

GUIDE TO LOW CARBON OFFICES

Practical Guide on
Carbon Audit and Management



Consultant :

HKPC[®]

About this Guide

» Climate change posed an unprecedented global challenge for everyone. **Hong Kong is committed** to contributing to the solution by taking community-wide actions to reduce greenhouse gases (GHG) emissions.

Carbon audit is an effective process to understand and measure our carbon footprint and a first step to identify appropriate carbon reduction measures.

This guide introduces the know-how of carbon audit and sets out the major steps of conducting a basic carbon audit for office-based operations.

A wide range of measures are also illustrated to facilitate office managers to reduce carbon emissions and to save operation cost.



Read on if you want to:

- cut your energy bills;
- improve your working place;
- meet your stakeholders' expectation; and
- contribute to the environment.

Background

The Paris Agreement adopted in the 21st session of the Conference of Parties to the United Nations Framework Convention on Climate Change is a crucial step in forging global efforts in combating climate change. 195 countries have agreed to strive for the common goal of holding the increase in the global average temperature to well below 2 degrees Celsius above pre-industrial levels. Countries should also strive to achieve carbon neutrality (i.e. no net carbon emissions to the atmosphere) by the second half of this century. With the positive outcome of the Paris Agreement, Hong Kong must ready itself for making greater efforts to combat climate change and reduce our carbon emissions.

Conducting carbon audit is a common first step of action. It helps assess the carbon performance and identify room for emission reduction in an organization. It is a cornerstone for saving energy as well as taking forward other low carbon and green measures.



This series of Practical Guides on Carbon Audit and Management outlines how an organisation can measure and manage its carbon footprint, and provide practical guides and examples for reference by the carbon audit practitioners and also the users of buildings and facilities. With content tailor-made for nine different types of premises and facilities, including offices, schools, swimming pools, community halls, etc, these Guidebooks would stimulate the collaboration across different sectors to drive Hong Kong's low carbon transformation.

The more that we are aware of our impact, the more prepared we can contribute to combating climate change. The Environment Bureau will continue to facilitate the public and private sectors to work together and to close the gap between awareness and action to build a low-carbon economy and a greener future for Hong Kong.

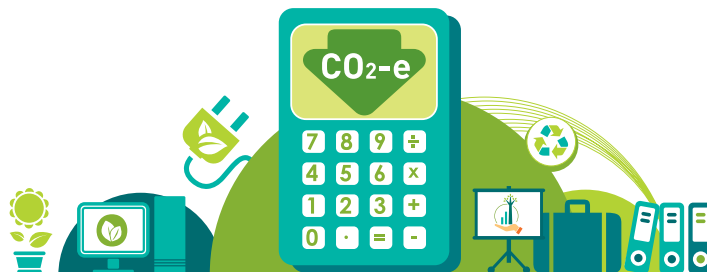
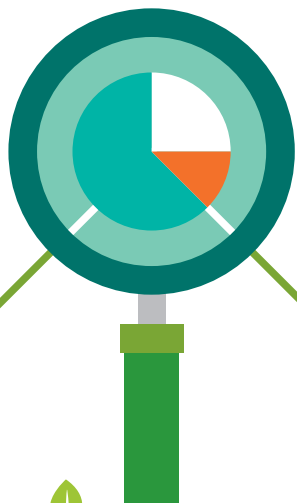


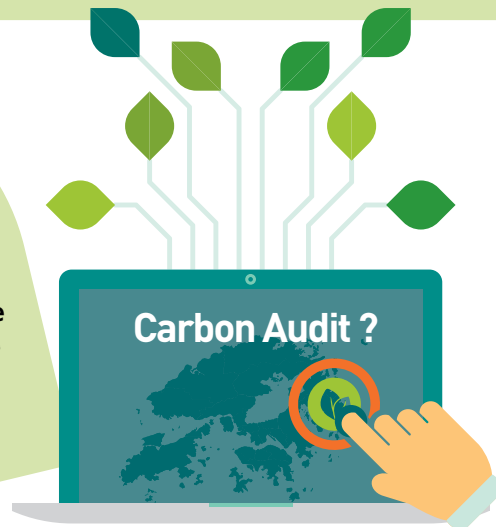
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Introduction

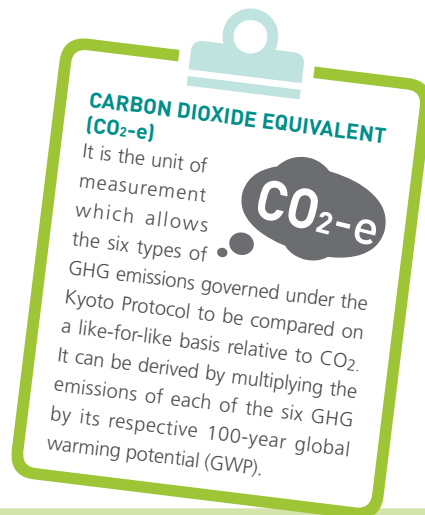
In this chapter we explain what **carbon audit** is and the benefits of doing so for office managers



What is Carbon Audit?

