effects of the harsh afternoon sun. By bringing the shading device downwards, the maximum amount of surface area can be protected without jeopardising the view. On the other hand, during the morning hours, the sun is at a higher angle in the sky. The sunshade at the southwest corner extends out to block the higher early morning and mid-day sun. The sunshade can also extend in a horizontal direction, which helps to bring indirect lighting into the space, without affecting the view of the outside.

Figure 3.2.16 Effect of façade
(Source: Henderson Land Development Company Limited)

Case study of Dennis Lau & Ng Chun Man Architects & Engineers Office:

Low Partition Wall

Use of low partition wall and open plan design allows daylight in while maintaining privacy. Generally the lower the partition, the more daylight can enter. However, it must not be too low in order to maintain a good acoustic environment and the staff's concentration. Moreover, staff can have a visual connection with the outside world. It not only improves the wellbeing of the staff but also saves energy needed for lighting.

Figure 3.2.17 Low partition wall with glass and open plan design to enhance daylight penetration
(Source : Dennis Lau & Ng Chun Man Architects & Engineers)

Case study of Conservation International Hong Kong-Green Sky:

Glass Partition Wall

Use of glass partition walls makes the entire office bathe in sunlight, which eliminates the need for constant artificial lighting while allowing all staff to have natural light and a harbour view. All artificial lighting uses low-energy and long-life LED bulbs.

Figure 3.2.18 Glass partition wall of Green Sky
(Source: Conservation International Hong Kong)

Office UNIT

Office BUILDING

Benefits for Office Building

Well-designed sun control and shading devices can dramatically reduce building peak heat gain and cooling requirements and improve the natural lighting quality of building interiors. Proper glare control may even reduce the energy consumption by 5-15%. In electric lighting design, it is beneficial to have the right amount of light with appropriate limits to glare. This can reduce the number of light fittings and lower the initial capital cost and operational costs in the long run.

Green Strategies for Office Building

- Access to adjustable window shades by occupants allows excessive daylight and glare to be controlled
- Incorporate proper sun shading devices in the building design
- Installation of a drapery system for custom control of the light in

Glare Control

Overview

Excessive lighting has an adverse effect, and direct sunlight creates glare causing discomfort. Therefore it is important to have proper glare control.

Avoiding glare in the main seating area creates a more pleasant environment for workers. Having less time in discomfort will surely increase productivity.

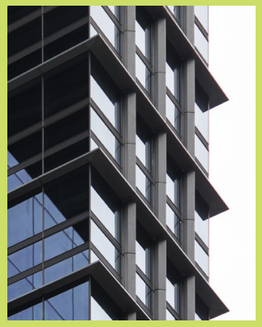


Figure 3.2.19 Glare control
(Source: Hysan Development Company Limited)

Benefits for Office Unit

Proper control of natural daylight by some types of shading device can prevent long-term damage to the eyes caused by excessive sunlight.

Areas of high brightness right next to areas of low brightness cause glare, making people uncomfortable.

Reducing glare will dramatically reduce the strain on the eyes.

Moreover, it increases the comfort level of workers and is a great asset for productivity.

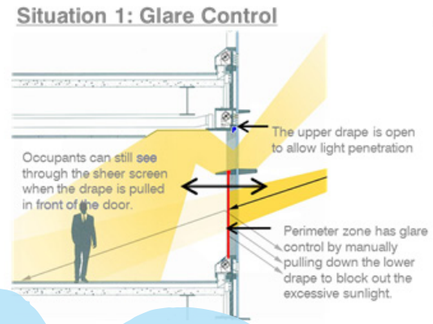
Green Strategies for Office Unit

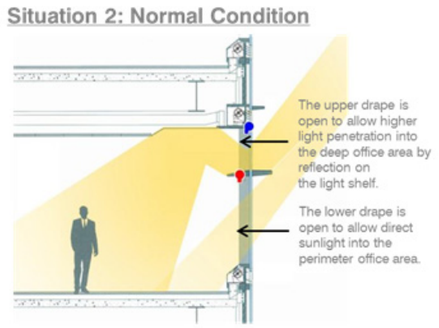
- Application of anti-glare coating to cut unwanted glare yet allow light in
- Installation of double layer blinds for a greater degree of glare control
- For desks located within 4.5m of windows, it is recommended that all computer screens be orientated such that they face within 20˚ perpendicular to the plane of the nearest window [1]
- Movable awnings

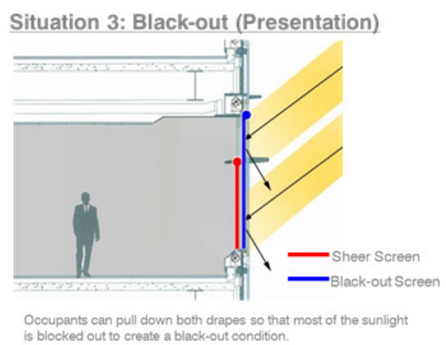
Read more at:
1. The Well Building Version 1.0

Office UNIT

Office BUILDING







Case study of Hysan Place:

Drapery System

Installation of sheer screens and black-out screens on the lower and upper parts of curtain wall units allows flexible use of drape in different daylight conditions for occupants' comfort.

Drape materials with high solar performance are selected for tenants to purchase, helping tenants to reduce electricity consumption.

Figure 3.2.20 Illustration of Drapery System
(Source: Hysan Development Company Limited)

Case study of Jones Lang LaSalle Pacific Place Office:

Anti-glare Coating and Double Layer Blind

Reflective sheet and curtain with flexible use of a drape to allow natural daylight and glare control.

It also allows employees to lower the window blind or curtain before leaving the office to avoid direct sunlight on the following day.

Glass room design to allow light from outside to penetrate the room area.

Figure 3.2.21 Jones Lang LaSalle Office Interior

Office UNIT

Benefits for Office Building

Office buildings with appropriate access to exterior views provide natural daylight for future tenants and hence lower their energy consumption during the operational stage.

Green Strategies for Office Building

- Regularly clean windows and skylights to maximise access to exterior views and natural daylight

Quality Views

Overview

With a steady increase in urban development, communities have experienced the negative impacts of overexpansion, greater commercial land use, and decreasing areas of undisturbed parcels of land. Moreover, a greater number of people are working and spending leisure time indoors. Urban lifestyles that include longer hours at the office, time constraints, and a subconscious separation from nature can have detrimental effects on communal and personal health and happiness.

BEAM Plus BI V1.0 IEQ 10

At least 60% of all workstations or seating to have a direct line of sight to external vision glazing or a naturally lit internal courtyard or atrium.

Figure 3.2.22 Views for tenants of Hysan Place
(Source: Hysan Development Company Limited)

Benefits for Office Unit

Physical workplace environments influence psychological and physiological factors of employees, specifically job satisfaction. People benefit from interaction with plants and nature. Visual access to green space helps to restore the mind's ability to focus, which improves job performance and helps alleviate mental stress and illness. It also improves experience, mood and happiness.

Green Strategies for Office Unit

- Encourage employees to regularly take breaks and look at outside views
- Organise the interior office space so that more employees will have outdoor views. Workstations or seating should be within 8m of the nearest vision glazing and, while seated, have a direct line of sight at an eye level of 1.2m of the vision glazing

Read more at:
1. http://www.beamsociety.org.hk/files/Manual/BEAM%20Plus%20Interiors%20Manual.pdf

Figure 3.2.23 Hong Kong Green Building Council Office Interior
(Source: Hong Kong Green Building Council)

Case study of Hong Kong Green Building Council Office:

Office Layout

More than 90% of the office space accesses external light through large windows to balance tenant comfort and energy use.

90.9% of workstations located within 8m of the nearest vision glazing have a direct line of sight to the outside.

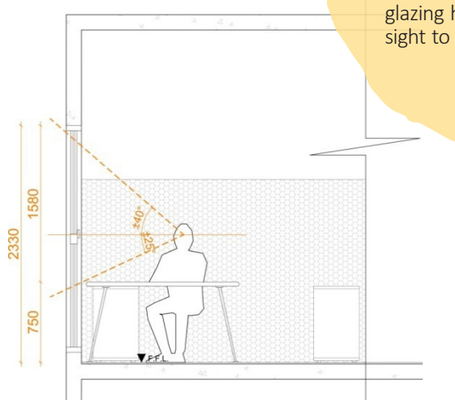


Figure 3.2.24 View angle
(Source: Hong Kong Green Building Council)

Figure 3.2.25 Hong Kong Green Building Council Office Interior Layout Plan
(Source: Hong Kong Green Building Council)

Office BUILDING

Benefits for Office Building

Buildings with a good acoustic environment will result in better well-being and performance, being not only beneficial for the employees, but also increase the efficiency and productivity of the company as a whole.

It will also improve the company's popularity as a workplace, which in turn can help you attract highly qualified employees.

Green Strategies for Office Building

- Establish green landscaping to soften noisy external environments
- Use of chilled beams rather than fan-coil units to reduce background sound

Good Acoustic Environment

Overview

A loud volume generally has a long echo, and a long reverberation amplifies noise and reduces speech intelligibility. In order to minimise this effect, the space should be designed with better sound absorption. In this connection, noise reduction can make for a more pleasant atmosphere. Office environments are recommended to follow the design criteria for unoccupied rooms:

BEAM Plus BI V1.0 IEQ 11

Criteria

- Internal Noise Level for Offices: NC 40;
- Reverberation Time for Offices: 0.6s
- Air-borne Noise Isolation for Offices: STC 48

Type of area	Sub-type	Recommended design sound level (dB(A))	Reverberation time (s)
Office type premises	Modular offices and conference rooms	40 (8 hours); 45 (5 min)	0.6 or below
	Large landscaped offices	45 (8 hours); 50 (5 min)	n/a

Benefits for Office Unit

Having a good accoustic environment is integral to providing people with a sense of well-being and satisfaction about the office in which they work every day.

A good working environment supports people in both communication and concentration.

Green Strategies for Office Unit

- Identify the balance of concentration and interaction among the workers in the office to help create zones
- Develop a layout strategy which will locate incompatible functions apart from each other
- Carefully consider the effect on neighboring workstations when locating supporting activities such as copier rooms, pantries and entries to conference rooms where a queue could be anticipated – adjacent to large conference rooms, for instance
- Provide a range of different work spaces and allow staff flexibility in their use to strike a balance between openness and privacy
- Specify ceilings having a minimum noise reduction coefficient (NRC) of 0.9 in open plan office areas and NRC of 0.8 in meeting rooms and training facilities. In conference, meeting and training facilities, provide noise absorbing panels on 25% of the walls with a minimum NRC of 0.8
- Cluster people who do the same work together
- Use of sound proofing material for partition walls

Read more at:
1. British Standard Institution. BS 8233 Code of Practice for sound insulation and noise reduction for buildings.
2. International Standard Organisation. ISO 3382. Acoustics -- Measurement of the reverberation time of rooms with reference to other acoustical parameters

Office UNIT

Case study of Hong Kong Green Building Council Office:

Sound Proof Partition Material

POLLI-BRICKS wall, 100% made from recycled PET bottles (Polyethylene terephthalate), is used to build the resource centre feature wall as well as room partitions.

As an application for interior partitions, the light, translucent and durable bricks offer excellent acoustic and thermal insulation.

Figure 3.2.26 POLLI-BRICKS Wall
(Source: Hong Kong Green Building Council)

Figure 3.2.27 POLLI-BRICKS Wall as Partition Wall
(Source: Hong Kong Green Building Council)

Figure 3.2.28 POLLI-BRICKS Wall Feature
(Source: Hong Kong Green Building Council)

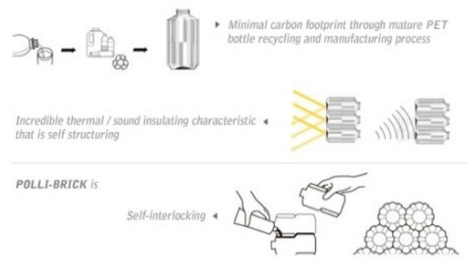


Figure 3.2.29 Characteristics of POLLI-BRICKS
(Source: Hong Kong Green Building Council)

Office UNIT

DESIGN STAGE 3.2.6 Good Acoustic Environment

Office BUILDING

Benefits for Office Building

Good indoor air quality is good business. Good indoor air quality management can reduce costs, improve a building's performance, and avoid potentially expensive building remediation.

Green Strategies for Office Building

- Pre-occupation evaluation of indoor air quality control
- Inspection of fittng out units
- Regular cleaning of air ducting and filtering system
- Odour elimination
- Smoke free policy
- Greening for air quality improvement

Indoor Air Quality

Overview

Indoor air quality has a significant effect on indoor environmental quality and can have serious health effects on occupants over time. Sources of indoor air pollution include natural sources, building materials, products, and occupants' activities. The common indoor air pollutants include (i) chemical pollutants, (ii) particles, and (iii) biological contaminants.

The intent of improving indoor air quality is to reduce human health risks by reducing exposure to indoor air contaminants, which can be done by avoiding the use of materials with high concentration of pollutants and volatile organic compounds (VOCs) and improving ventilation.

BEAM Plus BI V1.0 IEQ 1

Measurement approach

To conduct measurements in interior spaces to demonstrate that total volatile organic compounds (TVOCs), formaldehyde (HCHO), carbon monoxide (CO), nitrogen dioxide (NO_2), respirable suspended particulate (RSP) and ozone (O_3) comply with the Good Class requirements prescribed in the IAQ Certification Scheme.

IAQ Management Checklist (US EPA)

https://www.epa.gov/sites/production/files/2014-08/documents/mgmtlist.pdf.

Guidance Notes for the Management of Indoor Air Quality in Offices and Public Places

http://www.iaq.gov.hk/media/23671/gn_eng.pdf.

Benefits for Office Unit

Poor indoor air quality has an adverse effect on occupants' health. Improved indoor air quality can result in higher productivity, fewer lost work days and better business.

Green Strategies for Office Unit

- Avoid the use of materials with high concentration of pollutants and volatile organic compounds (VOCs)
- Specify the use of less harmful/ low-emitting materials
- Protect air duct system during construction process or use a temporary by pass ventilation system to minimise the dust pollution
- Perform air duct cleaning
- Ensure adequate ventilation to remove air contaminants
- Install air purifier
- Isolate areas of work to prevent contamination of clean/occupied spaces
- Provide local exhaust systems for polluting activities like redecoration and printing
- Avoid unnecessary partitioning of the premises and ensure sufficient fresh air supply after partitioning
- Clean up water spills and remove mouldy materials immediately
- Properly store all foods and dispose of trash promptly to prevent odours in offices

Office UNIT

Case study of International Commerce Centre:

Smoke-free Environment

ICC strictly complies with the Smoking (Public Health) Ordinance (Cap.371) and has joined the "Smoke free charter" to practice smoke-free living and actively promote a smoke-free world.

Vertical Green for Looks and Air

Our Green walls in lobbies on Levels 3 and 9 are to refresh the air quality of the area and to reduce dust and volatile organic substances.

Measures to contain dust and other harmful substances

Regular pre-occupation meetings are conducted with incoming tenants and their contractors. The work that is conducted on the premises and that will potentially contaminate indoor air can thus be contained.

Inspection of fitting out units

Our staff will inspect renovating premises regularly to ensure that all work conducted in the building is in compliance with the highest indoor air quality standard.

Regular cleaning of air ducting and filtering system

Air ducts and air filters of Air-Handling Units (AHUs) are regularly sterilised and cleaned to maintain excellent indoor air quality.

Odour Elimination

Nano Photocatalytic Oxidation (PCO) coating applied to lift cabins.

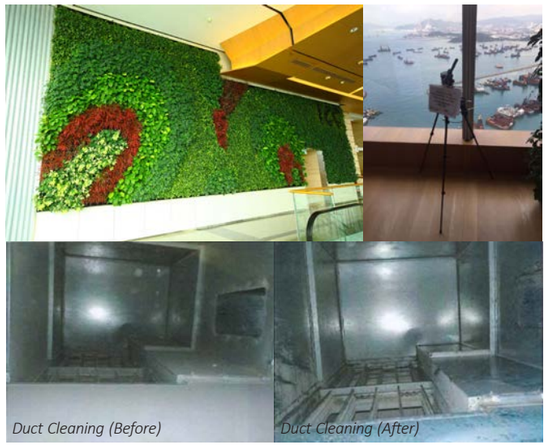


Figure 3.2.30 Indoor Air Quality Management Plan
(Source: Kai Shing Management Services Limited)

Figure 3.2.31 Exterior of International Commerce Centre
(Source: Kai Shing Management Services Limited)

DESIGN STAGE 3.2.7 Indoor Air Quality

Case study of Hong Kong Green Building Council:

- The installation of air purifiers in the printer room and office area can reduce the impact of contaminants such as ozone and particulates emitted from photocopiers and printers
- Excellent Class IAQ was achieved by air duct cleaning and providing local exhaust for printing room

Figure 3.2.32 Air purifier in printer room
(Source: Hong Kong Green Building Council)

Figure 3.2.33 Air duct cleaning
(Source: Hong Kong Green Building Council)

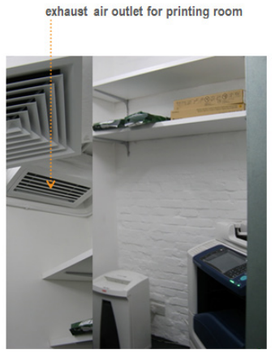


Figure 3.2.35 Location of exhaust
(Source: Hong Kong Green Building Council)

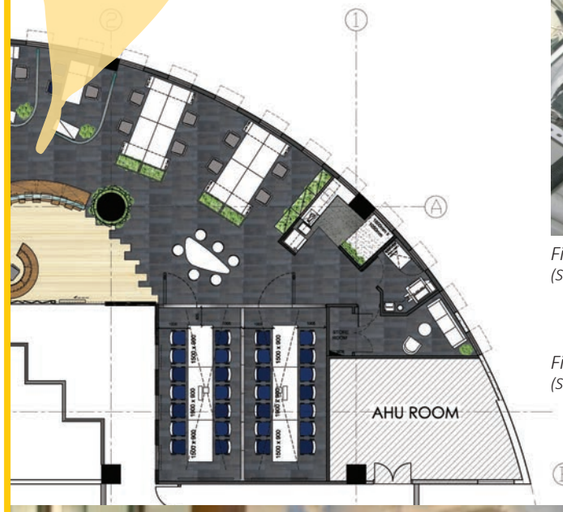


Figure 3.2.34 Location of air purifier
(Source: Hong Kong Green Building Council)

Figure 3.2.36 Hong Kong Green Building Council louvered wall for ventilation
(Source: Hong Kong Green Building Council)

Indoor Greenery

Overview for Office Unit

Indoor greenery is an important amenity within the office. There is a wide variety of different choices of indoor plants. Although common indoor plants are normally more shade tolerant and require less water compared to outdoor plants, they also need proper care for healthy growth.

Besides putting potted plants in office areas, there are innovative ideas like having a green column or green wall which are even more aesthetically pleasing and require less maintenance.

Benefits of Green Office Unit

Indoor greenery benefits office buildings by improving moisture levels and providing visual enhancement. Seeing nature in the work environment can increase job satisfaction. Moreover, plants can improve indoor air quality and deodorise gases caused by the use of certain materials, cleaning products and by human beings.

Since indoor plants improve indoor air quality significantly, staff productivity increases as well. Staff work more efficiently and with better concentration, especially staff working with computers.

Green Strategies for Office Unit

- Put under skylights or near glass exterior walls or windows where possible
- When using artificial lighting, light fittings which provide a full daylight spectrum should be used
- Rotate the plants regularly to enhance healthy plant growth in all directions
- Choose suitable indoor plants, e.g. when choosing houseplants, consider the resistance to insect infestation
- Adopt innovative indoor greenery ideas like green columns or green walls
- Appropriate plant species should be chosen so as not to induce insect problems

Figure 3.2.37 Indoor plants that can help to improve indoor air quality

Case study of Office of Ronald Lu & Partners (Hong Kong) Ltd:

Green Wall

The office embarked on research for sustainable urban living space in 2006 and the research included findings on vertical greenery. An area of 20 square metres in the office lobby was set aside in 2010 for the first experimental green wall design and construction in collaboration with the world-renowned green wall designer Mr Patrick Blanc. Despite its modest scale, the experimental green wall in the office comprises an automatic drip irrigation and nutrient system, built-in drainage and 353 plants from more than 50 plant species. The average yearly plant replacement rate is less than 10% and annual labour maintenance is around 10 man-hours.

Figure 3.2.38 Green Wall in Ronald Lu & Partners Office
(Source: Ronald Lu & Partners)

Case study of Office of Dennis Lau & Ng Chun Man Architects & Engineers (HK) Ltd.:

Potted Plants

Different species of indoor potted plants are placed throughout the office. This has created a nice interior view and improved indoor air quality. Potted plants throughout the office area have turned the whole office area into a green space.

Figure 3.2.39 Indoor greenery in DLN Office
(Source: Dennis Lau & Ng Chun Man Architects & Engineers)

Figure 3.2.40 Indoor greenery in DLN Office
(Source: Dennis Lau & Ng Chun Man Architects & Engineers)

Office BUILDING

Benefits for Office Building

Office buildings using low-VOC emitting materials provide a healthy indoor environment for future tenants and offer a good opportunity for both host office building and office units to obtain an excellent class under the IAQ certification scheme and to participate in other green building certification schemes.

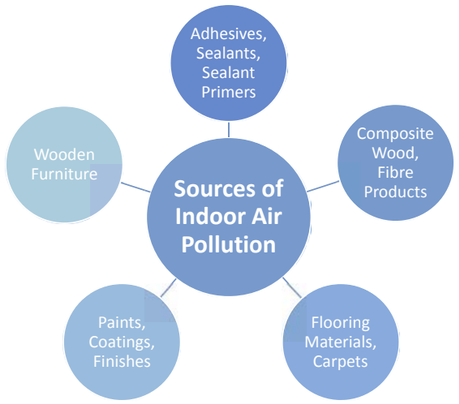


Figure 3.2.41 Effect of VOC

Low-VOC Emitting Material

Overview

Volatile Organic Compounds (VOCs) and formaldehyde are common chemical contaminants found in offices and are a source of odours. Possible sources of these chemical contaminants during office renovation include adhesives, sealants, sealant primers, paints, coatings, finishes, and composite wood and fibre products. Flooring materials, carpets, furniture, air fresheners, room deodorisers and cleaning agents are the major VOC and formaldehyde contributors during office operations. Prolonged exposure to VOCs can have detrimental health impacts. Related health symptoms include eye, nose, and throat irritation; headaches and dizziness, nausea and vomiting; and damage to the respiratory system.

BEAM Plus BI V1.0 IEQ 1

Design approach

A1. Adhesives and Sealants
A2. Paints, Coatings and Finishes
A3. Wood and Laminates
A4. Flooring Materials and Carpets
A5. Furniture

Benefits for Office Unit

High concentrations of Volatile Organic Compounds (VOCs) are known to cause health problems, including eye and throat irritation, headaches, and damage to the liver and the nervous system[1]. In addition, some Volatile Organic Compounds (VOCs) are thought to cause cancer.

Reducing the Volatile Organic Compound (VOC) emissions from materials such as paints, adhesives, and pesticides can have a positive effect on public health.

Green Strategies for Office Unit

- Use low Volatile Organic Compound (VOC) products such as paint, carpeting and adhesives whenever possible. (e.g. Volatile Organic Compound (VOC) content limits for adhesives for wood is 30 g/L) [2]
- Avoid the use of air fresheners and room deodorisers
- Plant indoor plants to remove toxins from the air and make the office a healthier place to work
- Acquire handheld detectors for regular detection of Volatile Organic Compound (VOC) concentrations in offices

1. Mølhave, Lars. "Volatile organic compounds, indoor air quality and health." Indoor Air 1.4 (1991): 357-376
2. http://www.epd.gov.hk/epd/english/environmentinhk/air/prob_solutions/files/MaxVOC_adheisves_sealants.htm

Office UNIT

Case study of Conservation International Hong Kong- Green Sky:

Low VOC Paint

Green Sky was awarded an Indoor Air Quality Certificate Award 2014 of Excellent Class by the Government. By using eco-friendly paint and adhesives, and no ozone-depleting substances during construction, staff and guests can enjoy extremely fresh air inside the office.

Figure 3.2.42 VOC free office interior
(Source: Conservation International Hong Kong)

Office UNIT

Separation of Printing Room

Overview for Office Unit

Laser printers emit paper fibres, organic vapours and inorganic gases during the printing process. Particle emission levels are printer specific and affected by printing conditions including the number of pages printed, cartridge age and toner coverage.

Photocopiers generate ozone when high-voltage charging devices produce an electrostatic discharge during a copy run. The concentration of ozone in the air around the photocopier is affected by the usage rate, the size of the room, and the rate of air exchange or ventilation.

If photocopiers and laser printers are located in unfavourable conditions or operated in excess of expected copy volumes, occupant exposure to indoor air pollutants may be exacerbated.

Benefits of Green Office Unit

The provision of exhaust systems for photocopying and printer rooms in office buildings can help to improve the indoor air quality and thermal comfort.

Separate rooms for photocopying and printing equipment help to eliminate the potential and direct exposure to ozone which is generated by photocopiers and laser printers. As ozone is such a highly reactive substance, any adverse health effects will be found essentially at the sites of the initial contact; the respiratory tract (nose, throat and airways), the lungs and, at higher concentrations, the eyes. The principal health effects are produced by irritation of and damage to the small airways of the lungs.

Green Strategies for Office Unit

- Ensure that equipment such as photocopiers, laser printers and fax machines are situated in well ventilated areas and with independent exhaust systems
- Do not locate the equipment in corridors or escape routes because of the increased fire risk and impeding the means of escape
- Regularly service and maintain printers and copiers to ensure the equipment is in good working condition

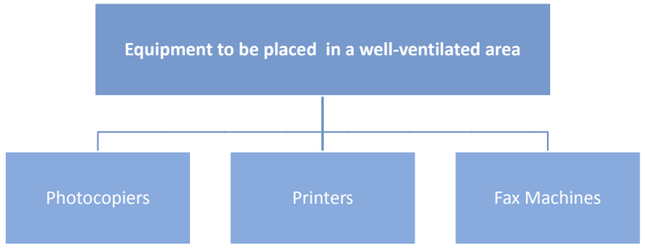


Figure 3.2.43 Improve the Indoor Air Quality in Your Building

Figure 3.2.44 Separate printer room in office buildings

Case study of Dennis Lau & Ng Chun Man Architects & Engineers Office:

Separation of printing room and server room

There is a separate room for printing as printers emit paper fibres, organic vapours and inorganic gases during the printing process. This can improve the indoor air quality.

Paper Recycling

Paper recycling bins are placed next to printers and are easily accessible, thus promoting paper recycling.

Figure 3.2.45 Separation of Printing Room at DLN Office
(Source: Dennis Lau and Ng Chun Man Architects & Engineers)

Separation of Server Room

Overview for Office Unit

Whenever possible, it is worth placing server equipment in a small, partitioned room for noise management and optimising operating conditions. The continuous operation of server equipment generates unwanted noise in the workplace. In addition, server equipment requires strict control on temperature, humidity and water detection. Setting up a small server room can be of benefit to server operations and create a quiet working environment. Furthermore, isolation of the server equipment can avoid dust. IT equipment in a dusty environment will burn out components much more frequently than one whose environment is relatively clean. A dedicated server room also offers the ability to secure IT equipment against casual theft or tampering.

Benefits of Green Office Unit

A dedicated server room with a separate air conditioning system can greatly improve the efficiency of the office air conditioning system.

A separate server room also helps to provide flexible control of the air conditioning system and therefore improves air conditioning efficiency.

Green Strategies for Office Unit

- Raise the floors in server rooms to facilitate the distribution of cool air, electrical power, telephone/data cables and water for room cooling units
- Use the hot/cold aisle principle. Hot-cold aisle configuration in the rack space allows the separation of hot and cold air flows to maximise efficiency of the cooling system. Cold air is delivered to hot equipment and hot air is returned most efficiently to the Computer Room Air Conditioning Unit (CRAC) for cooling
- Ensure proper cable management for proper ventilation
- Develop micro-cooling zones in larger server rooms to allow the precise amount of cooling to be delivered to where it is needed

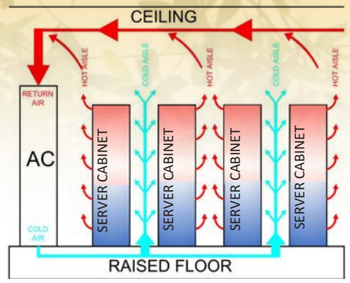


Figure 3.2.46 Green server room design

Benefits for Office Building

The IAQ Certification Scheme helps to recognise good IAQ management practices. Through participating in the Certification Scheme, an office building owner's efforts in providing environment with a good IAQ will be publicly recognised. Furthermore, the competitiveness of the building in attracting tenants will be increased.

Indoor Air Quality Certification Scheme

Overview

The Indoor Air Quality (IAQ) Certification Scheme is a voluntary programme launched by the Environmental Protection Department and is managed by the IAQ Information Centre. This scheme is applicable to the buildings or totally enclosed areas used as offices or public places which are served by mechanical ventilation and air conditioning systems. Up to June 2015, according to the list of certified premises from the Environmental Protection Department, there were 216,240 buildings that have obtained the Excellent Class IAQ certificate, while 806,920 buildings have obtained the Good Class IAQ certificate. The increasing number of IAQ certificates reflects the greater awareness by the public towards good indoor air quality.

Figure 3.2.47 Sample of Indoor Air Quality Certificate
(Source: IAQ Information Centre, http://www.iaq.gov.hk)

Benefits for Office Unit

It provides a good and healthy indoor environment for staff, improves productivity and minimises medical expenses by reducing sick leave and absenteeism due to poor indoor air quality. The corporate image is also enhanced.

ENERGY EFFICIENCY AND WATER SAVING

Office BUILDING

Sustainable Building Services System

Overview for Office Building

A building services system has a significant impact on our natural resources. Nowadays, the sustainability movement has gained attention and various sustainability concepts and practices can be combined with the building services system to contribute the overall benefits to the environment and sustainability.

The key elements for sustainable building services systems include, but are not limited to, the improvement of equipment and system efficiency, better utilisation of energy based on actual demand, reduction of emissions, recovery of the waste energy or waste water, and combining the building services system with the use of natural resources and a low carbon building approach.

Benefits of Green Office Building

- Improve health and indoor environment
- Reduce water use
- Reduce amount of indoor pollutants entering the external environment
- Tenants benefit from office buildings in several ways:
  - Reduce construction waste at the time of renovation for each new tenant
  - Enhance ease of modification to suit tenants' needs
  - Standardisation for easier adaptation by different tenants
  - Reduce energy use by recovery of waste energy

Green Strategies for Office Building

- Use of equipment and system with high operating efficiency
- Better utilisation of energy based on actual demand
- Reduction of carbon emissions from system
- Integrate BS system with the use of natural resources
- Recovery of waste energy and waste water

Office BUILDING

Sustainable Energy

Overview for Office Building

During the consideration of design and planning, applying the concept of innovative techniques can bring advantages to the buildings, including commonly known renewable energy techniques, such as wind energy and solar thermal energy. Use of PV panel systems may also be considered.

It has been found that solar PV technologies are potentially suitable for wide scale application in Hong Kong, given the abundant solar resource and the dense nature of our urban built environment. On the other hand, solar thermal power (electricity) generation and solar water heating could be pursued as site-specific applications on a case-by-case basis.

The resource potential of wind energy could be significant in Hong Kong, with a theoretical resource from urban wind turbines for the whole of Hong Kong estimated at between 2 and 3 TWh/yr. This is equivalent to between 5% to 8% of Hong Kong's annual electricity demand. However, individual machines in urban areas have several design issues which must be addressed prior to proceeding, such as safety, building stability, foundation stability, noise and vibration impact.[2]

Benefits of Green Office Building

The energy sector is the largest contributor to Hong Kong's carbon dioxide emissions, being responsible for about 97% of the total carbon dioxide emissions, most of which come from electricity generation. Using sustainable energy can help to minimise the environmental impact of energy production and use, and promote the efficient use and conservation of energy. Though its usage is subject to various constraints (such as space and initial capital cost) and its application is usually not more than 1% of the total building consumption, it can improve public health and environmental quality by limiting greenhouse gas emissions.

There is a vast and inexhaustible energy supply if we use renewable energy. This points us to the road of sustainable development.

Green Strategies for Office Building

- Use of Photovoltaic Panel (PV panel) or BIPV systems
- Use of solar thermal energy for power (electricity) generation and water heating
- Use of wind energy
- Bio-diesel tri-generation
- Use of district cooling systems

Figure 3.3.1 Photovoltaic panels installed on roof
(Source: Hong Kong Science and Technology Parks Corporation)

Read more at:
1. Study on the Potential Applications of Renewable Energy in Hong Kong, Electrical and Mechanical Services Department P.44
2. Study on the Potential Applications of Renewable Energy in Hong Kong, Electrical and Mechanical Services Department P.62-63

Office BUILDING

Figure 3.3.2 Bio-diesel Tri-generation
(Source: Construction Industry Council)

Case study of Zero Carbon Building:

Solar Energy

Polycrystalline and Building Integrated Photovoltaic (BIPV).

PV converts solar energy directly into electricity which supplements the supply of electricity to meet the demand of office operations.

Polycrystalline PV is relatively cheaper with higher efficiency while BIPV could be integrated with the building envelope as a cost effective solution.

Bio-diesel Tri-generation

(Comprises bio-diesel generator, adsorption chiller, desiccant dehumidification).

Bio-diesel tri-generation makes use of bio-fuel made from waste cooking oil for combined cooling, heating and power generation for office operations.

Figure 3.3.3 Solar Panel of Zero Carbon Building
(Source: Construction Industry Council)

Office BUILDING

Benefits for Office Building

- Reduce building energy consumption and carbon emissions.
- Reduce operational cost of building public systems.
- By applying the latest technologies, not only will it save energy, but it also increases the efficiency of appliances

HKGBC Benchmarking and Energy Saving Tool - Office Buildings (HK BESTOF)

(Since Nov 2015) – A certification scheme and a web-based energy benchmarking tool have been developed to promote energy efficiency for commercial buildings, by providing a reference to building owners and property management companies.

Energy Saving Technology

Overview

Technology is always improving. We see that more and more new energy efficient products are being launched into the market while the less efficient systems faded out. For example, the typical centrifugal chiller efficiency figure (measured in Coefficient of Performance COP) was about 5.2 at the end of last century. Recently, the market requirement was raised to 5.7. The same situation is also found in lighting technology where fluorescent lamp efficiency (measured in "luminous efficacy") has nearly doubled from the previous T10 tube to the latest T5 tube.

The following list sets out some examples of the latest energy efficient technologies which are applicable to office buildings/units.

Due to technological advancements, more and more technologies will soon be available on the market. Stakeholders can consult professionals on the detailed applications.

Figure 3.3.4 Application of photo sensor in office

Figure 3.3.5 Escalator with infra red sensor for energy saving

Benefits for Office Unit

- Improve energy consumption by the office unit
- Reduce operational costs for the office unit
- By applying the latest technologies, not only will it save energy, but it will increase the efficiency of the appliances

HKGBC Benchmarking and Energy Saving Tool – Office Occupants (HK BESTOO)

(Since Nov 2013) – the Scheme and a web-based energy benchmarking tool have been developed to promote energy efficiency and recognise outstanding energy saving performance by office occupants.

Office UNIT

Office BUILDING

Energy Saving Technology for Office Building

a. Lighting

- Energy saving lighting such as T5 or LED in common areas
- Occupancy/photo sensors for lighting control (see figure 3.3.4)
- Power over Ethernet (PoE) lighting (for saving on cabling)
- Appropriate number of lighting control zones
- Timer control for lighting

b. Heating, Ventilation and Air Conditioning (HVAC) system

- Energy efficient air-conditioning system
- High efficiency chillers with variable speed drives
- Oil-free chillers with magnetic float bearings
- Variable speed drives for motors of water pumps and fans
- VRV air conditioners
- Chilled ceilings/chilled beams
- DC motors for fan coil units
- CO_2 sensor control of the amount of fresh air supply
- Heat wheels
- Optimisation in chiller sequencing
- Use of heat pumps for space heating and hot water systems
- Total hydronic balancing in chilled water systems
- VAV system static pressure reset control
- Solar control window film

c. Lifts and Escalators

- Energy saving mode for lifts and escalators (see figure 3.3.5)
- Lift parking mode during non-peak hours
- Destination control system for lift bank
- Application of power regeneration

d. BMS systems

- Provision of smart metering for energy and water consumption monitoring

Green strategies for Office Building

- Oil-free chiller with magnetic float bearings
- High efficiency chillers with variable speed drives
- Variable speed drives for motors of water pumps and fans
- VRV air conditioners
- Heat recovery unit
- Energy saving lighting (such as T5 and LED)
- Occupancy sensors (for automatically switching off light and A/C)
- Daylight sensors and dimmable lighting ballast
- CO_2 sensor controls (minimise excessive fresh air supply)
- Destination control system for lift banks
- Escalator infra-red sensor (low speed at non-peak hours)
- Automated lighting
- Lift parking mode during non-peak hours

Energy Saving Technology for Office Unit

a. Lighting

- Energy saving lighting such as T5 or LED
- Occupancy/photo sensors for lighting control (see figure 3.3.4)
- Automated/time scheduled lighting zones
- Use of task lights

b. Heating, Ventilation and Air Conditioning (HVAC)

- VRV air conditioners
- Chilled ceilings/chilled beams
- DC motors for fan coil units
- CO_2 sensor controls on the amount of fresh air supply
- Building-Integrated Photovoltaic panels (BIPV panels)
- Solar control window film

Green strategies for Office Unit

- VRV air conditioners
- Energy saving lighting (such as T5 and LED)
- Occupancy sensors (for automatically switching off light and air conditioning)
- Daylight sensors and dimmable lighting ballast
- CO_2 sensor controls (minimises excessive fresh air supply)
- Appropriate zoning of lighting
- Appropriate zoning of air side systems with more thermostat controls

Office UNIT

Energy Saving Technology for Office Building

Electrical System

- Enhancement in system reliability by feeding from 3 different primary 11kV substations, strengthening the power supply as well as strengthening the reliability of the telecommunication facilities, etc.
- Power Monitoring System (PMS) monitors the power supply quality and the efficient use of electricity of each electrical device/equipment/ facility
- Provision of emergency generators to support back-up power

Lighting System

- Maximise the use of daylight
- Wide use of energy efficiency lights like T5 tubes and LED lights
- Wide use of electronic ballasts
- Select lighting with effective reflectors
- Building Management System (BMS) is designed to control lighting in common areas by means of time schedules for appropriate lighting zones
- To maximise energy efficiency, office areas are located at the perimeter whilst amenities areas and lift lobbies are located at the inner core of the building. Office room depth is also restricted to maximise effective daylight access
- Solar powered lawn lamps are used at night
- Use of light tubes and light shelves to capture daylight
- Use of task light with reduced general illumination

Air-conditioning System

- Thermal Comfort Analysis is conducted to compare different design scenarios on solar heat gain
- Use of Variable Air Volume (VAV) system for control of demand to arrive at energy savings
- Energy efficiency and cleaning devices are applied in the AC system:
  - Automatic condenser tube cleaning system to maintain a high heat transfer efficiency
  - Application of condenser water filtration system with centrifugal separator to prevent debris accumulation and reduce fouling in the cooling tower water circulation and enhance the chiller COP and save energy
  - Variable Speed Drives (VSD) for secondary chilled water pumps, cooling towers and Air-Handling Unit (AHU) respectively
  - Variable primary flow configuration for the chilled water system
  - CO_2 sensors are used to signal the VSD control of the Air-Handling Units (AHUs) to adjust the airflow for fresh air ventilation in the building's common areas in response to occupancy, thus arriving at energy savings
  - Heat pumps for space heating
  - Hydronic balancing in chilled water system
- Proper commissioning on air and water side systems

Lift and Escalator System

- Overcoming dynamic effect in lift shaft due to strong wind resulting from piston effect- research and aerodynamic modifications to minimise high wind loads
- Use of high-speed double-decker lifts can cut down the number of lift shafts needed while a specially-designed co-ordinated lift destination control system with crowd control sensors can ensure smooth vertical passenger movements even in rush hours
- Specially-designed regenerative drives for lifts that make use of surplus power to drive other lifts in the same system
- Adoption of VVVF motors in all lifts and escalators
- Use of service-on-demand escalator

Figure 3.3.6 Electrical System
(Source: Kai Shing Management Services Limited)

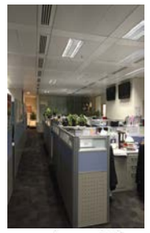


Figure 3.3.7 Solar Tube
(Source: Kai Shing Management Services Limited)

Figure 3.3.8 Fluorescent Light
(Source: Kai Shing Management Services Limited)

Figure 3.3.9 Air-conditioning System
(Source: Kai Shing Management Services Limited)

Figure 3.3.10 Under floor cooling
(Source: Construction Industry Council)

Case study of Zero Carbon Building:

Chilled Beams and Under-Floor Displacement Cooling

A high temperature cooling system with chilled beams and under floor displacement cooling is used. In convective cooling, cool air is distributed from the floor with a higher supply temperature and lower air speed. The system operates at higher chilled water temperatures and avoids another reheating process. For radiant cooling, chilled beams cool and absorb heat from inhabitants and spaces, requiring less pump and fan energy to deliver cooling.