Excessive greenhouse gas (GHG) emissions cause climate change. This poses the largest threat ever to humankind worldwide. Governments and businesses around the world carry out a wide array of initiatives to reduce GHG emissions to combat climate change. These include advancing the use of renewable and cleaner energy sources, improving energy efficiency and encouraging better energy and carbon management

Carbon footprint refers to the total GHG emissions caused directly and indirectly by an organisation's activities. Carbon audit is a scientific means of quantifying an organisation's GHG emissions and a useful starting point for carbon management and reduction.

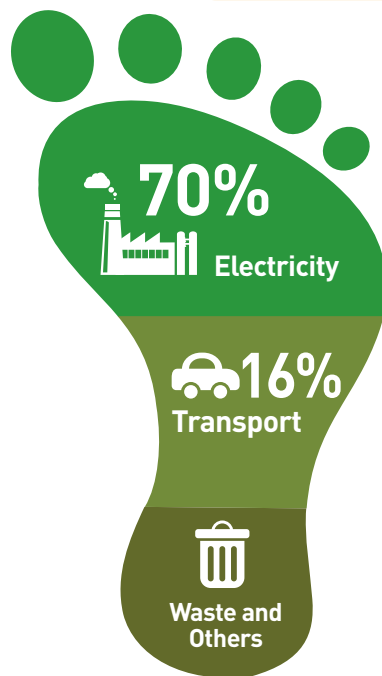


Carbon Audit in Hong Kong

Hong Kong is a service economy with limited energy-intensive manufacturing. Nearly 70% of Hong Kong's GHG emissions are attributed to electricity generation. Transport sector comes next (~16%) and waste constitutes ~5% of total emissions.

Buildings, including commercial buildings, account for nearly 90% of electricity consumption. If all offices pursue better electricity consumption management and improve energy efficiency, this will not only cut their energy costs, but also significantly reduce Hong Kong's overall carbon emissions.

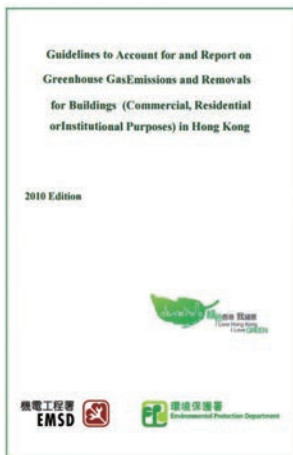
HK's GHG Emissions by Sector in 2014*



- HK's Total GHG Emissions in 2014:
44,900 kilotonnes CO₂-e
- HK's Emissions per Capita in 2014:



* Provisional figures subject to revision



The Environmental Protection Department (EPD) and the Electrical and Mechanical Services Department (EMSD) have devised a set of Carbon Audit Guidelines to facilitate office managers to calculate the GHG emissions from the operation and to identify areas of improvement.

Read the Guidelines at :

<https://www.climate-ready.gov.hk/page.php?id=56&lang=1>

To lead by example, the Government has:

- Rolled out energy-cum-carbon audits for more than 120 Government buildings and public facilities;
- Encouraged major Government buildings to carry out regular carbon audit to track the effectiveness of carbon reduction efforts;
- Conducted a “paper approach” carbon audit exercise for more than 40 major Government buildings in 2016/17; and
- Launched the Carbon Footprint Repository (CFR) (www.carbon-footprint.hk/) on 15 December 2014 for listed companies to disclose their carbon footprint. At the launching ceremony co-organised by the Environment Bureau and the Hong Kong Exchanges and Clearing Limited (HKEx) in Dec 2014, certificates were presented to listed companies in recognition of their first-mover contributions and efforts in auditing their carbon footprints and disclosing their carbon data through the CFR.