High-Volume-Low-Speed Ceiling (HVLS) Fan

A patented airfoil and winglet design is able to move a large volume of air at a slow speed. As a result, discomfort due to high humidity is minimised from the higher rate of evaporation through increased airflow. The acceptable temperature for inhabitants is raised by 2°C with an air flow of 0.5m/s, thus energy savings can be achieved.

Desiccant Dehumidification

Instead of overcooling the supply air to achieve dehumidification, a desiccant wheel handles the dehumidification process separately from the cooling system. Desiccant is dried by recovered heat from the Combined Cooling Heating and Power (CCHP) system.

Figure 3.3.11 High Volume Low Speed (HVLS) fan
(Source: Construction Industry Council)

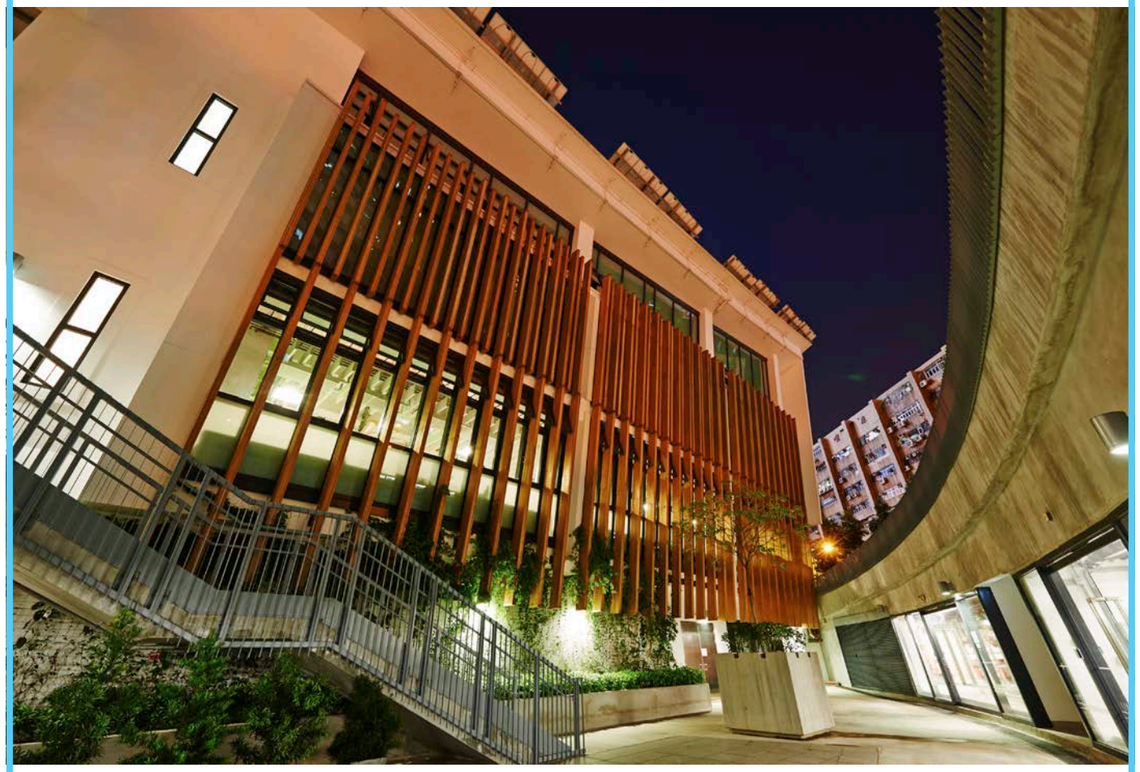


Figure 3.3.12 Zero Carbon Building
(Source: Construction Industry Council)

Indoor lighting control:

- Reduce lighting power consumption
- Encourage the use of task lighting
- Work with potential tenants (LEED CI)

Nano Luminaire:

- Higher diffuse reflectance
- Wider spread of light rays
- Wider lighting coverage
- Maintain the lighting level with less luminaire to save energy
- Nano luminaire achieves a minimum average lux level at 300Lux and power density below 8w/sm
- Use of task lighting in an office can reduce energy consumption and operational costs

Figure 3.3.13 Illustration on Task Lighting

Figure 3.3.14 Nano luminaire
(Source: Hong Kong Green Building Council)

Figure 3.3.15 Position of photo sensor
(Source: Hysan Development Company Limited)

Case study of Hong Kong Green Building Council:

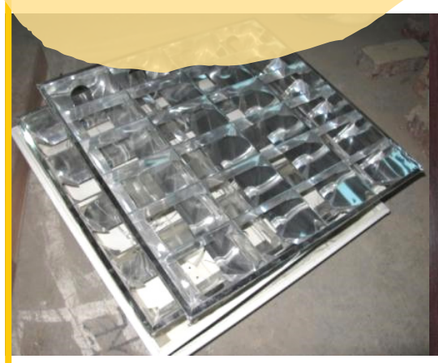


Figure 3.3.16 LED tubes
(Source: Hong Kong Green Building Council)

Figure 3.3.17 Hong Kong Green Building Council office entrance
(Source: Hong Kong Green Building Council)

To achieve the objectives of energy savings and improved illumination, existing T8 tubes were replaced with more energy efficient LED tubes.

For some lighting fittings, reflectors with high reflectance (95%) are used in order to maximise the energy efficiency and enhance light distribution.

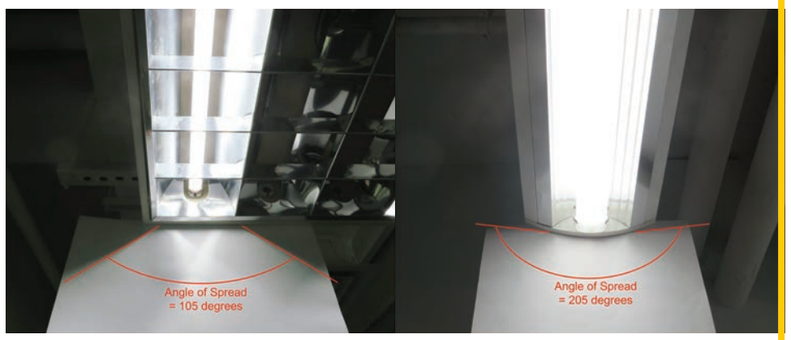


Figure 3.3.18 Lighting Reflectance
(Source: Hong Kong Green Building Council)

Case study of Jones Lang LaSalle Pacific Place Office

Lighting control:

- Daylight responsive control
- Occupancy sensors
- Every solar exposure has a separate control zone
- Interior spaces are separately zoned for controlling lighting power
- Use of energy efficient lamps
- Utilise exterior lighting for function/ meeting rooms
- Utilise natural light from glass window throughout office

Photo Sensors on Office Floors:

Dim the light in perimeter zones under the right daylight conditions and reduce energy consumption.

Figure 3.3.19 Photo Sensor

Figure 3.3.20 LED lighting panels in Jones Lang LaSalle Office

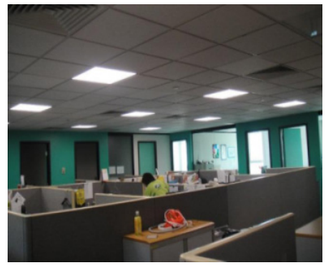


Figure 3.3.21 LED lighting panels
(Source: Business Environment Council)

Figure 3.3.22 LED lighting panels at Business Environment Council
(Source: Business Environment Council)

Business Environment Council Office	No. of Luminaire	Unit Power per Luminaire (W)	Annual Power Consumption (kw/h)
T8 Florescent Tube	148	60	23,088
LED Panel	102	40	10,608
Change	46% Reduced	33% Reduced	54% Reduced

Case study of Business Environment Council Office

LED Lighting Panels

Replacement of T8 fluorescent tubes with LED lighting panels.

Payback Period of LED Panels (Full Cost): 5.5 Years.

Case study of International Commerce Centre

- Reduce Lighting number-> 39 number
- Reduce Lux Level : 500 Lux-> 300 Lux
- Approximately 14% overall annual energy saving includes 39% saving on lighting annually

LED Light Panel *Motion Sensor* *Task Light for individual station*

Figure 3.3.23 Lighting Energy Saving Techniques in ICC
(Source: Kai Shing Management Services Limited)

Case study of Business Environment Council Office

Energy Saving

Annual reduction in energy use of the BEC Headquarters is expected to be at least 20% based on actual electricity billing/metering data. A reduction of 24.6% in energy consumption was recorded for the period of July 2014 to September 2014.

Use of power analyser, motion sensor, lighting zoning plan and manual dimming control.

Figure 3.3.24 Power analyser
(Source: Business Environment Council)

Figure 3.3.25 Lighting zoning plan
(Source: Business Environment Council)

Air conditioning control:

Offices and specialty room occupancies (conference rooms, kitchen, etc.) have active controls capable of sensing space use and modulating the HVAC system in response to demand from different areas.

Figure 3.3.26 Air-conditioning control
(Source: Jones Lang LaSalle)

Case study of Jones Lang LaSalle

Figure 3.3.27 Energy efficiency label

Figure 3.3.28 ENERGY STAR label

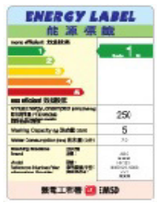


Figure 3.3.29 Energy efficiency label

Office Equipment:

Use equipment with energy label / ENERGY STAR label.

Office UNIT

Office BUILDING

Benefits for Office Building

- Reduce waste disposal into the environment
- Reduce fresh water use in the building to protect the natural water cycle and to save water resources for future generations

Green Strategies for Office Building

- Water saving faucets
- Low volume flush water closets and urinals
- Infra-red sensors for water taps (automatic shut off after use)
- Provide check meters to monitor water consumption
- Dual flushing fitments

Reducing Water use

Overview

Most of the water consumption in an office building results from hand washing and toilet flushing. Water saving sanitary fitments are available from the market. Owner/tenants can purchase the water saving product of WELS Grade 1 or WELS Grade 2 based on the recommendations of the Voluntary Water Efficiency Labelling Scheme (WELS) from the WSD.

BEAM Plus BI V1.0 WU 2

The use of water efficient devices shall lead to an estimated aggregate annual water saving of 30% when compared with BEAM Plus baseline.

BEAM Plus BI V1.0 WU 3

The flushing system installed within the project space should be water efficient, lowering sewerage volume.

Water efficient flushing systems include, but are not limited to:

- Sensor type urinal
- Waterless urinal
- Flushing system certified by WELS Grade 1
- Dual flush water closet

Figure 3.3.30 Use of water saving sanitary fitments in the toilet

The Voluntary Water Efficiency Labelling Scheme (WELS) is a water conservation initiative of the the Government. WELS intends to cover the common types of plumbing fixtures and water-consuming appliances. Products participating in WELS will incorporate a water efficiency label that tells consumers the level of water consumption and water efficiency to help consumers choose water efficient products for water conservation. WELS has been implemented in phases for different categories of plumbing fixtures and appliances. (http://www.wsd.gov.hk/en/plumbing_and_engineering/wels/index.html).

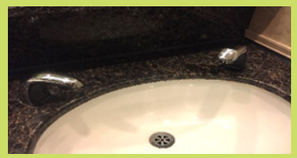


Figure 3.3.31 Sensor Water Tap

Benefits for Office Unit

- Reduce operational costs

Green Strategies for Office Unit

- Water saving faucets
- Low flush water closets and urinals
- Infra-red sensors for water taps (automatic shut off after use)
- Dual flushing fitments

Office UNIT

Case study of Hong Kong Green Building Council

A dual flush sensor promotes best practice in water economy (short or long flush) and hygiene in toilets.

Reduction of water for flushing-20,000m³/year.

Figure 3.3.33 Dual flush sensor
(Source: Hong Kong Green Building Council)

To protect the environment, no bottled water is used.

The selected dispenser has OASIS® Quick Change Filtration and is NSF certified under Standards 42 and 53 with carbon filtration, lead, cyst and Volatile Organic Compound (VOC) reduction media.

Using a water-saver outlet to reduce excessive discharge from the faucet and achieve up to 84% in water savings.

Hand washing sensor reduces potable water for pantry use and hand washing-4,500m³/year.

Figure 3.3.34 Hand Washing Sensor
(Source: Hong Kong Green Building Council)

Office UNIT

Figure 3.3.32 Water saving fixtures in office pantry
(Source: Hong Kong Green Building Council)

Office BUILDING

Water Recycling

Overview for Office Building

To enhance water economy, some of the water discharged by the building can be recycled so that fresh water consumption can be reduced. Water recycling schemes include, but are not limited to, recycling rain water, greywater, condensate water, cooling tower bleed-off water and fire services water.

BEAM Plus NB V1.2 WU 4

Harvesting of rainwater shall lead to a reduction of 5% or more in the consumption of fresh water.

Recycled greywater shall lead to a reduction of 5% or more in the consumption of fresh water.

Figure 3.3.35 Rainwater recycling system

Benefits of Green Office Building

- Reduce water demand on water main
- Reduce cost of water usage
- Reduction in the amount of fresh water needed for sewage conveyance
- Reduction in the total amount of fresh water drawn from natural water bodies
- Similarly a reduction in the volume of sewage entering the public sewage infrastructure

Green Strategies for Office Building

- Recycle rainwater for irrigation or cleansing uses
- Recycle grey water from low contaminated waste water in office
- Recycle air conditioning condensate for flushing use
- Recycle cooling water bleed-off for flushing use
- Recycle waste water during fire services system annual inspection for cleansing

Case study of Hysan Place:

Rainwater Collection System.

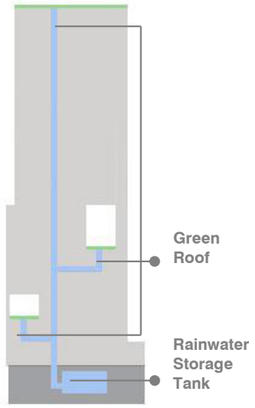


Figure 3.3.36 Rainwater collection system

Rainwater collection → Rainwater Storage Tank → Filtration System → Automatic Irrigation System

Rainwater Harvesting System makes use of rainwater collected on green roofs, exterior walls and at ground level for non-potable and safe use purposes. A rainwater harvesting system has a significant effect on the reduction of potable water used for irrigation.

GREEN BUILDING CERTIFICATION

- New Building
- Existing Building
- Office Interior

Office BUILDING

BEAM Plus New Buildings (BEAM Plus NB)	BEAM Plus Existing Buildings (BEAM Plus EB)
For developer: • New construction • Major renovation to existing buildings • New construction and an existing building, e.g. expansion of a building • A combination of new construction and major renovation	For developer and property management: • Existing building

Green Building Certification

Overview

Nowadays, the global trend is to pursue developments through sustainability. Several local and international green building certification bodies have developed assessment tools to cater for the unique nature of office spaces. Each of the assessment guidebooks list up-to-date architectural and building services design criteria and management ideas for planners, future and existing owners, and tenants and operators.

In April 2010, a consolidated version of the Building Environmental Assessment Method (BEAM) Plus system was issued for "New Buildings" and "Existing Buildings" by the BEAM Society Limited, BEAM Plus "Interiors" was developed in 2013 for non-domestic interiors and fitting-out work including retail, office and commercial interiors projects in Hong Kong.

In all existing BEAM Plus rating systems, better building performance is classified into Platinum, Gold, Silver and Bronze. To learn more, BEAM Plus certification tools with credit requirements are available free online. To encourage the development of green building, there is a Gross Floor Area (GFA) concession capped at 10% of the total GFA of the development for those new development projects with an application for BEAM Plus certification as one of the prerequisites.

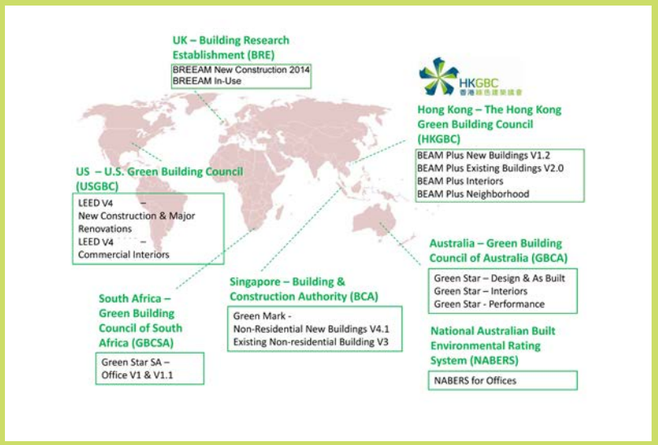


Figure 3.4.1 Worldwide green building rating tools

Read more at:
BEAM Plus certification tools
Hong Kong Green Building Council. BEAM Plus certification tools in 2016, from https://www.hkgbc.org.hk/eng/BEAMPlus.aspx.

Green Strategies

Try to engage BEAM professionals, authorised persons, registered architects, registered professional engineers in structural/building services disciplines to identify sustainable elements which can be incorporated into the office spaces at the early planning and design stage when most significant benefits can be obtained.

Consider implementing green building certification such as BEAM Plus. Where green building certification is not pursued, it is important to use green building certification standards as a reference for better quality control and quality assurance for the implementation of green measures in office spaces.

BEAM Plus Interiors
For tenants: • New buildings' fitting-out and interior projects • Renovation of buildings' fitting out and interior projects

Office UNIT

OPERATION AND MANAGEMENT

4.1.1
Green Operation and Management

4.1.2
Intelligent Building Management

4.1.3
Green Education and Support

4.1.4
Waste Management

4.1.5
Occupant Behaviour

4.1.6
Maintain Energy Efficiency

4.1.7
Energy Audit

4.1.8
Monitoring and Benchmarking

4.1.9
Pest Control

4.1.10
Post Occupancy Survey

Office BUILDING

Benefits for Office Building

- Higher electricity savings, lower operating costs, longer building lifespan and economic payback
- Increase market reputation and business opportunities
- Reduce regulatory risk when legislation bans inefficient practices
- Reduce weather-related risk as less damage caused by extreme weather

Green Strategies for Office Building

- Intelligent Building Management Systems
- Green Education and Support for Tenants
- Energy Efficiency
- Energy Audit
- Waste Management
- Monitoring and Benchmarking

Green Operation and Management

Overview

Well-planned operational and management practices and procedures are crucial for long-term implementation and achievement throughout the whole process of maintaining a green office environment.

For a new green office building, although designers and builders have contributed to establish a good foundation for a green environment, their efforts will be in vain if the building is poorly operated and managed. It will be worse when green practices are unfamiliar to the users.

For the non-green office building, poor operation and management in achieving environmental efficiency will become nearly impossible, cost-wasting and risky due to continuous energy inefficiency.

In general, green operation and management involves a team effort of "top-down commitment" from the landlord and "bottom – up participation" from tenants in maintaining the building system and environment and also ongoing improvement to catch up the green trend in the long term. The main green strategies of operation and management will be elaborated in this chapter.

Successful examples of office buildings and units going green

- Developer of United Kingdom, British Land Company PLC, benefited from increased value of office portfolio by 7.3% to £3.6 billion in 2012 after implementing green initiatives over 2 years. New customers were attracted to leasing substantial office areas and occupancy rates increased to 98%

(Source: British Land Co. PLC)

- Director of sustainable business solution of an international firm, PricewaterhouseCoopers (PwC), highly recommends business to adopt sustainability as "it creates value, attracts customers, retain employees and improves capital and funding"

(Source: Entrepreneur)

- Green program named Tenants Go Green implemented by Aon Center in Chicago, conducive to development of good collaboration with tenants. Microsoft, one of the tenants, highly appreciates green benefits gained through being a partner in Tenants Go Green

(Source: Environmental Protection Agency of United States)

Benefits for Office Unit

- Reduce energy consumption and office operating expenses
- Expand business opportunities and competitiveness
- Staff awareness and, in return, higher staff productivity and lower health costs
- Upgrade of the indoor environment due to green office design

Green Strategies for Office Unit

- Energy Efficiency
- Green Education and Support for Staff Members
- Waste Management
- Monitoring and Benchmarking

Read more at:
1. 2012 Annual Report of British Land Co. PLC, available at http://www.britishland.com/~/media/Files/B/British-Land-V4/documents/2012_annual_report.pdf
2. Joanna L. Krotz (2013) "Businesses Find Benefits in Going Green" in Entrepreneur, available at https://www.entrepreneur.com/article/227295
3. Energy Star of U.S. Environmental Protection Agency (2014), "Successes in Sustainability: Landlords and Tenants Team Up to Improve Energy Efficiency", available at http://betterbuildingssolutioncenter.energy.gov/sites/default/files/attachments/EPA_ES_Tenant_Report_508.pdf

Office UNIT

Figure 4.1.1 Process of top down commitment and bottom up participation
(Source: Business Environment Council)

Intelligent Building Management System

Overview for Office Building

A Building Management System (BMS) is a computer and network based control system which operates to monitor and control a range of building electrical installations and technical services.

The range of building services controlled by a BMS may include: lighting, ventilation, air conditioning, security, access control, fire services installations, lifts and escalators, plumbing, control panels and other engineering systems.

As the BMS is built on and operated using IT infrastructure, it can save time on communications between the supervisory controller and field controller. Meanwhile, the controllers can use the system to readily consolidate data on energy consumption and thus it subsequently leads to better management of data information. The data generated can be used for further analysis and planning of energy saving, in forming a procurement strategy and even an energy audit without on-site personnel inspection and measurement.

A range of building services controlled by BMS:

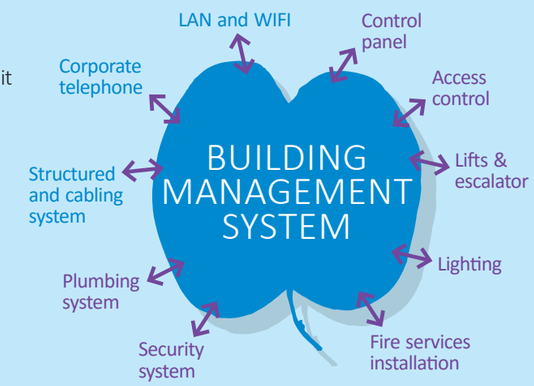


Figure 4.1.2 Building Management System

Benefits of Green Office Building

BMS is useful as a tool for improving energy performance for a range of building electrical installations and technical services. It is conducive to:

- Saving on operating costs
- Central or remote control of building equipment
- Efficiency in identification of irregularities
- Save time in monitoring and measuring power use
- Ease of evaluation, analysis and planning for energy efficiency

Green Strategies for Office Building

- Apart from BMS, there are several advanced technologies available to reduce the energy consumption and most of them are commonly used, such as variable speed drive, Light-Emitting Diode (LED) and sensor system, etc. (detail is available in section 3.3.3)
- Building Environmental Performance Assessment Dashboard system – functions as graphical user interface for displaying and evaluating a building's environmental performance (refer to Zero Carbon Building in Hong Kong, available at http://zcb.hkcic.org/Eng/index.aspx)

Intelligent Building Management System (BMS)

The BMS acts as an integrated platform to control and monitor the building services system together with the environmental performance within the office. The system comprises monitoring devices distributed throughout the office area (including electricity meters, thermostats and lux meters sensors, etc.), to provide instantaneous data. The direct digital controller, BMS server and workstation will then process the collected field data and execute the control strategy. Through this process, energy and environmental performance can be optimised.

The Building Environmental Performance Assessment Dashboard (BEPAD)

The BEPAD communicates to occupants how the office is performing through displaying environmental and energy information against targeted benchmarks.

Figure 4.1.3 Building Environmental Performance Assessment Dashboard (BEPAD) of Zero Carbon Building
(Source: Construction Industry Council)

Office BUILDING

Benefits for Office Building

The environmental programmes aimed at providing green education and support for tenants and occupants to practice "recycle, reuse and reduce" in the building with ease. Green facilities and activities provided by the landlord can promote the introduction of green concepts to tenants and encourage opinions about improvements in the green policy for the building.

Green Strategies for Office Building

- Targeting Green Goals
  1. Engage a BEAM Professional (BEAM Pro) for setting adoptable green strategies
  2. Building provisions and guidelines to allow tenants to implement green practices with ease
  3. Measures and campaigns for encouraging green behaviour among occupants
  4. Formation of green teams and encourage participation by different parties
  5. Planning and implementation of green programmes

Green Education and Support

Building Owner to Tenant

Tenant management can provide educational and awareness opportunities about green business practices to office tenants as well as the community as a whole. Landlord-tenant collaboration is conducive to aligning green incentives and achieving long-term sustainability benefits through bringing about necessary behavioural change.

Tenant to Staff Member

Staff management can encourage staff involvement and staff awareness of green office practices. Support and cooperation from staff members can lead to successful implementation of green office management in the long term.

Figure 4.1.4 "Green Trail" tour – educational tour at Hong Kong Science Park Phase 3 is available for booking by public.
(Detail can be referred to Green Trail of Hong Kong Science Park: https://www.hkstp.org/hkstp_web/en/Community/science-explorer/green-trail-science-park-phase-3)

Benefits for Office Unit

The concept of green management "Recycle, Reuse and Reduce" can be effectively implemented in offices and can contribute to an awareness among both employers and employees in terms of staff-related costs and health in return. Green office design and management can also help to upgrade the indoor green environment, resulting in achieving staffing goals, i.e., reduce costs of staff turnover, improve staff retention rate and increase company revenue due to better staff performance.

Green Strategies for Office Unit

- Improve Staff Awareness
  1. Education and Training
  2. Operation and Maintenance Guidelines
  3. Paper and office equipment consumption management
  4. Transport plan to reduce carbon emissions

Office UNIT

Office BUILDING

Green Education and Support to Tenants

Educational Environmental Programmes

Several recycling programmes introduced by the Environmental Protection Department and Non-Governmental Organisations (NGOs) allow tenants to practice "recycle, reuse and reduce" in the building.

An organic farming programme can be set up in the building. Food waste such as coffee grounds and eggshells can be directly reused as fertiliser. If the building has no space available for farming, planting in boxes or cartons is recommended.

Figure 4.1.5 Rechargeable Battery Recycling Programme
(Source: Environmental Protection Department)

Green Tour

A green tour can be arranged in one's own office building. Tours are not limited to other green office buildings, green centers and tailor-made green local tours. A green tour facilitates the direct introduction of green concepts to tenants.

Seminar, Conference, Exhibition and "Green Day" on environmental protection

Seminars, conferences, exhibitions and green days are regularly arranged by professional organisations and the Government authorities for the public, e.g.:

- Hong Kong Green Building Council https://www.hkgbc.org.hk/eng/
- Business Environment Council http://bec.org.hk/
- Environmental Campaign Committee http://www.ecc.org.hk/
- World Green Organisation http://thewgo.org/website/eng
- Environmental Protection Department http://www.epd.gov.hk/epd/
- The Hong Kong Institution of Engineers http://ev.hkie.org.hk/
- Friends of the Earth (HK) http://www.foe.org.hk/
- Zero Carbon Building http://zcb.hkcic.org/Chi/index.aspx

Figure 4.1.6 Programme on Source Separation of Commercial and Industrial Waste
(Source: Environmental Protection Department)

Green Policy to Encourage Waste Reduction

- To adopt the Building Management System and green technology as provided by the landlord
- A green procurement policy. To cooperate with green contractors and offer discounts (i.e., through bulk purchase) to encourage tenants to use green products
- Waste management during fitting-out, e.g., separate demolition waste by category for recycling and introduce covered wheelie bins for temporary storage
- Formation of workgroup as "responsibility party" to take the lead to provide ideas on waste reduction, promote green practices and to monitor the progress of waste reduction

Figure 4.1.7 Sha Tin Community Green Station (Environmental Protection Department)
(Source: Press release of news.gov.hk (11 May 2015), "Sha Tin Community Green Station open to public from tomorrow", available at http://www.info.gov.hk/gia/general/201505/11/P201505110596.htm)

Green Education and Support to Staff Members

Education and Training

To improve staff awareness by:

- Provide waste reduction information and guidelines
- Post environmental practices memos in common areas, such as the pantry and lobby
- Hold orientation training and seminars
- Hold regular meetings for sharing successful cases and reviewing the outcome
- Appreciate the efforts of staff and encouraging staff members to express green ideas
- Organise regular green activities or competitions

Operation and Maintenance Guidelines

Guidelines are an effective tool for guiding staff during implementation of green practices. They can also contain long-term strategies, e.g.:

- Promotion of Green Awareness
  - Refer to the abovementioned ways in "Education and Training"
- Green Procurement Policy
  - Collaboration with green suppliers for green purchasing
  - Bulk green purchasing for the purchase of green stationery, green office equipment and green cleaning materials, etc.
- Preventive Maintenance Plan
  - Well-planned maintenance schedule
  - Replacement of obsolete parts rather than the whole item of equipment
  - Testing and inspection
  - Operation manual for advanced green technologies, if installed
- Waste Reduction Practices
  - Several waste reduction tips can be provided for clearly guiding green operations and maintenance. (Tips are available in "Waste Management" in this Chapter)
- Ongoing Monitoring and Evaluation
  - Control of renovation and fitting-out works
  - Formation of Green Teams
  - Measurement and analysis
  - Regular audit
  - Reporting and review of findings

Note:

There are significant research results on the relationship between staff productivity and a green environment provided by the World Green Building Council "Health, Wellbeing & Productivity in Offices – the next chapter for green building", e.g.:

- Green design for IAQ and ventilation can obtain 0.8-1.3% health cost savings and 3-18% productivity gains
- Performance reduction around 4-6% when room tempertures are too low or too high
- Performance reduction around 66% in environments with distracting noise
- Employees prefer access to windows and daylight which is beneficial to staff's health

Figure 4.1.8 Signposting
(Source: Jones Lang LaSalle)

Figure 4.1.9 Recycle Bins at Jones Lang LaSalle Pacific Place Office
(Source: Jones Lang LaSalle)

Figure 4.1.10 Green office design provides better environmental comfort

Figure 4.1.11 World Green Building Council "Health, Wellbeing & Productivity in Offices – the next chapter for green building" available at http://www.worldgbc.org/news-media/health-wellbeing-and-productivity-offices-next-chapter-green-building

Office UNIT

Green Motivations to Tenants

Coffee Grounds

Coffee grounds, which can be used as a fertiliser, are collected from tenants for utilisation in planters, organic farming and smoking areas as ash-tray filler. Other than that, coffee grounds are re-packed for distributing to tenants for fertilising the plants in their offices.

Figure 4.1.12A

"Say No to Disposable Utensils"

ICC encourages tenants to use reusable utensils instead of the disposable ones. To go with this campaign, tailor-made reusable lunch utensils are available for sale at the concierge, encouraging tenants to work together to ease the burden on the 3 landfills in Hong Kong.

Figure 4.1.12C

Experimental Farm

Using Eco-bricks, an experimental farm was set up on the podium at the International Commerce Centre (ICC) in 2011. The farm not only further "greens" the outdoor environment of the building, it also encourages tenants to participate in green living at their workplace by enjoying the fun of being "city farmers".

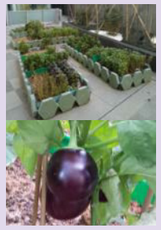


Figure 4.1.12B

Green Messages to Tenants

Green messages are spread to tenants through the green corner on the official website as well as via a bi-monthly pamphlet "Green Keeping" and a newsletter "Inside the Dragon Tail". For conservation reasons, all these publications are available online and only a small number of handouts are printed on an as-needed basis.

Figure 4.1.12D

Figure 4.1.12 A to D Green Motivation of ICC
(Source: Kai Shing Management Services Limited)

"Give and Take" and Community

The "green business" of ICC does not just rest within the building itself. ICC also works hard in the "Give & Take" approach as well as in spreading green concepts to the community.

Besides, ICC encourages tenants to participate in waste recycling programmes at the building. ICC works closely with stakeholders in the community, Non-Governmental Organisations (NGOs) and business parties to gather greater green power to build a better future for the building environment.

Since 2013, ICC actively "Takes" the following recyclables from the community, turning them into reusable materials, and "Gives" them back to society.

Figure 4.1.13A

Coffee Ground

There are 3 ways for coffee grounds collected from tenants to be recycled. They have a variety of uses: in planters of ICC, organic farms, smoking areas as ash-tray fillers for cigarette butt extinguishing. Coffee grounds are distributed to tenants upon their request or utilised by partnering schools and organic farms like C. & M.A. Sun Kei Secondary School and the HKFYG organic farm.

Figure 4.1.13B

Figure 4.1.13 A and B Green Community of ICC
(Source: Kai Shing Management Services Limited)

"Give and Take" and Community

Food Waste

Besides collecting from tenants, food waste is also collected from our neighborhood at Kowloon station which includes Yan Oi Tong Chen Cheng Yuk Yee Kindergarten, YMMSS Yau Tsim Neighborhood Elderly Centre and Ritz Carlton Hong Kong. After the collection, food waste is treated in either the food decomposer installed at the International Commerce Centre (ICC), or sent to Kowloon Bio-technology Limited to form fish food.

Figure 4.1.14A

Figure 4.1.14B

Plastic Bottles

In ICC, plastic bottles are not just collected for recycling into raw materials, they are also utilised as eco-enzyme containers. Eco-enzyme is a kind of eco-friendly cleaner produced by St. James Settlement Youth Services Causeway Bay Integrated Services Centre. It is a kind of eco-friendly cleaner that is harm-free to the environment.

The bottles are collected by ICC in its daily operations and from Ritz Carlton Hong Kong. They are sent to the centre regularly after being cleaned.

Utilisation of Decomposed Fertiliser

Fertiliser formed after the decomposing process in the food decomposer is utilised by both in-house and collaborating partners of ICC nearby, like coffee grounds, being used in the planters and organic farm of ICC to fertilise the plants. Decomposed fertiliser is also packed properly for further distribution to organic farms organised by Non-Governmental Organisations (NGOs) and schools.

Figure 4.1.14C

Unwanted clothes, books and computers

Used and unwanted materials may still be usable and useful to the needy. In order to recycle used books and clothes, together with unwanted computers and parts, these materials are collected regularly from tenants to distribute to people who are in need through voluntary organisations, namely World Vision Hong Kong, The Salvation Army and Caritas Hong Kong.

Figure 4.1.14D

Figure 4.1.14 A to D Green Community of ICC
(Source: Kai Shing Management Services Limited)

Office BUILDING

Benefits for Office Building

- Resources use incurs cost, so cost can be minimised if waste can be reduced
- Waste management shall contribute to both creating a green environment and saving operating cost

- Successful example of implementing waste management: - Johnson & Johnson, an international health care company, firstly introduced waste management programme in 1988 which had conduced to save materials costs at $2.8 million. On average, 2,750 tons packaging have been reduced annually, main strategies include reduction in paper, plastic, metal, etc. (Source: EPA)

Waste Management

Overview

Managing Paper and Equipment Consumption

Simple daily tips to effectively reduce waste in office, e.g.:

- Encourage staff to adopt single-side used paper, double-side printing and electronic mail
- Print only if hard copy is necessary and include a green slogan in internal email, e.g., "please consider the environment before printing this email."
- Upload and download documents through the internet platform
- Apply technology to paper saving, e.g., paper cut sensors on printers which assist in estimating printing costs and records the amount printed by each staff member
- Create a ranking table for the printing record among staff members to provide self-incentive to control paper use
- Place recycling bins in offices to separate and collect used paper and toner cartridges, etc. for recycling
- Switch off electrical appliances when not in use
- Fix or refurbish the equipment rather than replace it
- If replacing equipment, consider that someone may need it and donate the equipment to the needy

Food Waste Management

- Divide and compost food waste for recycling (it is suggested that information on what food can be composted is provided to tenants/ staff members)
- Donate surplus food (e.g., fruit provided by the company) to charities, such as Food Angel (refer to http://www.foodangel.org.hk/en/)
- Reuse food waste which itself can be a fertiliser, such as eggshells tea-leaves and coffee grounds (refer to Low Carbon Living, available at http://www.lowcarbonliving.hk/chi/kitchenwaste.aspx)
- Provide storage to tenants/ staff members for keeping food waste (e.g., food scrap buckets) before throwing it into the compost facility or sending it to a recycling centre/organisation

Transport Plan

A transport plan can be organised as an initiative to minimise vehicle use as well as business travel costs, e.g.:

- Encourage employees to travel by public transport
- Encourage the use of communication technologies, e.g. emails and video-conferencing
- Promote vehicle sharing
- Use fuel-efficient vehicles and electric cars and consider whole-life costs
- Control the frequency of transport delivery

Green Strategies for Office Unit

- Simple daily tips such as "managing paper and office equipment consumption" can effectively reduce waste in the office
- Food waste management can be implemented in the office in order to help solve the basic food waste problem – to reduce and prevent food waste at source
- Motor vehicles are one of the major sources of carbon emissions. A transport plan can be organised to minimise vehicle use as well as business travel costs

Read more at:
1. Queensland Health (Mar 2009) "Green Office Resource Guide", available at https://www.health.qld.gov.au/carbon_management/green_office_guide.pdf
2. US EPA, (1993) "Business Guide for Reducing Solid Waste - National Service Center for Environmental Publications (NSCEP)", EPA publication no. 530K92004, available at https://nepis.epa.gov/

Office UNIT

Office BUILDING

Benefits for Office Building

- A green procurement policy can be implemented for the sake of waste management in the office
- Resources sharing platforms allow sharing of useful resources which can be reused by the needy. Life span of products will be extended and users will be encouraged to adopt sustainable practices

- Waste management can be implemented during fitting-out
- The data on resources consumed in the office should be collected and analysed in order to manage resources efficiently
- The collected data can help track consumption behaviour from time to time and to figure out areas for improvement

- Checking invoices and sub-metering are some feasible ways to collect the data

Waste Management

Overview

Green Purchasing

- Purchase products made from recycled materials and reusable products
- Purchase certified energy saving equipment and appliances
- Encourage suppliers to improve their logistic strategies for reducing carbon emissions during delivery
- Introduce bulk purchasing so as to reduce packaging and delivery costs

Resources Sharing

- Establish a platform for sharing reused resources, including office equipment, furniture and fitting-out materials
- Join HK G-Share, which is an e-platform established by Hong Kong Green Building Council to allow resources sharing by the public. Two established sharing platforms are:
  - Domestic Resources Sharing Platform: public users are encouraged to donate resources which can be reused for domestic use
  - Building and Construction Resources Sharing Platform: public users can share or sell construction materials and resources which can be reused for construction purposes
  - Registration and details can be obtained from the link to HK G-Share: http://g-share.hkgbc.org.hk/mindex.php

Waste Management during Fitting-Out

- Separate demolition waste by category for recycling and introduce covered wheelie bins for temporary storage
- Do not allow contractors to discharge waste water and associated effluent or dissolved materials into any drains without installation of proper sediment traps
- Control of water consumption. Check for any leakage so as to ensure the water-consuming equipment works effectively. Also monitor consumption by sub-meters or water-consuming equipment or by inspection.

Measuring and Monitoring

- Regularly review relevant procedures to ensure compliance with the waste management plan
- Monitor recycling performance and identify areas for improvement
- Ensure compliance by cleaning and recycling contractors
- Hold periodic meetings for reviewing the current effectiveness of waste management

Note: more strategies can be referred to below link of Worldwide Responsible Accredited Production (WRAP) "Business Resources Efficiency Guide – Green Office: A Guide to Running a More Cost-Effective and Environmentally Sustainable Office": http://www.wrap.org.uk/sites/files/wrap/WRAP_Green_Office_Guide.pdf

Figure 4.1.15 HK G-Share, an e-platform allowing resources sharing in the public.
(Source: HK G-Share of Hong Kong Green Building Council)

Read more at:
1. Queensland Health (Mar 2009) "Green Office Resource Guide", available at https://www.health.qld.gov.au/carbon_management/green_office_guide.pdf

Office UNIT

Waste management is a continuing mission of the International Commerce Centre (ICC) to ensure all waste generated from the tallest building in Hong Kong is treated properly. The Waste Separation Centre was set up in 2010 to facilitate waste separation in ICC. With continuous efforts, ICC is now separating 26 kinds of recyclables and reusable waste from general waste collected from tenants, such as:

Figure 4.1.16 26 kinds of recyclables and reusable waste
(Source: Kai Shing Management Services Limited)

Figure 4.1.17 ICC in-house waste compactor
(Source: Kai Shing Management Services Limited)

ICC makes a great effort to collect as many kinds of recyclables as it can to eliminate the amount of waste being disposed to landfills. However, some of the waste is still not suitable for recycling, and has to be sent to landfills for disposal.

To alleviate this problem, ICC continually looks at ways to eliminate the influences of non-recyclables on the environment.

An in-house waste compactor is located inside the waste separation centre to compact waste into smaller packs before sending it to the landfills. Reducing the volume of general waste not only allows ICC to have more space for storing the recyclables before they are further treated, it also effectively cuts down the number of truck trips required and lowers the amount of carbon which is emitted.

Figure 4.1.18 Waste management programme
(Source: Hong Kong Green Building Council)

Waste Recycle Bins

Recycled categories in the pantry include non-combustible items, paper, aluminum cans, plastic bottles, glass, batteries and CDs.

All documents and related information on projects are saved on a hard-disk instead of being printed so as to reduce the consumption of paper.

An electronic project platform also reduces paper use by different work teams.

Office BUILDING

Benefits for Office Building

By changing the behaviour of occupants, energy consumption can easily be controlled since how occupants behave accounts for 50% of office energy consumption, a slight change in daily habits can actually make a major difference!

Green Strategies for Office Building

- Provide guidelines for tenants
- Involve staff in the contribution of green ideas
- Organise events that promote green office practices

Occupants Behaviour

Overview

It is important to encourage tenants and occupants to understand the benefits of a green office environment and its operation.

Landlords can provide green tips to tenants and the tenant can also post green tips for their office occupants, staff and visitors to follow such as:

- Turn off lights in areas/rooms which are not in use or install occupancy sensors which can switch off lights when there is no occupant. This will help to reduce energy use
- Turn off computers and peripheral equipment when not in use
- Recycle and reuse paper for printing, encourage double-sided printing
- Install waste sorting bins to enhance recycling

Benefits for Office Unit

The well-being of occupants can be improved by engaging staff in green practices such as using the stairs instead of elevators.

Green Strategies for Office Unit

- Green practice reminder
- Turn off lights when not in use
- Turn off computers when not in use
- Double-sided printing, reuse paper
- Waste sorting bins
- Encourage staff to dress appropriately for the environment

Office UNIT

Figure 4.1.19 Stair day at Business Environment Council
(Source: Business Environment Council)

Figure 4.1.20 Lights out at lunch
(Source: Business Environment Council)

Business Environment Council 10 Green Initiatives

- Stair day every Monday and Friday (except for the injured)
- Switch off the monitor when leaving one's seat for more than 10 minutes
- Ask colleagues sitting in the room to switch off the light when leaving the room for more than 10 minutes
- Switch off light zone lighting if you are the last one to leave
- Set the air-conditioner's temperature above 25 degree Celsius
- No food waste and drink all water using your mug
- Refuse to take disposal cutlery when buying lunch boxes
- Wash the plastic lunch box and dispose of it in the recycling bin
- Reuse single-sided printed paper
- Donate clothing and goods to the Salvation Army Recycling Programme

Figure 4.1.21 Business Environment Council Office staircase
(Source: Business Environment Council)

Zero Carbon Building Housekeeping Rules for Staff

- Always switch off computers and monitors before leaving the office each day
- In the natural ventilation mode, open the windows first. Switch on the ventilation fans only when natural ventilation is inadequate. When a fan is on, it should be set at an appropriate speed level, which is normally between 1 and 2 (with a maximum of 10)
- Under the air-conditioning mode, make sure all windows are closed. Always close the door behind you. Switch on the ventilation fans to improve indoor comfort if needed. When a fan is on, it should be set at an appropriate speed level, which is normally between 1 and 2 (with a maximum of 10)
- When natural light is inadequate, switch on task lights first before switching on the ceiling lights
- There are two ceiling light control zones in the office, with the switches located near the reception counter and in the printer area. The last one leaving the zone should switch off the lights in that particular zone, including the lighting for the printer area
- Switch on meeting room lights only when the natural light is inadequate and switch off the lights immediately after use
- Facility Management Office should ensure that CCTV monitors and building management system monitors are switched off when not in use
- Think twice before printing a hard copy
- Consider reusing printed paper before shredding or disposing of it
- Sort waste and put it in the appropriate recycling bins

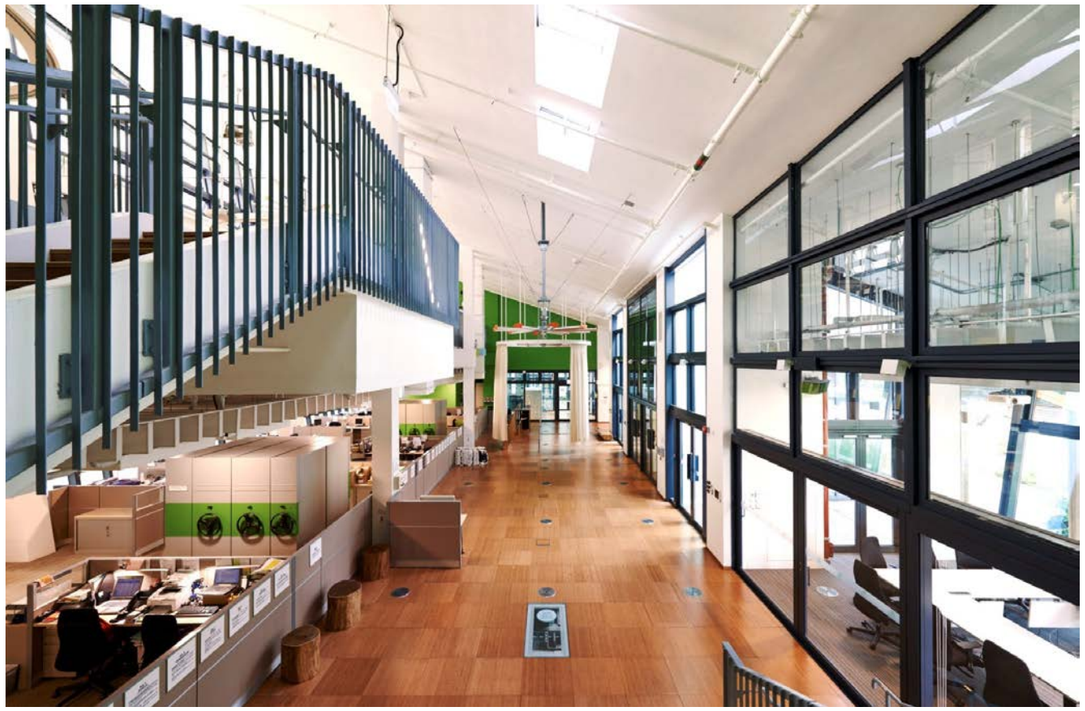


Figure 4.1.22 Zero Carbon Building Interior
(Source: Construction Industry Council)

Paper Saving Reminder in Toilets

Paper towels cause pollution during their manufacture and generate waste and pressure on landfills. Reminders like this can increase the awareness of users and can actually make a difference.

Figure 4.1.23 Paper Saving Reminder

Energy Saving Reminder

Staff were asked to switch off equipment at the end of the day.

Monitors were set to enter standby mode after a short time period.

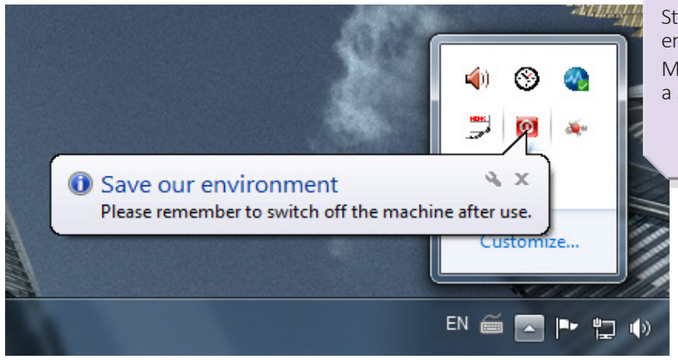


Figure 4.1.24 Energy saving reminder

At Green Sky, interns are encouraged to write on the walls, which reduces the use of paper in an innovative way. This strategy is not only beneficial to the environment, but also increases staff productivity by having a creative approach in conveying ideas.

Figure 4.1.25 Glass wall for writing
(Source: Conservation International Hong Kong)

Office BUILDING

Benefits for Office Building

Maintaining the Mechanical & Electrical (M&E) system regularly can retain the building services system's operational efficiency and reduce operational costs.

It can help lower the chances of system failure and increase energy efficiency.

Green Strategies for Office Building

- Proper preventive maintenance of equipment to avoid a loss of operational efficiency
- Compare the system's efficiency with historical data
- Clean cooling coils and heat transfer surfaces regularly
- Replace/clean blocked air filters regularly
- Carry out re-commissioning of the system regularly or after any renovation work
- Clean the diffuser of light fittings regularly
- Implement ISO 50001

Maintain Energy Efficiency

Overview

Lack of maintenance of the M&E system will reduce the energy efficiency of the system and also increase the system's failure rate.

The building operator is encouraged to review the system's operations regularly in order to improve the energy efficiency.

Benefits for Office Unit

Maintaining the M&E system regularly can retain the building services system's operational efficiency and reduce operational costs.

It can help lower the chances of system failure and increase energy efficiency.

Green Strategies for Office Unit

- Clean cooling coils and heat transfer surfaces regularly
- Replace/clean blocked air filters regularly
- Clean the diffuser of light fittings regularly
- Implement ISO 50001

Office UNIT

Office BUILDING

Case study of International Commerce Centre (ICC)

Application of ISO 50001 Energy Management System (EMS)

ICC was the first Hong Kong commercial property to obtain ISO 50001 Energy Management Systems Certification by the HKQAA in September 2011.

Plan

ICC team received and analysed the building's energy performance, defined the major energy sources, established energy performance objectives and targets, then formulated a series of action plans in relation to energy saving opportunities.

Do

ICC implemented energy saving action plans for Mechanical, Ventilation and Air Conditioning (MVAC), Electrical Lighting and Lift and Escalator Systems accordingly.

Check

With regular reviews of the facilities' operations and close monitoring of the energy usages via routine checking and energy performance reviews, the efficiency of the action plans can be identified.

Act

If the result is unsatisfactory or further areas for improvement can be spotted, improvement plans are developed and followed up to ensure the sustainable enhancement of the energy performance of ICC.

Figure 4.1.26 ISO 50001 EMS Model
(Source: Kai Shing Management Services Limited)

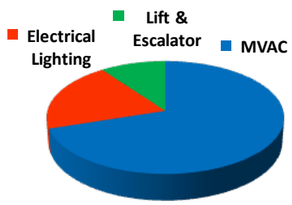
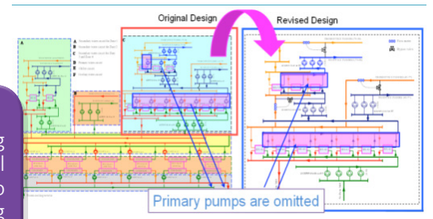


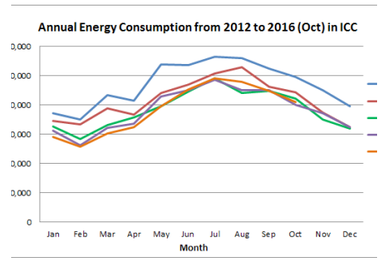
Figure 4.1.27 Main Energy Source
(Source: Kai Shing Management Services Limited)

MVAC System (1st Energy Source)

Action Plan 1

Optimise operating hours of the mechanical ventilation system to shorten the operating hours of the Air-Handling Unit (AHU) and exhaust air fans.





Action Plan 2

ICC-Managment Services Office has worked with a local university to seek means to improve chiller plant operation. Various air conditioning optimisation control strategies have been implemented, such as:

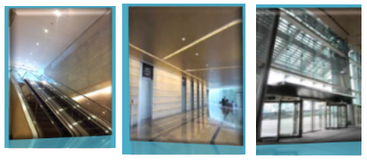
- Chilled water supply temperature optimisation
- Cooling tower control strategy
- Design configuration for heat exchange (HX) with primary pumps being omitted

Figure 4.1.28 MVAC System
(Source: Kai Shing Management Services Limited)

OPERATION AND MANAGEMENT STAGE 4.1.6 Maintain Energy Efficiency

Office BUILDING

Electrical Lighting System (2nd Energy Source)



LED Lamps Replacement

In the main office, entrance lobby and office floor corridors of ICC most of the damaged lights were replace by LED tube, MR16, LED Down light.

Mechanical Floor

Reschedule of Operating Hours

Switch off lighting on mechanical floors.

Lighting schedule adopts Air-Handling Unit (AHU) operating schedule.

Office Floors

Use of Timers and Sensors

Install timers and sensors to control lighting in areas not covered by the BMS.

Use of timers and sensors in plant rooms

De-lamping

Reduce excessive lighting in common areas such as lift lobbies.

De-lamping inside VIP lobby

De-lamping inside Lift lobby

Figure 4.1.29 Electrical Lighting System
(Source: Kai Shing Management Services Limited)

Lift & Escalator System (3rd Energy Source)

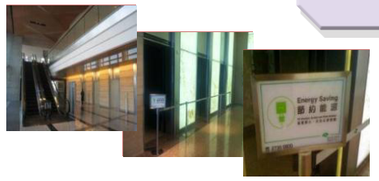
LED lamps

Replace lift car spot lamps with LED lamps in all lift cars.

Suspension of Lifts & Escalators

During non-peak hours and holidays.

- Zones 1 – 5: office and shuttle lifts
- Levels 1,2,3,8,9,48 and 49: escalators



Make Use of the Staircase

Encourage staff and tenants to walk between floors.

Figure 4.1.30 Lift and Escalator System
(Source: Kai Shing Management Services Limited)

Office BUILDING

Benefits for Office Building

An energy audit can encourage the building owner to explore more energy saving strategies.

Building energy audits benefits office buildings in several ways:

- Improvement of energy efficiency
- Improvement of product cost
- Good reputation for customers on environmental sustainability

Green Strategies for Office Building

- Proper preventive maintenance of equipment to avoid dropping of operating efficiency
- Compare the system efficiency with historical data and bench-marking

Energy Audit

Overview

To promote energy saving, The Government of the HKSAR enacted the Buildings Energy Efficiency Ordinance (Chapter 610) and all new office building designs need to comply with the Building Energy Code published by the Electrical and Mechanical Services Department (EMSD). In addition, energy audits for existing buildings also become mandatory.

However, the coverage of an audit is confined to the landlord's areas.

Even though some energy saving opportunities (called EMOs) can be identified through the energy audit, the implementation of the auditor's recommendations is not required under the Ordinance.

Pre-audit data collection

↓

Audit detailed measurement

↓

Data analysis

↓

Suggestion for implementation

Benefits for Office Unit

An energy audit can encourage the unit owner to explore more energy saving strategies.

Green Strategies for Office Unit

- Compare the utility usage with historical data and benchmarking
- Regular preventive maintenance of equipment to increase system efficiency

Office UNIT

Office BUILDING

Benefits for Office Building

An office building with a good energy index has a better reputation for the owner.

The benefits of monitoring and benchmarking are as below:

- Improvement of overall operational efficiency.
- Achieve long-term sustainability.

Green Strategies for Office Building

- Proper preventive maintenance of equipment to avoid loss of operating efficiency
- Compare the system efficiency with historical data and bench-marking

Monitoring and Benchmarking

Overview

Sufficient metering provisions are required to facilitate continuous monitoring of the energy consumption for office buildings. Nowadays, the electronic/smart metering devices are less expensive and an owner can set up an automatic monitoring platform to record the energy use pattern of the office.

To further identify energy saving opportunities, energy consumption for the office can be compared with the energy index from a local database, such as Hong Kong Green Building Council's Benchmarking and Energy Saving Tool – Office Occupants (HK BESTOO) or EMSD's Energy Consumption Indicators and Benchmarking Tools.

Figure 4.1.31 Intelligent Building Management System
(Source: Business Environment Council)

Benefits for Office Unit

Reduce utility costs.

Green Strategies for Office Unit

- Compare the utility usage with historical data and benchmark-ing
- Regular maintenance of office equipment

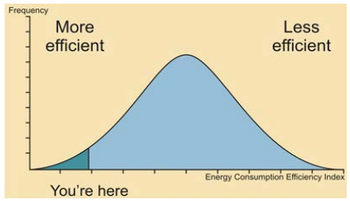


Figure 4.1.32 Benchmarking with energy index
(Source: Electrical and Mechanical Services Department)

Office UNIT

Hong Kong Science and Technology Park Phase 3:

Tenant metering and sub-metering

- Sub-meters compile tenants' lighting, HVAC and small power usage (down to 1 minute intervals if needed)
- Tenants can access their energy data via a dedicated web-portal and mobile app
- Tenants' energy data is also shared with the landlord to monitor whole-building energy performance
- "Pay-per-use" air conditioning for tenants with dedicated Air-Handling Units (AHUs) (via thermal / flow meters)

Building performance monitoring and dissemination

Building performance displayed at the entrance lobby of each building, with information including:

- Overall energy consumption during the last 12 months (actual versus target and EMSD indicators in kWh/m^2/yr)
- Annual savings in energy expenditure (HK$) and associated CO2 emissions (in terms of kg and equivalent number of trees)
- "Saving Star" Tenants in the previous month (energy use by the best performing R&D, laboratory and SME Tenants, in kWh/m^2)
- Photovoltaic, LED lighting, ultra-efficient HVAC & lift destination control savings (in kWh & HK$ during the year and since opening)
- Thermal storage, hybrid ventilation and rainwater harvesting data (e.g. m^3 water and HK$ water savings during the year and since opening)

Swire Properties Limited:

Data Management System

Swire Properties Limited (SPL) has established an extensive data management system. More than 20,000,000 items of operating data and 70,000 energy data items are captured, standardised and stored per day. In addition, a robust waste management framework has been developed since 2002, with data being collected for over 20 types of waste at present.

VAV (Variable Air Volume) Fault Detection System

Since 2008, SPL has funded and collaborated intensively with Tsinghua and Hunan University on in-depth research studies, with their commercial buildings being used as living laboratories for testing pilot initiatives in energy efficiency improvement. The VAV fault detection system is one of the advance systems invented by Hunan University and SPL, and has now been patented. The system can automatically identify malfunctioning VAV boxes in SPL's buildings with details so that rectification work can be arranged accordingly in order to maintain good building performance.

Business Environment Council:

Figure 4.1.33 Smart Metering
(Source: Business Environment Council)

Smart Metering

24 power meters have been installed to track the power consumption of air-conditioning, lighting and small power, as well as plumbing and drainage systems. They enable the building manager to take prompt and targeted actions to improve the energy efficiency of specific facilities. Chilled water meters have also been installed in areas used by other building users in order to evaluate their respective amounts of energy consumption associated with central air-conditioning.

Figure 4.1.34 Office Buildings in Hong Kong
(Source: Swire Properties Limited)

Office BUILDING

Benefits for Office Building

Proper pest control not only creates a healthy working environment within the building but also minimises damage to the structural components and landscaped areas caused by pests and therefore eliminates the maintenance cost.

Good pest control benefits the marketing of the building and increases the competitiveness of the building.

Green Strategies for Office Building

- Develop, implement and maintain an indoor integrated pest management plan
- Arrange regular pest control inspections
- Educate building occupants on integrated pest management

Pest Control

Overview

Pests in the surrounding environment will carry disease or cause health problems. Pest control is not only the responsibility of the cleaning staff but also requires the joint effort of maintenance staff, building managers, building occupants and pest management professionals. Traditional pest control only involves the routine application of pesticides which is insufficient. Office building/units with bad pest control may lower the attractiveness of the building and affect the health and the productivity of the staff.

Benefits for Office Unit

It creates a good and healthy indoor environment for staff through a reduction of the exposure to potentially hazardous chemical, biological and particulate contaminants.

Green Strategies for Office Unit

- Carefully source appropriate office buildings with good pest control
- Encourage staff to participate in pest control educational training provided by building management
- Prepare the area for pest control services

Office UNIT

Office BUILDING

Benefits for Office Building

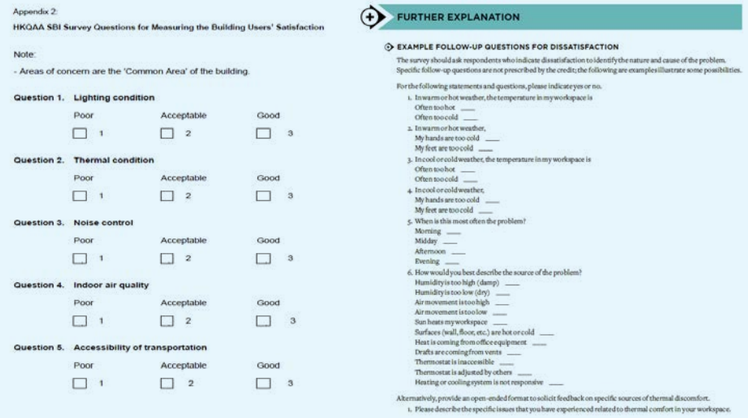
It encourages the use of occupants' feedback to improve building operation and maintenance.

Post occupancy surveys also keep the management team up to date with how buildings perform in practice.

Sample of a Post Occupancy Survey

1st reference : HKQAA SBI reference guide

2nd reference: LEED reference guide O+M Version 4



Appendix 2:

HKQAA SBI Survey Questions for Measuring the Building Users' Satisfaction

Note:

- Areas of concern are the 'Common Area' of the building.

Question 1. Lighting condition

Poor	Acceptable	Good
☐ 1	☐ 2	☐ 3

Question 2. Thermal condition

Poor	Acceptable	Good
☐ 1	☐ 2	☐ 3

Question 3. Noise control

Poor	Acceptable	Good
☐ 1	☐ 2	☐ 3

Question 4. Indoor air quality

Poor	Acceptable	Good
☐ 1	☐ 2	☐ 3

Question 5. Accessibility of transportation

Poor	Acceptable	Good
☐ 1	☐ 2	☐ 3

FURTHER EXPLANATION

EXAMPLE FOLLOW-UP QUESTIONS FOR DISSATISFACTION

The survey should ask respondents who indicate dissatisfaction to identify the nature and cause of the problem. Specific follow-up questions are not prescribed by the credit; the following are examples illustrate some possibilities.

For the following statements and questions, please indicate yes or no.

1. In warm or hot weather, the temperature in my workspace is
   Often too hot ___
   Often too cold ___
2. In warm or hot weather,
   My hands are too cold ___
   My feet are too cold ___
3. In cool or cold weather, the temperature in my workspace is
   Often too hot ___
   Often too cold ___
4. In cool or cold weather,
   My hands are too cold ___
   My feet are too cold ___
5. When is this most often the problem?
   Morning ___
   Midday ___
   Afternoon ___
   Evening ___
6. How would you best describe the source of the problem?
   Humidity is too high (damp) ___
   Humidity is too low (dry) ___
   Air movement is too high ___
   Air movement is too low ___
   Sun heats my workspace ___
   Surfaces (wall, floor, etc.) are hot or cold ___
   Heat is coming from office equipment ___
   Drafts are coming from vents ___
   Thermostat is inaccessible ___
   Thermostat is adjusted by others ___
   Heating or cooling system is not responsive ___

Alternatively, provide an open-ended format to solicit feedback on specific sources of thermal discomfort.

1. Please describe the specific issues that you have experienced related to thermal comfort in your workspace.

Figure 4.1.35 Sample of a post occupancy survey

Post Occupancy Surveys

Overview

A post occupancy survey is a complaint response system set up between the building management team and occupants to collect anonymous comments about thermal comfort, acoustics, indoor air quality, lighting levels, building cleanliness and other occupant comfort issues. For better evaluation, a well-established survey system should be set up, which details the survey period, review period of the post occupancy survey form and the number of occupants to be surveyed.

Office UNIT

LANDLORD AND TENANT

Office BUILDING

Landlord and Tenant Considerations

Landlord Considerations

Preliminary Landlord Considerations	
Budget	• Increase initial capital cost and cost savings expected as economic payback after implementing green practices
Effective and Transparent Communication	• Improve collaboration with tenant about green fitting-out works, green lease, promotional campaign and performance evaluation • Good communication among staff members
Proper Maintenance and Assessment	• Lifecycle of building system and facility • Proper preventive maintenance plan to reduce waste and maintain smooth green operation
Human Resources Management	• Train staff to become green-conscious • Recognise capability of staff in implementing green practices • Obtain effective decision-making
Others	• Utilise recycling programme and cooperate with recycling contractors to reduce construction and disposal waste generated by replacement of old system and facilities

Tenant Considerations

Preliminary Tenant Considerations	
Budget	• Increase initial capital cost and cost savings expected as economic payback after implementing green practices
Effective and Transparent Communication	• Good communication with landlord/ property agent and employees for long-term implementation of green practices and conflict mitigation
Proper Maintenance and Assessment	• Lifecycle of control system and electrical appliances • Proper preventive maintenance plan to reduce waste and maintain smooth green operation
Human Resources Management	• Train staff to become green-conscious • Promote a view of confidence about the change
Others	• Renovation or relocation of office area to build a green environment would involve fixture re-selection and office layout design

Benefits of Green Office Building and Unit

- Both landlord and tenants have to take different considerations into account to achieve green benefits
- According to the Hong Kong Green Building Council, green buildings with a BEAM certificate can achieve an average annual energy reduction of 13-30%

Source: Prof. John Ng (2014) "Compact Sustainability and Liveability in Hong Kong", available at https://www.hkgbc.org.hk/eng/BPRef-others.aspx#papers

Green Strategies

- Preliminary considerations of landlord and tenant
- Budget
- Effective and transparent communication
- Proper maintenance and assessment
- Human resources management
- Others
  - Waste management (landlord)
  - Fixture selection and layout plan (tenant)

Read more at:
1. Alev Durmus-Pedini and Baabak Ashuri (April 2010) "An Overview of the Benefits and Risk Factors of Going Green in Existing Buildings", available at https://community.ifma.org/knowledge_library/m/free_fm_content/1057518/download
2. World Green Building Council (2013) "The Business Case for Green Building", available at http://www.worldgbc.org

Office UNIT

Office BUILDING

Benefits for Office Building

The benefits from implementing "green" in return become an incentive for the landlord:

- Waste saving and improve green awareness
- Improve reputation. More investment opportunities and tenancy occupancy
- Financial advantages: lower operational costs and economic payback
- Improve corporate social responsibility
- Permanent green strategy developed. Reduce regulatory risk, market risk and weather-related risk

Example of a successful landlord: MTR Corporation Limited (MTR) has taken a leading role in the property industry to implement environmental criteria of BEAM Plus in 2010. The environmental campaign has led to energy savings of approximately $4 million annually and the achievement of BEAM Plus certification has resulted in an improved reputation of the Corporation and its managed buildings.

(Source: MTR Sustainability Report, 2013 and 2014)

Incentive for Landlord Overview

Overview

It is generally recognised that the landlord will achieve substantial benefits from implementing green policies and thus the benefits in return become an incentive for the landlord. The landlord will gain advantages from several environmental programmes, certification schemes, financial savings, green activities and development of a permanent green strategy, etc.

Incentive for Tenant Overview

Overview

In general, the tenant will also gain substantial benefits from implementing green policies and this becomes an incentive for the tenant. The tenant will gain advantages from several environmental programmes, green policies, financial savings, green activities and green culture developed in the office.

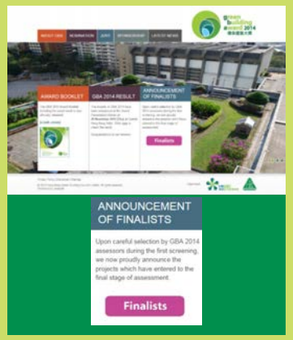


Figure 4.2.1 The Green Building Award is established by the Hong Kong Green Building Council and the Professional Green Building Council. Finalists are announced on the website.
(Source: Hong Kong Green Building Council, https://www.hkgbc.org.hk/gba2014/)

Benefits for Office Unit

The benefits of implementing "green" in return become an incentive for the tenant:

- Waste saving and improved green awareness
- Higher staff productivity. Fewer physical complaints and lower staff costs
- Financial advantages: lower operational costs and economic payback
- Green culture incorporated. Reduced regulatory risk and tenancy risk
- Improved corporate social responsibility. Increased market value and improved public relations

Example of successful tenant: Red Smith, an international law firm in the United States, looked for a sustainable floor plan and thus moved office to Three Logon located in Philadelphia in 2014 (a building with ENERGYSTAR certification). With support from senior management, a high-quality and sustainable workspace has been offered to staff members and 35% annual energy saving has been projected.

(Source: Environmental Protection Agency of United States)

Read more at:
1. MTR Sustainability Report (2014), available at http://www.mtr.com.hk/en/corporate/sustainability/2014rpt/pdf/mtrfull2014.pdf
2. MTR Sustainability Report (2013), available at http://mtr.com.hk/eng/sustainability/2013rpt/MTR%20SR2013_Final.pdf
3. US EPA, (1993) "Business Guide for Reducing Solid Waste - National Service Center for Environmental Publications (NSCEP)", EPA publication no. 530K92004, available at https://nepis.epa.gov/

Office UNIT

Incentives for Landlord

Green benefits in return become incentives for the landlord. The landlord gains advantages because:

- Several programmes provided by the Government departments and Non-Governmental Organisations (NGOs) are free-of-charge for participation. The participant would benefit from waste saving, lower energy consumption and improved green awareness through simply joining the programmes

Figure 4.2.2 Hong Kong Green Building Week 2016
(Source: Hong Kong Green Building Council, available at https://www.hkgbc.org.hk/eng/gbw.aspx)

- A certification scheme is offered by environmental programmes, such as the Indoor Air Quality Certification Scheme of the Environmental Protection Department. Recognised buildings can be listed on the website, e.g. certified buildings listed in BEAM Society Limited's website (http://www.beamsociety.org.hk). Allowing certification to be made public not only attracts tenants and visitors to the building but also creates a good reputation in the community, brings more investment opportunities and increases tenant occupancy in return

Figure 4.2.3 Sample of IAQ Certificate
(Source: IAQ Information Centre, http://www.iaq.gov.hk/)

- Financial advantage due to lower operation cost, economic payback, longer building longevity, lower maintenance and repair cost
- Holding green days, exhibitions and green tours, etc. would improve corporate social responsibility. In return, the landlord benefits from increased market reputation and business opportunities
- A permanent green strategy would be gradually developed. This can reduce regulatory risks when building sustainability becomes a trend and legislation is passed banning inefficient buildings. Meanwhile, market risk and weather-related risk would be reduced as a green building is more marketable and less damage is caused by extreme weather

Figure 4.2.4 Certified building list at BEAM Society Limited's website
(Source: BEAM Society Limited, http://www.beamsociety.org.hk/)

Note

Establishment of a green office can be costly in the early stages. Funding sources or financial support can be sought to cover the initial cost.

- Funding for introducing energy efficiency projects in a building can be obtained through the Government, namely the Environment and Conservation Fund (ECF) of the Environment and Conservation Fund Committee. For details, please refer to the website of the ECF: http://www.ecf.gov.hk/en/application/index.html
- Green environmental programmes and schemes organised by the Environmental Protection Department and NGOs provide useful guidelines and relatively cost-free green activities
- Relevant Government authorities and professional organisations may consider establishing a landlord's green incentive programme by setting fund subsidy, providing professional advice, promoting green events and activities and conducting periodic audits for inefficient buildings

Incentives for Tenant

Green benefits in return become incentives for the tenant. The tenant gains advantages because:

- Several green programmes offer benefits from lower energy consumption and improved green awareness among employees through simply making use of the provision of the programmes. A certification scheme would be conducive to enhancing the company's reputation

- Green policies involve staff training so that staff are trained to be green-conscious. Green systems always enhance the health of staff. This raises staff quality as there is less absenteeism as well as fewer physical complaints and lower staff costs caused by medical and insurance risk, staff movement and replacement

Figure 4.2.5 Computer & Communication Products Recycling Programme
(Source: Environmental Protection Department: http://www.epd.gov.hk/epd/)

- Financial advantages arise due to lower operational costs, economic payback, lower maintenance and repair costs

- A green culture would be gradually incorporated into the company culture. A permanent green strategy can reduce regulatory and tenancy risks when legislation is passed banning inefficient office practices and landlords mostly prefer tenants who have green policies

- Holding or attending green days, seminars, exhibitions and green tours, etc. would improve corporate social responsibility. In return, the tenant benefits from increased market value, positive public relations and the opportunity to attract more business, investment and cooperation

Figure 4.2.6 Organising green activities for staff members such as a green tour at headquarter of Electrical and Mechanical Services Department (EMSD). For more information and booking, please refer to EMSD: http://www.emsd.gov.hk/emsd/eng/pee/ep.shtml
(Source: Energizing Kowloon East, Development Bureau (2012), http://www.ekeo.gov.hk/en/green_map/trail/emsd/index.html)

Landlord's Support

Overview for Office Building

Common green support by a landlord to tenants:

- Introduce environmental programmes in the building and hold green activities for tenants
- Provide advice, guidelines and tips on environmental protection to tenant;
- Engage in green leases with tenants
- Post the green plan and circulars in open areas and publish green practices on a website and use apps for sharing green efforts
- Form a green team and invite tenants to join. Encourage tenants to express ideas and review the existing green policies and programmes
- Issue certificates to recognise the efforts of tenants
- Allow tenants to participate in bulk green purchasing and provide a list of green product providers to tenants
- Provide waste management initiatives, e.g.:
  - An automatic refuse collection system (ARCs) allows isolated and hygienic collection of refuse from each office floor
  - Centralised collection of reused resources, such as toner cartridges, fluorescent bulbs, batteries and food waste
- Provide a green system, facilities and services for tenants, e.g.:
  - Bicycle facilities, electric chargers for electric vehicles and a shuttle bus
  - Recycling bins and relevant facilities
  - Internet platform for trading office furniture or fixture
  - A building management system or other advanced green technologies to manage energy use and occupancy patterns (refer to section 3.3.3 and 4.1.2)
  - Green fittings, e.g., natural daylight from glass windows
  - Green maintenance services. e.g., regular cleaning of air conditioning units

Figure 4.2.7 Recycling bins at building
(Source: Jones Lang LaSalle)

Benefits of Green Office Building

The landlord's provision for green policies is highly important to improve tenants' incentives for green implementation. The landlord can offer value-added services to tenants as a way of providing support.

Green Strategies for Office Building

- Environmental programmes and green activities
- Advice, guidelines and tips on environmental protection
- Engagement in green lease
- Posting and publication of green plan and practices
- Formation of green team allowing tenants' participation
- Certificate for recognition
- Waste Management initiatives
- Bulk green purchasing and provision of a list of green suppliers
- Green system, facilities and services for tenants

Note: Detail of Automatic Reuse Collection System can be referred to:
1. AEL Associated Engineers, "Automatic Reuse Collection System" available at https://www.ael.hk/en/category/49/building_contracting/product/177/automated_refuse_collection_system
2. Ros Rosa Environment, "Automatic Reuse Collection System" available at http://www.rosroca.com/en/products/waste-collection/automated-waste-collection-system/

Office BUILDING

Green Lease

Overview

Below are some common terms of green lease for consideration:

- The purpose of the lease, e.g., to achieve a green environment and improve energy performance
- The tenant is invited to join the green team. Commitments of the green team can be listed
- Provision for information on waste audits if being practiced, e.g. visual waste audit, waste characterisation and desktop audits. The tenant may be required to submit information and allow entry to the premises for audit purposes. The objectives can be listed in the lease
- The tenant may be required to attend meetings held by the green team for reporting and reviewing purposes
- The tenant is required to agree to the installation of measuring devices and submission of consumption records and permit entry to premises for record purposes
- The tenant is required to adopt the relevant forms and methodology set by the landlord/ property agent for data submission and analysis;
- The tenant is allowed to join the bulk purchasing scheme for minimising waste. The procurement procedure and terms can be listed in the lease
- Mutual sharing the cost of installation and implementation of green practice measures if necessary. Landlord and tenant respectively can obtain an economic payback

(To be continued on next page..)

Benefits for Office Building and Office Unit

Green lease is a lease that involves sustainability as part of a landlord-tenant agreement. It encourages landlord-tenant collaboration in agreeing and implementing green goals. "Green leases have the potential to provide the leased US office market up to $3.3 billion in annual cost saving, reducing energy consumption by up to 22% and reduction in utility expenditure by $0.51 per sq.ft." (The Institute for Market Transformation, 2015).

(Source: Jones Lang LaSalle, "Green Leasing", 2015)

Green Strategies for Office Building and Office Unit

- ◤ Common terms of green lease
- The purpose of the lease
- Participation in green team
- Information on waste audits if being practiced
- Meeting for reporting and reviewing purpose
- Installation of measuring devices and submission of consumption record
- Form and methodology
- Bulk purchasing if implemented
- Cost and profit sharing
- Leasing term initiatives
- Relevant timeframe

Read more at:
1. Jones Lang LaSalle, Green Leasing (Oct 2015), available at https://www.jll.com/Documents/Sustainability/jll-green-leasing-whitepaper-oct-2015.pdf
2. Hong Kong Green Building Council (2014) "Green Tenancy Driver for Office Buildings", available at https://www.hkgbc.org.hk/eng/got.aspx

Office UNIT

Office BUILDING

Green Lease

Overview

- Leasing term initiatives:
  - A longer term can encourage the tenant to put in higher green capital cost for procuring green materials, products and appliances
  - Allow flexibility in the "as-is" condition when the tenant moves out in order to avoid waste due to reinstatement works
- Mutually agree the relevant timeframe, e.g. waste audit, submission of consumption record and periodic meetings
  *Example of succcessful green lease:
  - One of the leading real estate companies in the United States, Brandywine realty Trust, advocated energy efficiency among tenants by developing a green lease strategy. By 2012, the company had already received Energy Star labels for 83 managed buildings. The main green lease strategies included:
  - Charging energy saving measures to tenants as long as tenants would benefit from operational cost savings in return. Brandywine understood tenant had concerns about the estimated pay back and thus monitored energy performance and allowed for a repayment period. Tenants would not need to pay if the pay back was over estimated. – This is a win-win situation
  - Obtaining tenants' consensus to allow check meters to be installed in units. Otherwise, monthly data should be submitted by themselves. This ensures data can be collected for monitoring purposes

(Source: Institute for Market Transformation, 2012)

Figure 4.2.8 Hong Kong Green Building Council (2014) "Green Tenancy Driver for Office Buildings", available at https://www.hkgbc.org.hk/eng/got.aspx
More green lease terms, principles and sample can be referred to "Green Tenancy Driver for Office Buildings" of Hong Kong Green Building Council.

*Note

The following 10 main reasons for tenants to engage in a green lease are taken from Jones Lang LaSalle (JLL)'s "Perspective on sustainable tenant strategies – 10 reasons you should have a green lease":

- To save energy and water consumption costs
- To maintain a good relationship with the landlord
- To support corporate green goals
- To enhance the reputation of the company
- To demonstrate vision and leadership within the industry
- To improve civic relations
- To contribute to certification efforts
- To improve staff productivity
- To obtain additional savings through waste management
- To contribute to creating a green environment

Read more at:
http://www.us.jll.com/united-states/en-us/Research/JLL-Perspectives-on-sustainable-tenant-strategies.pdf

Green Strategies for Office Building and Office Unit

- ◤ Common terms of green lease
- The purpose of the lease
- Participation in green team
- Information on waste audits if being practiced
- Meeting for reporting and reviewing purpose
- Installation of measuring devices and submission of consumption record
- Form and methodology
- Bulk purchasing if implemented
- Cost and profit sharing
- Leasing term initiatives
- Relevant timeframe

Read more at:
1. Hong Kong Green Building Council (2014) "Green Tenancy Driver for Office Buildings", available at https://www.hkgbc.org.hk/eng/got.aspx
2. U.S. Department of Energy, Institute for Market Transformation (IMT), EEBHub (2012) "Brandywine Realty Trust Overcomes the Split Incentive Barrier and Obtains Tenant Utility Data", available at http://apps1.eere.energy.gov/buildings/publications/pdfs/alliances/brandywine_case_study_10-15-12.pdf

Office UNIT

OPERATION AND MANAGEMENT STAGE 4.2.4 Green Lease

Hong Kong Science and Technology Park Green Lease Provisions

On the part of the Landlord

- The landlord's vision is to be a role model in sustainable operations, with a long term ambition to be net carbon zero
- Carry out annual Indoor Air Quality (IAQ) tests in accordance with EPD's "Good" certification standard
- Use paints, sealants and adhesives that contain no or low emission materials or Volatile Organic Compounds (VOCs) and monitor their use (and those of the tenant) during fitting out in accordance with the Tenant Handbook
- Provide facilities for the collection of recyclable paper, cardboard, aluminum cans, toner cartridges, fluorescent bulbs, batteries and mobile phones
- Procure the facilities to enable the management office to implement an Environmental Management Plan (EMP)
- Ensure that installations (air-conditioning, lighting, electrical, lifts and escalators) comply with EMSD's building energy code
- Carry out energy audits (of the air-conditioning, lighting, electrical, lifts and escalators) every 10 years in accordance with EMSD's energy audit code

On the part of the Tenant

- Collaborate with the landlord in reducing overall utilities consumption
- Maximise the use of sustainability features of Phase 3 and minimise the impact of tenant activities
- Use environmentally friendly materials in accordance with the fitting out guidelines
- Allow entry by the landlord to measure the use of energy and water and management of waste of tenants
- Use best endeavors to dispose of all recyclable materials using the facilities provided by the landlord
- Submit environmental management guidelines governing the reduction of energy and carbon emissions
- Provide data on energy use and waste generation for performance evaluation by the landlord
- Install separate energy meters compatible with the central energy monitoring system

Green Tenancy Driver Training Toolkit

The Training Toolkit focuses on daily green practices in offices and covers various aspects including energy efficiency, waste reduction, water conservation and paper reduction. The Training Toolkit offers some easy-to-understand tips in the form of checklists and guidelines. In addition, toolkit users will be provided with some useful forms to monitor the environmental performance in offices, so as to keep track of the effectiveness of each green measure after implementation.

(Source: Hong Kong Green Building Council, https://www.hkgbc.org.hk/eng/toolkit.aspx)

Office BUILDING

Benefits for Office Building and Office Unit

- Educate tenants during implementation of sustainable design and green improvement plan
- Raise awareness among tenants of the importance and benefits of developing a green environment
- Assist in success of the building by participating in green campaigns
- Attract tenants who are looking for a green prospect

Guidelines for Tenants

Overview

- Green Fitting-Out Guide can be used as an effective tool for education and promotion purposes for green practices
- Building User Guide can introduce clear green goals and share successful green practices
- Other General Guidelines provide information on relevant legislation and green certification programmes
- Green Interior Certification can be introduced as a tailored environmental programme to arouse green awareness and provide practical standards/criteria to tenants

* The abovementioned guidelines to tenants will be elaborated in this chapter

The landlord can consider issuing green publications to tenants in order to transmit the green message and update new green practices. For example, "Green Keeping" published by the International Commerce Centre (ICC), refer to http://www.shkp-icc.com/website/showGeneralContent.do.

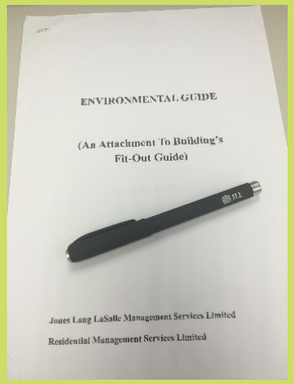


Figure 4.2.9 Green fitting-out practices can be included in an Environmental Guide attached to the Fitting-Out Guide for the building.
(Source: Jones Lang LaSalle)

Green Strategies for Office Building and Office Unit

- ◤ Guidelines for Tenants – Green Fitting-Out Guide
- Control pollution
- Control construction methods and work periods
- Encourage choosing green materials and products
- Provide professional advice on green office design
- Implement waste management during fitting-out

Green Strategies for Office Unit

- ◤ Guidelines for Tenants- Building User Guide
- Green Goals
- Building Services
- Energy Saving Policies
- Monitoring and Targeting
- Transportation Facilities

◤ For an example of building user guide, please refer to Green Building Council of Australia (Sep 2013) "Green Star Building Users' Guide Template", available at http://www.gbca.org

Read more at:
1. Associate of Green Property Owners & Managers – Green Office Building Tenant Plan (2014) "Green Tenant Behavioural Plan for tenants of office buildings", available at http://agpom.org/

Office UNIT

Guidelines for Tenants – Green Fitting Out Guide

- Control of pollution, e.g.:
  - Control of pollution during cleaning and pest control. Use natural, solvent free and hydrocarbon free cleaning products
  - Isolate working areas by installing partitions or sheeting
  - Control of smoking activities of the fitting-out contractor and provide a smoking area for smokers
  - Vacuum cleaning wherever paint and dust emission occur
- Control of construction methods and work periods, e.g.:
  - Set noisy work periods during non-peak hours
  - Install fresh air supply and proper ventilation devices such as fans and blowersControl use of toxic chemicals
  - Protect air conditioning system during carrying out of works
- Green materials and products, e.g.:
  - Recommend choosing green materials and products with a lower level of harmful emissions to minimise pollution (detail is available in "Collective Bargaining for Green Products" in section 4.2.6)
  - Provide a list of suppliers for sourcing green materials and products
- Professional advice on green office design, e.g.:
  - Light coloured decorative design and more glass windows for natural light so as to allow brighter indoor and use less artificial lighting
  - Planting indoors to create a green working environment
  - (*If the landlord practices pre-vetting to fitting-out plans, suggestions for green office design can be provided in vetting comments.)
- Waste management during fitting-out, e.g.:
  - Do not allow contractors to discharge waste water and associated effluent or dissolved materials into any drains without installation of proper sediment traps
  - Control on water consumption. To ensure the existing water-consuming equipment works effectively, check for any leakage and monitor consumption by installing sub-meters or new water-consuming equipment or by inspection

Guidelines for Tenants – Green Interior Certification

This is an effective tool to encourage tenants to practice green strategies. It allows the publication of certificated tenants in public places or on websites/apps, which can attract visitors and occupants to the credit of the tenants while their company image will be improved. The landlord can make use of this tool for recognising green efforts by tenants and encouraging renewal of the certificate.

- Provide practical green standards/ criteria for self-evaluation, e.g., indoor air quality, paper consumption, water saving and energy saving
- Provide training focusing on the green office
- Use the certification programme in conjunction with other support provided to tenants, e.g., professional advice and green facilities
- The tenant will learn how to apply green concepts to daily business practices

*For procedures and terms related to the certification scheme, please refer to "HKGBC Benchmarking and Energy Saving Tool- Office Occupants (HK BESTOO)" available at:

http://bestoo.hkgbc.org.hk/greenbuilding/index.aspx
http://bestoo.hkgbc.org.hk/greenbuilding/files/Applicant_Guide.pdf

Figure 4.2.10 The decoration wall at reception made of recycled content
(Source: Office of Jones Lang LaSalle at Pacific Place)

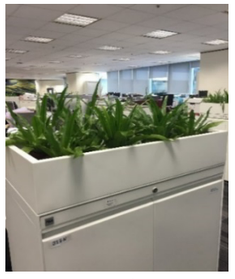


Figure 4.2.11 Planting inside office for a green working environment
(Source: Office of Jones Lang LaSalle at Taikoo Place)

Guidelines for Tenants – Building User Guide

A building user guide can provide information on:

- Green Goals

  Set clear green goals and share successful green practices in the guide, e.g., promote LED lighting and participation in recycling activities etc.

- Building Services

  This refers to provisions by the landlord, such as green services, green facilities, green programmes and building system. The landlord has to provide an operating manual for the building management system

- Waste Saving Policies

  Provide several waste recycling and reduction tips and introduce the hierarchical concept of waste management

- Monitoring and Targeting

  It is recommended to consider forming a green team and encourage participation by different parties aiming to:
  - ensure compliance with relevant legislation and target corporate social responsibility requirements
  - provide administrative support, such as evaluation forms to facilitate tenants to record energy and water performance and green practices
  - measure and record energy and water consumption for review and set target based on analysis
  - conduct waste audit periodically;
  - report relevant findings for motivating energy efficiency
- Transportation Facilities

  Reduce carbon emissions by:
  - providing information on public transport which connects the building and different districts in order to encourage use of public transport
  - providing shuttle bus for occupants
  - allowing parking spaces for bicycles and providing bicycle facilities

Guidelines for Tenants – Other General Guidelines

- Legislation and Certification Programme for Green Buildings

  Note references to green-related legislation and certification programmes:

Water Pollution Control Ordinance (Cap. 358)	Buildings Energy Efficiency Ordinance (Cap. 610)
Noise Control Ordinance (Cap. 400)	Indoor Air Quality Certification Scheme
Hazardous Chemicals Control Ordinance (Cap. 595)	Motor Vehicle Idling (Fixed Penalty) Ordinance (Cap. 611)
Ozone Layer Protection Ordinance (Cap. 403)	Air Pollution Control Ordinance (Cap. 311)
Waste Disposal Ordinance (Cap. 354)	Forests and Countryside Ordinance (Cap. 96)
Product Eco-responsibility Ordinance (Cap. 603)	Environmental Impact Assessment Ordinance (Cap. 499)
Quality Water Recognition Scheme	Water Services Department
Flushing Water Plumbing Quality Maintenance Recognition Scheme	ISO 14001 – audit of Environmental Management Systems
Environment and Conservation Fund	

Figure 4.2.12 Waste Management Principle

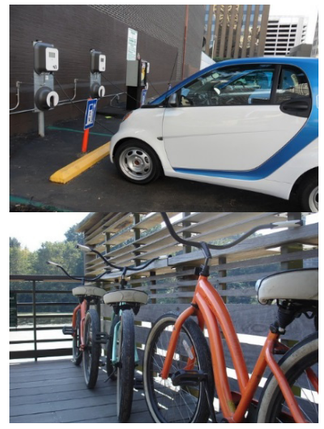


Figure 4.2.13 Electric chargers for electric vehicles and parking spaces for bicycles
(Source: Pixabay)

Benefits for Office Building and Office Unit

Both landlord and tenant will gain in the long term:

- Lower product packaging costs
- Lower delivery and transportation costs
- Green product have a longer life span
- Less trouble in disposing non-green materials
- Higher incentive to buy green products and thus contribute to creating a green environment

Green Strategies for Office Building and Office Unit

- Cooperate with green contractors to offer discounts so as to encourage tenants to use green products
- Five main steps for implementing green procurement from Green Council "Green Purchasing Best Practices Guidebook"
  - Research and formulate relevant policies
  - Set procedure and criteria
  - Communicate with parties involved, such as partner, participant, and supplier
  - Improve staff awareness
  - Monitor initiatives and review result

Collective Bargaining for Green Products

Overview

If the landlord allows tenants to join a bulk purchase scheme for green products, the culture of green procurement will be developed in office buildings. Both landlord and tenants will gain from bulk purchasing, especially through discounted product costs and reduced packaging and delivery costs.

Green products:

- Green stationery, i.e., reused pens, box files and paper
- Green office equipment, i.e., Liquid-crystal display (LCD) screen, copying machines with functions of double-sided printing, scanning and e-faxing
- Recycled furniture
- Materials with certified organic/ renewable content, low Volatile Organic Compounds (VOC), low emission of formaldehyde, no polyvinyl chloride (PVC), recyclable, low greenhouse gas emissions, non-odour, non-toxic, durable, mould resistant, self-cleaning and with easy maintenance
- Electrical appliances with energy saving labels

Note:

Procurement procedures and terms of bulk purchasing can be listed in the Green Lease if available.

Note:

"Eco-Product Directory" developed by Hong Kong Green Building Council provides an online directory of green building products and links to suppliers. Technical information and benchmarking of green products are also listed. Refer to website of Eco-Product Directory, available at http://epdir.hkgbc.org.hk/index.php.

Figure 4.2.14 Sample of an energy label and the newsletter "Energy Wits" on energy efficiency and related matters from the Electrical and Mechanical Services Department (EMSD) available at EMSD: http://www.energylabel.emsd.gov.hk/en/mainpage.html

Read more at:
1. Green Council "Green Purchasing Best Practices Guidebook", available at http://www.greencouncil.org/guidebook/guidebook.html

Benefits for Office Building and Office Unit

Performance evaluation is conducive to motivating the implementation and development of permanent green strategies among staff, tenants, business partners and investors. It allows both landlord and tenants to evaluate their progress and achievements in maintaining a green environment.

Green Strategies for Office Building and Office Unit

- A green team is generally formed for the purpose of performance evaluation. At the first stage, it has to decide its organisation and duties - promoting green concepts and maintaining effective communication to ensure the best green practices are feasibly implemented
- A green team can consist of tenant, landlord, property agent and business partner, etc.
- At the preliminary stage of implementing effective performance evaluation, development of standard documents (e.g. evaluation form and guidelines), measurements, procedures and timeframe will be required
- To understand the level of resources consumption, key performance indicators (e.g. the average amount of water used per occupant and the average amount of paper used per user) should be established
- Benchmarking (e.g. recycling, consumption of paper and water, level of emissions, etc.) is also recommended in the early stage

Performance Monitoring and Review

Overview

Below are common practices for effective performance evaluation:

- Monitor compliance with relevant legislation and target corporate social responsibility requirements
- Develop evaluation forms for entering required information, such as quantity of recycled materials and green practices
- Develop house rules for minimising renovation noise and to check compliance
- Measure and record energy and water consumption for review
- Review the recycled condition and consumption record and set targets for savings
- Review the indicators used for evaluation, such as total amount of energy input, amount of waste and amount of green product purchased through bulk green purchasing, etc.
- Report energy performance in order to motivate energy efficiency. Hold meetings with relevant parties for reporting purposes
- Analyse results of performance evaluation, publish the results and give recommendations. Keep reviewing the feasibility of introducing more green systems and facilities
- Conduct a survey targeting occupants in order to understand their needs as well as their satisfaction with air-quality, cleanliness, acoustic, thermal, lighting and other green aspects
- Commission an external audit by green professionals or arrange an inspection by experts
- Appreciate top performance and introduce a certification scheme to recognise tenants' efforts
- Conduct a waste audit periodically
- Keep reviewing objectives and achievements based on the monitoring results in order to follow up and implement continuous improvement

Note:

Main objectives of waste audit:

- to control quantity of materials being wasted
- to measure and review the effectiveness of the existing waste management system
- to identify opportunities for improvement

Note:

For details of waste audit, please refer to "Waste Audit Users Manual – A Comprehensive Guide to the Waste Audit Process" (Apr 1996) written by Fenco MacLaren Inc. and Angus Environmental Inc. of Canada, available at http://www.ccme.ca/files/Resources/waste/packaging/pn_1210_e.pdf.

CASE STUDY FACT SHEET

Hysan Place

- Water Saving: Rainwater harvesting system
- Natural Daylight: Low-E glass reflects much of the infrared portion of the solar spectrum while transmitting most of the light
- Glare Control: Installation of sheer screen and black-out screen at lower and upper part of curtain wall units allows flexible use of drapes in different daylight conditions for occupants' comfort
- Natural Ventilation: Urban window, operable vent
- Outdoor Greenery: Sky gardens, green roof and wall
- Indoor Greenery: Internal courtyard with green wall
- Energy Efficiency: Mixed mode ventilation, hybrid cooling, solar shading and low-E double-glazing
- Thermal Comfort: Mixed mode ventilation
- Indoor Air Quality: Low emitting & Low Volatile Organic Compound (VOC) materials
- Use of Green Building Materials: FSC certified wood, high recycled content, regional materials, low emitting and Volatile Organic Compound (VOC) materials
- Convenient Public Transportation: Connection to the public transportation network and is directly linked to the MTRC's Causeway Bay Station. The connection to the MTR occurs at the first two basement levels. Accessing the tower shuttle lifts at the entrance is obvious
- Green Operation and Management: Facilitation of tenants wishing to pursue green building goals
- Construction Noise and Pollution Control: Recycling of the excavation materials
- Facing Hennessy Road instead of heavily illuminated billboards lessens the light pollution in Causeway Bay

Figure 5.1 Hysan Place
(Source: Hysan Development Limited)

H Queen's

Natural Daylight:

- Laminated Insulated Glass Unit (IGU) façade system with low-e coating on low-iron glass substrate and two layers of translucent ceramic fritted pattern

Natural Ventilation:

- Use of wind guide
- Curtain wall façade with slide-open modules at each floor is designed to enhance cross ventilation in interior spaces

Outdoor Greenery:

- Vertical green wall

Energy Efficiency:

- Heat recovery ventilator
- Hybrid ventilation
- Intelligent fan coil unit (iFCUs)
- Chiller optimisation
- Shorten air duct routing

Green Operation and Management:

Food waste processor will be installed in the refuse storage and materials recovery chamber to degrade the food waste; maximise the efficiency of waste management and minimise the landfill loading.

Figure 5.2 H Queen's
(Source: Henderson Land Development Company Limited)

18 King Wah Road

Water Saving:
- Reduction in demand
- Water recycling
- Leakage detection

Lighting:
- Light shelf shading devices
- Energy efficient lighting for interior
- Sensors

Energy Efficiency (HVAC):
- High performance cooling towers
- Photovoltaic panels
- Solar thermal system
- Solar responsive façade with high performance glazing
- Active chilled beams
- Bio-mechanical louvers
- Extra high cop chillers

Indoor Environmental Quality:
- Integrated solar desiccant system
- Hybrid ventilation with operable windows
- Low Volatile Organic Compound (VOC) and photo-catalytic wall surfaces
- Multiple air filtrations safeguard health

Outdoor Greenery:
- 3D greenery

Green Operation and Management:
- Interactive platform for occupants
- Separation at source and recycling of waste
- Real-time display for knowledge sharing and education
- Weather system
- Integrated Building Management System (IBMS)
- Electric vehicle charging stations
- Construction waste reduction

Construction waste management
- Minimise environmental pollution during construction
- Measures against water pollution
- Excavation waste recycling

Use of Green Building Material:
- Pre-fabricated modules
- Regional Material
- 100% FSC certified wood

Consideration of impact on the neighbourhood:
- Create healthy and comfortable environment for the community
- Building massing and height for minimal impact
- Walkable communities linked

Figure 5.3 18 King Wah Road
(Source: Henderson Land Development Company Limited)

International Commerce Centre

Building Qualities:
- Lighting system
- Electrical system
- Lift and escalator system
- Air-conditioning system

Indoor Environmental Qualities:
- Indoor air quality (IAQ)
- Water quality
- Our regular works
- Noise control
- Views
- Smoke-free environment
- Outdoor environment
- Lobby areas
- Office floors
- Green purchasing policy
- For floors under fitting out

Energy Management System:
- Application of ISO 50001 energy management system
- MVAC System (1st Energy Source)
- Electrical lighting system (2nd Energy Source)
- Lift and escalator system (3rd Energy Source)

Waste Separation Programme-Green Motivations to Tenants:
- Coffee grounds
- Experimental farm
- "Say No to Disposable Utensils"
- Green messages to tenants

"Give and Take" with Community:
- Coffee grounds
- Food waste
- Utilisation of decomposed fertiliser
- Plastic bottles
- Festive food
- Unwanted clothes, books and computers
- In-house compactor for non-recyclables
- Green Practices in Management Services Office

Figure 5.4 International Commerce Centre
(Source: ICC Management Office)

Hong Kong Green Building Council Office

Water Saving:
- Ensure water quality
- Use water saving outlet

Lighting:
- Replace fluorescent light with LED
- Use reflectors with high reflectance
- Photo sensors and motion sensors
- Solar control film
- Reflective roller blinds

Energy Efficiency:
- Brushless DC Electric (BLDC) motor fan coil unit (FCU) with Variable Air Volume (VAV) algorithm controller
- Electronic thermostat
- Energy efficient appliances

Indoor Air Quality:
- Air purifiers
- Printer room exhaust
- Louvered wall to facilitate air flow

Use of Green Building Materials:
- Use of rapidly renewable materials
- Use of FSC certified wood
- Use of low Volatile Organic Compound (VOC) paint and adhesives
- Use materials with high recycled content
- Reusing waste materials

Construction Pollution Control:
- HVAC system protection
- Source control
- Pathway interruption
- House keeping
- Scheduling

Green Operation and Management:
- Promote the use of hard disks instead of printing
- Electronic project platform

Figure 5.5 Hong Kong Green Building Council Office
(Source: Hong Kong Green Building Council)

Jones Lang LaSalle Pacific Place Office

Lighting Control:
- Daylight responsive controls and occupancy sensors

Daylight and Glare Control:
- Installation of reflective sheets and air curtains with flexible use of drapes

Energy Efficiency:
- Offices and specialty occupancies (conference rooms and kitchen, etc.) have active controls capable of sensing space use and modulating HVAC system in response to space demand
- Purchase of green power

Office Equipment:
- Use of a high percentage of ENERGYSTAR rated equipment

Water Saving:
- Use of water efficient fittings

Green Operation and Management:
- An independent commissioning authority has been appointed for enhanced commissioning
- The project installed sub-metering equipment to measure and record energy uses within the office

Thermal Comfort:
- Carbon dioxide sensors installed to control amount of fresh air

Indoor Air Quality:
- Low emission and Volatile Organic Compound (VOC) materials

Use of Green Building Materials:
- Low Volatile Organic Compound (VOC), non-toxic, high recycled content, recyclable, durable, high mould resistant, manufactured locally

Construction Control:
- Apart from the original packaging, the stored on-site materials were placed in a specific storage area with additional plastic covers to isolate any impact on/ from the surrounding work area
- The installed materials such as carpet and wall fabric were covered with plastic sheeting and sealed during the construction period

Figure 5.6 Jones Lang LaSalle Pacific Place Office

Business Environment Council Office

Lighting Control:

- Replacement of T8 fluorescent tubes with LED lighting panels
- Energy saving lighting designs
- Motion sensors / daylight sensors
- Manual dimming control
- Light zoning
- Power analyser/ sub-metering

Energy Efficiency:

- Installation of oil-free variable speed air-cooled chillers
- Introduction of smart metering for electrical systems

Green Operation and Management:

- Green Office Team
- Energy saving reminders
- Lighting zones map
- Lights off during lunch hour
- Stair Monday and Friday
- Invite tenants to participate
- Install a weather system and integrate with building management system to optimise energy consumption

Promotion of Energy Saving:

- Seminars for professionals
- Building tours
- Business Environment Council Institute of Environmental Education School Programme
- Green lease
- Building Management System (BMS) upgrade

Beneficial Outcomes:

- Improved energy performance
- Reduce fresh water consumption by 10%
- Implemented Green Lease with Business Environment Council tenants
- A showcase for upgrading an existing commercial building to BEAM Plus Platinum Rating
- Achieved Good Class in indoor air quality certification
- Compared to 2013, the overall energy tariffs (including electricity tariffs and fuel charges) in 2014 decreased by 14.35% on average

Figure 5.7 Business Environment Council
(Source: Business Environment Council)

Conservation International Hong Kong: Green Sky

- Water Saving: Use of low flow water aerators on faucets
- Natural Daylight: Use of glass partition wall to allow sunlight in
- Natural Ventilation: Operable window
- Indoor Greenery
- Indoor Air Quality: Use of eco-friendly paint and adhesives, and zero ozone-depleting substances during construction
- Use of Green Building Materials: The "green" carpet contributes to cleaner seas and income for fishermen
- 100% of the loose office furniture is second-hand, purchased at only 60% of the cost of new furniture
- Convenient Public Transportation: Connects to the public transportation network
- Operation Waste Reduction
- Water filters installed on taps avoid the need for plastic bottled water

Beneficial Outcomes

- The average monthly electricity bill for lighting, appliances and electronics is only HK$449
- 87% of Green Sky can be easily relocated to a future office space
- 100% of the loose office furniture is second-hand, purchased at only 60% of the cost of new furniture
- An estimated annual water saving of 60% is achieved through the use of low flow water aerators on the faucet
- The office's green features create educational opportunities for sharing with the NGO's visitors.

Figure 5.8 Green Sky
(Source: Conservation International Hong Kong)

The Good Lab

Carbon Care Label 2014- by Carbon Care Asia, issued on 21 October 2014 (Certificate No. CCL-20014-1-02-124).

United Nations Millennium Development Goals Green Office Award Labelling Scheme 2014-15- by World Green Organisation.

- Unused lights and air-con switched off during opening hours
- Many green plants are grown in different corners by members
- Inno Friday seminars held by Carbon Care Asia at Good Lab from time to time
- Partner of Hong Kong Green Building Week for Hackathon and Ideas Pitch programme since 2014

Figure 5.9 The Good Lab
(Source: The Good Lab)

blueprint

blueprint is a multifaceted startup initiative and tech community initiated by SPL. It was launched in January 2015 in Cornwall House at Taikoo Place.

Office Space Design:

- A flexible space with minimal environmental impact
- Open space design
- Utilises upcycled materials

Energy Efficiency:

- Implements advanced lighting and climate controls that respond to occupancy levels in each zone of the space
- Monitors usage and makes modifications as necessary to achieve maximum efficiency

Landlord Support:

- Each startup enjoys six months' free office space
- Mentorship support from top executives and entrepreneurs which can benefit the startups' business development

Figure 5.10 blueprint
(Source: Swire Properties Limited)

Swire Properties Limited

Awards:

- Taikoo Place and Cityplaza: Grand Award under the "Existing Building" category of the Green Building Award 2014
- Swire Properties Limited: Grand Award under the "Green Building Leadership" category of Green Building Award 2016

Energy Efficiency:

- Established extensive data management system
- Target to reduce 64m kWh in Swire's 2020 Energy Reduction Pledge

Waste Management:

- Development of a robust waste management framework with data being collected for over 20 types of waste at present

Green Management:

- Implemented various stakeholder programmes to engage the collaboration of staff, partners and the community
- Offer a wide range of recreational and cultural events for the local community
- Organise or sponsor more than 70 arts and cultural events, educational and environmental activities and volunteer initiatives
- Over 1,300 of the Company's volunteers, the Community Ambassadors, devoted more than 5,500 hours volunteering across a wide range of different programmes

Figure 5.11 Swire Properties Limited Office
(Source: Swire Properties Limited)

Hong Kong Science and Technology Park Phase 3

Selected Green Features:

- Hybrid/natural ventilation to lobbies and R&D offices
- Daylight/occupancy sensors, daylight factors 7%
- High efficiency LED lighting
- High performance low-E double glazing
- CO2 demand controlled ventilation
- Heat recovery and air-side free cooling
- High efficiency district cooling system (DCS)
- Absorption chiller via solar hot water heating
- Phase change material (PCM) thermal storage
- Tenant sub-meters and data sharing (green lease)
- "Pay-per-use" direct billing for air conditioning
- EV charging and cycling facilities
- Roof-mounted PV panels
- Hybrid solar / wind power street lighting
- 1,100m^3 rainwater collection & recycling
- Food waste collection & recycling
- Integrated chilled beams (central facilities management office)
- Centralised Automatic Refuse Collection System
- "Green Pad" organic farming and "Green Trail"

Awards:

- BEAM Plus Platinum Ratings (including the highest scoring project as at Oct 2015)
- LEED Platinum v2009 Core and Shell (Building 12W, 2014)
- Best Asian Pacific Smart City initiative (IDC, 2015)
- Sustainability Achievement of the Year 2015 (RICS-HK)
- Hong Kong Green Building Award 2014 (Grand Award– Completed New Building)
- Best Project Team of the Year 2013 (RICS-HK)
- Hong Kong Green Building Award 2012 (Grand Award– Building Project under Design)
- Hong Kong Green Building Award 2010 (Finalist – Sustainability Master Planning)

Figure 5.12 Hong Kong Science and Technology Park
(Source: Hong Kong Science and Technology Parks Corporation)

China Resources Building

Natural Daylight:

- Use of glass partition wall to allow sunlight in

Artificial Lighting:

- Integration of photo sensors to reduce electricity consumption
- Replacement of T8 to T5 in public areas

Energy Efficiency:

- Installation of highly efficient Air Handling Units (AHUs)
- Utilisation of CO_2 demand control ventilation with CO_2 sensors (also for performance review)
- Maintain sea water cooling
- Upgrade of lifts and escalators to reduce energy consumption

Ventilation:

- Improvement of carpark ventilation by introducing jet fan system
- Improvement of natural ventilation

Use of Green Building Materials:

- Use of low-e glass
- Use of long life cycle LED with limited coverage
- Semi-unitised curtain wall system with pressure equalised system and drain gutter for easy maintenance and higher flexibility in construction sequence

Construction Waste Reduction:

- Use of existing structure instead of rebuilding
- Reduction of waste: 97% of the existing envelope was retained
- Reduction of carbon emissions
- Recycling and reuse of construction waste

Construction Noise and Pollution Control:

- Use of tower working platform
- Existing windows were maintained during installation of new façade to reduce air and noise pollution in the indoor environment
- Use of low noise demolition methods
- Construction works were divided into different phases

Consideration of impact on the neighbourhood:

- Extended public passage in a weather-controlled environment
- More access for disabled
- Improved elevator zoning
- Better planning of the building fringe

Green Operation and Management:

- Incentive programmes for tenants, e.g. early bird award to avoid high traffic time and allow longer construction work time
- Arrangements for business centre in case of noise disturbance

Tenants Involvement:

- Seminars to explain construction methods and sequence of works and to gather opinions from tenant
- Meetings with neighbourhood and DLO for understanding

Figure 5.13 China Resources Building
(Source: China Resources Property Limited)

Wholesale Conversion of Industrial Building @ Wong Chuk Hang into GENESIS

Under an initiative of the Hong Kong Development Bureau to facilitate wholesale conversion of industrial buildings, the project aims to revitalise an abandoned industrial building into a contemporary artists' vertical village in Hong Kong Island South. Consisting of 22 floors, the project was planned to be completed by June 2014, marking a new chapter in adaptive re-use of architecture in Hong Kong.

With support from the Hong Kong Arts Development Council, the 12th Floor of the GENESIS is dedicated to offering low rent studios to artists and designers to promote the development of local art and culture.

Figure 5.14 The Genesis
(Source: Barrie Ho Architecture Interiors Ltd)

Energizing Kowloon East Office

Artificial Lighting:

- T5 fluorescent tubes integrated with task lights effectively reduce the lighting power density (LPD)
- Daylight and motion sensors were installed to further save lighting energy consumption when the lighting is not required

Energy Efficiency:

- Variable refrigerant volume (VRV) air conditioners were installed which give energy efficiencies (above 3.8) much higher than room air conditioners / split units (usually below 3.0)

Water Management:

- Low-flow taps were installed at the toilets and pantry
- Rainwater is harvested for irrigation of the landscaped areas

Indoor Environmental Quality:

- Independent exhausts are also provided for photocopiers to remove the particulates at source
- Indoor air quality meets the Good Class of the IAQ Certification Scheme
- The building is set back from the street boundary by about 15m to minimise traffic noise impact from the abutting road

Ventilation:

- Ventilation system designed to provide higher outdoor air ventilation rates than the minimum requirements by ASHRAE 62.1-2007 (ASHRAE, 2007) and to facilitate dilution of indoor air pollutants

Construction Waste Reduction:

- Extensive use of prefabricated building components such as the freight containers and mild steel framing structures help minimise construction waste
- Most of the construction waste including wood, rebar and concrete were reused or recycled

Construction Noise and Pollution Control:

- Off-site fabrication
- Reduction of inter-phasing

Site Specific design for land saving:

- Revitalising a piece of unattractive land on a site under the Kwun Tong Bypass

Figure 5.15 Energizing Kowloon East Office
(Source: Energizing Kowloon East Office)

Zero Carbon Building

Building Performance Monitoring Systems and Devices:

- Intelligent Building Management System (BMS)
- Building Environmental Performance Assessment Dashboard (BEPAD)

Material Aspects:

- Modular, prefabricated office furniture system
- Green raised floor system
- Rapidly renewable materials

Energy Use:

- High temperature cooling system
- High-volume-low-speed ceiling (HVLS) fans
- Desiccant dehumidification
- Wind catchers
- Cross-ventilated layout
- Optimised window to wall ratio (WWR)
- High performance glass wall system
- Intelligent lighting management
- Task lighting
- Light pipe

Renewable Energy Use:

- Polycrystalline/ building integrated photovoltaic (PV)
- Bio-diesel tri-generation (Comprising bio-diesel generator, adsorption chiller and desiccant dehumidification)

Water Use:

- Grey and black water recycling
- Waterless urinal
- Low-flow sanitary ware

Indoor Environmental Quality:

- Room design for daylighting
- Green carpet
- Zero Volatile Organic Compound (VOC) sealer and paint
- Suspended acoustic baffle
- Enhanced security

Figure 5.16 Zero Carbon Building
(Source: Construction Industry Council)

Office of Dennis Lau & Ng Chun Man Architects & Engineers (HK) Ltd

Water Saving:

- Automatic sensor tap
- Water saving reminder
- Dual flush toilet

Lighting:

- Full height window
- Blinds for glare control
- Glass partition wall to maximise light entry
- Light off during lunch hour
- Light zoning for overtime work

Indoor Greenery:

- Potted plants throughout the office

Energy Efficiency:

- Energy saving reminders

Indoor Environmental Quality:

- Separation of printer and server rooms
- Access to exterior view

Material Conservation:

- Promote paper-less office
- Set printers at 2-side printing
- Use recycled paper whenever possible
- FSC printing paper

Health and Well-being

- Family-friendly policy: paternity leave
- Nursery room
- Promote healthy lifestyle– sports team
- Promote healthy lifestyle by connecting two storeys with stairs

Beneficial Outcomes

- Workers' productivity is increased
- Reduce expenditure on materials
- Better indoor air quality can reduce the chance of sickness
- Use of automatic sensor taps has reduced water use

Figure 5.17 Dennis Lau & Ng Chun Man Architects & Engineers Office

Office of Ronald Lu & Partners (Hong Kong) Ltd

Lighting:

- Regular bulbs replaced with LED bulbs, which use on average 80% less energy and last longer than regular bulbs
- Alert staff to switch off all lighting and electronic devices before leaving office
- Switch off all lightings during lunch time

Indoor Greenery:

- Living green wall

Energy Efficiency:

- Monthly energy consumption reports
- Set energy saving mode to all computers and copiers
- Installed silver screen roller blind to reduce indoor temperature
- Regulated office temperature to save energy

Material Conservation:

- Promote paper-less office
- Set printers at 2-side printing
- Use recycled paper whenever possible
- Changed to electronic salary pay-slip in 2010
- Metering of photocopiers since 2007

Use of Green Building Materials:

- 98% LED lighting in public spaces
- 100% LCD monitors
- 100% FSC printing paper
- All walls painted with non-VOC paints
- Low Volatile Organic Compound (VOC) carpets
- Cloud computing

Health and Well-being:

- Improved room acoustics
- Improved IAQ / purified air
- Promote greener life-style: Biz-green Monday and photo contest
- Family-friendly policy: family care leave, special work arrangement for pregnant staff and marriage leave

Figure 5.18 Green Wall of Ronald Lu & Partners (Hong Kong) Ltd's Office
(Source: Ronald Lu & Partners)

GLOSSARY

Item	Term	Definition
1	Air-handling unit (AHU)	Air-handling unit consists of a fan or fans and coils for cooling, dehumidification, heating and filtration used for space air-conditioning.
2	BEAM Professional (BEAM Pro)	Also known as “BEAM Pro”, a green building professional accredited by the Hong Kong Green Building Council in the various aspects of the green building life cycle. One key role of a BEAM Pro is to integrate the latest green building standards and practices into everyday building planning, design, construction and operation.
3	BIM	Building Information Modelling (BIM) is a process involving the generation and management of digital representations of physical and functional characteristics of places.
4	BIPV panel	Building-integrated photovoltaic panel is a photovoltaic panel that has been integrated into the design of the building or structure.
5	Carbon footprint	A form of carbon calculation that measures the amount of carbon dioxide equivalent that a country, a business, industry or an individual is responsible for.
6	Direct digital control	Direct digital control or DDC is the automated control of a condition or process by a digital device.
7	Double glazing window	Insulated glazing (IG), more commonly known as double glazing (or double-pane, and increasingly triple glazing/pane) are double or triple glass window panes separated by an air or other gas filled space to reduce heat transfer across a part of the building envelope.
8	Energy audit	Energy audit is an effective energy management tool for examination of an energy system to ensure that energy is being used efficiently. By identifying and implementing improvements identified in an energy audit, it is not only possible to achieve savings on energy bills, but also extend the life of the equipment under efficient operation. An energy audit has to be conducted by a competent person having adequate technical knowledge of building services installations. The energy auditor examines the energy account of an energy system, checks the way energy is used by its various components, checks for areas of inefficiency or where less energy can be used, and identifies the means for improvement.
9	Fan coil unit	Fan coil unit consists of a small fan or fans and a coil for cooling, dehumidification, heating and filtration used for space air-conditioning.
10	Formaldehyde	Formaldehyde is a type of indoor pollutant and is an organic compound with the formula CH_2O or HCHO. It is a type of volatile organic compound which is often present in building materials, adhesives, fabrics, carpets, etc. Formaldehyde is a suspected human carcinogen.
11	FSC certified wood	FSC-certified wood is wood that is certified under the standards set by FSC or the Forest Stewardship Council. FSC-certification is given to companies and landowners to verify that they practice forestry that is consistent with FSC standards. The FSC label on wood or paper products guarantees that consumers can trust the sources.
12	Grey water	Grey water is water with a quality between fresh water and sewage water. In a building, grey water is the water leftover from baths, showers, hand basins, kitchen sinks, floor drains, etc.
13	Life cycle cost	Economic cost of a product or building over its expected life, including initial cost, operating cost and, when appropriate, cost of disposal or demolition.
14	Illuminance (lux) level	The amount of luminous flux falling on the surface of a unit area, measured in units of lux or lumen/m^2.
15	Independent commissioning authority	The individual designated to organise, lead and review the completion of commissioning process activities, and who facilitates communication between the owner, designer and contractor to ensure that complex systems are installed and function properly.
16	Integrated heat pump	A heat pump that simultaneously can provide heating, hot water, and air-conditioning within only one system.
17	ISO standard	The International Organisation for Standardisation, known as ISO, is an international standard-setting body composed of representatives from various national standards organisations.
18	Light shelf	A light shelf is a horizontal surface that reflects daylight deep into a building. Light shelves are placed above eye-level and have high-reflectance upper surfaces, which reflect daylight onto the ceiling and deeper into the space.
19	Low emissivity (low-e) glass product	Low emissivity (low e or low thermal emissivity) glass products are characterised by a glass surface condition that emits low levels of radiant thermal (heat) energy.
20	Municipal solid waste	Solid waste produced by domestic, commercial and industrial sources.
21	Prevailing wind	Prevailing wind is wind that blows predominantly from a single general direction over a particular point on the building.
22	PVC content	Polyvinyl chloride, commonly abbreviated PVC, is the third-most widely produced plastic, after polyethylene and polypropylene. PVC is used in construction because it is more effective than traditional materials such as copper, iron or wood in piping and profile applications. It can be made softer and more flexible by the addition of plasticisers, the most widely used being phthalates. It emits gases and is potentially harmful to humans, and can cause irritating respiratory illnesses such as asthma.
23	Quality assurance	Quality assurance (QA) refers to the engineering activities implemented in a quality system so that requirements for a building or a space will be fulfilled.
24	Quality control	Quality control, or QC for short, is a process by which entities review the quality of all factors involved in construction and operation of a building.
25	Reverberation time	(1) Pressure level in the enclosure to decrease by 60 dB after the source has stopped. (2) The time in seconds given by T60 = 60 dB/R, where R is the rate of decay of sound in the room expressed in decibels per sound.
26	T5 fluorescent tube	T5 fluorescent tube is 16mm (5/8”) in diameter and has a higher lumens-per-watt efficiency than T8 or T12 fluorescent tubes of about the same power.
27	Vinyl	Vinyl is a plastic made from polyvinyl chloride (PVC). It emits gases and is potentially harmful to humans, and can cause irritating respiratory illnesses such as asthma.
28	Volatile Organic Compound (VOC)	Volatile Organic Compounds (VOCs) are a diverse group of organic compounds that evaporate at room temperature. In a typical indoor environment, there are more than 100 compounds that can be classified as VOCs being emitted from sources such as building materials, cleaning agents, cosmetics, waxes, carpets, furnishings, laser printers, photocopiers, adhesives, paints and lacquers. Certain VOCs at high levels are toxic and have adverse effects on the central nervous system, liver, kidney and blood of human bodies. Hypersensitive individuals can have severe reactions to a variety of VOCs at very low concentrations. Exposure to compounds such as benzene for long periods may also increase the risk of cancer. It is desirable to reduce exposure to VOCs, as the toxicological and sensory effects of VOCs are not completely known.
29	VOC products	Products containing VOCs can release these chemicals when they are being used and when they are stored. An odour may be noticed when using these products. Product labels often list VOC ingredients and recommend that they should be used in well ventilated areas. Ventilation means bringing in fresh, outdoor air to mix with indoor air.
30	Waste management plan	A plan that lists the work processes or activities that will generate waste construction and demolition materials during the course of the work and describes the measures to reduce/ minimise that waste.
31	Water-cooled chiller	Water-cooled chiller is equipment that includes an evaporator, compressor, condenser and regulator control, and which serves to supply chilled water. The heat absorbed by the refrigerant in the chiller is expelled into the outdoor environment by evaporation through cooling towers, or by seawater discharge to the sea.

GLOSSARY

Consultant team of the Hong Kong Green Office Guide

The following consultant team was engaged by Hong Kong Green Building Council to develop the Hong Kong Green Office Guide:

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Environmental and BEAM consultant:

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Facility and asset management consultant:

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China Resources Property Limited	1.3, 3.1.8, 3.1.43, 3.1.44, 3.1.53, 3.1.54, 3.1.55
Conservation International Hong Kong	3.1.36, 3.1.46, 3.1.47, 3.2.18, 3.2.42, 4.1.25
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China Resources Property Management Limited

Citybase Property Management Limited

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