Reduce Operational Cost



Improve Organisation's Image



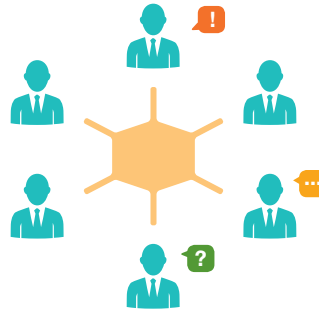
Demonstrate Corporate Responsibilities



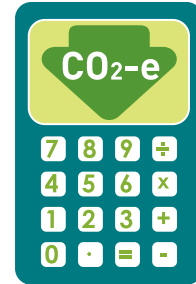
Managing And Reducing Your Carbon Footprint Can Bring About Many Advantages



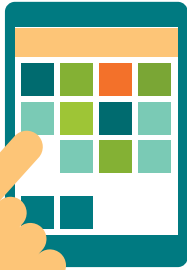
Staff Engagement



Meet Stakeholders' Expectation



Support Government's Reduction Target



What is Carbon Audit

In this chapter we explain the major steps of conducting a carbon audit and the data needs to be collected by the office manager for calculation

The major steps in conducting a carbon audit:



STEP I. Define Physical and Operational Boundaries

An important first step is to set clear and explicit physical and operational boundaries of your office that is included in the carbon audit

PHYSICAL BOUNDARY

Physical boundary refers to the physical area occupied by the organisation which usually matches the site boundaries of the office premises concerned.

OPERATIONAL BOUNDARY

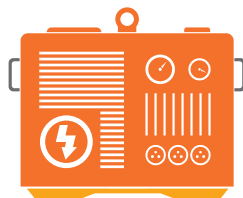
Operational boundary refers to the scope of emissions from activities under your office's operational control. There are 3 scopes (Scope 1, 2 and 3) in accordance with the Guidelines.

STEP II. Identify Emission Sources

SCOPE 1: DIRECT EMISSIONS AND REMOVALS



Stationary source combustion:
e.g. Towngas heaters



Stationary source combustion:
e.g. Emergency electricity generators



Fugitive emissions from air
conditioning/refrigeration
systems/fire extinguishers



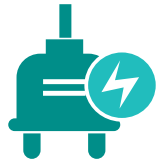
Newly planted trees that are able
to reach at least 5 metres in height
(*Removal Source)



Mobile source combustion:
e.g. Organisation's vehicles

* Based on the emission factor set out in the Guidelines to Account for and Report on Greenhouse Gas Emissions and Removals for Buildings (Commercial, Residential or Institutional Purposes) in Hong Kong published by the Environmental Protection Department in February 2010 (the Carbon Audit Guidelines), 23kg carbon dioxide will be removed by a newly planted tree that can reach at least 5m in height per year. Newly planted trees referred to those trees planted within the physical boundary of the audited buildings/premises after the beginning stage of construction of the concerned buildings/premises. Please refer to page 20 of the Carbon Audit Guidelines for details.

SCOPE 2: ENERGY INDIRECT EMISSIONS



Electricity purchased



Town gas purchased

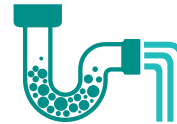
SCOPE 3: OTHER INDIRECT EMISSIONS (Optional To Include)



Paper waste disposal



Fresh water consumption



Sewage discharge



Overseas business travel



Staff travelling



Emissions from rented vehicles

GREEN TENANCY AND GREEN LEASE

The behaviour of office/building tenants has great impact on the carbon emissions. Landlords or property management companies can encourage tenants to support green initiatives through various approaches, for example:

- Adopt "Pay for use" billing of air conditioning;
- Sharing of energy use data with tenants;
- Provide incentives for tenants to support environmental practices;
- Setting of joint environmental improvement targets;
- Establish targets on the lease with tenants to achieve environmental goals collaboratively.



STEP III. Data Collection

Once the emission sources are identified, the office manager should coordinate to collect and collate the following activity data associated with these sources. Where any data is not available, estimations and assumptions would have to be made.

ACTIVITY DATA TO BE COLLECTED

SCOPE 1 : DIRECT EMISSIONS AND REMOVALS



Fuel consumption receipts/records/meter readings (e.g. Towngas, diesel oil, LPG or petrol for organisation's fleet)



Refrigerant and fire extinguisher purchase, storage and disposal records



Records of number of trees planted that are able to reach at least 5 metres in height within the physical boundary of the office

SCOPE 2 : ENERGY INDIRECT EMISSIONS



Electricity bills/meter readings



Towngas bills/meter readings

SCOPE 3 : OTHER INDIRECT EMISSIONS



Water bills



Paper purchase and recycling records



Overseas travel records/
staff transportation data

STEP IV. Apply Emission Factors for Calculation

The carbon footprint (measured in tonnes of CO₂-e) is calculated by multiplying the activity data by the respective emission factor and the global warming potential (GWP) of the respective GHG emitted:

$$\text{CO}_2\text{-e} = \text{Activity Data} \times \text{Emission Factor} \times \text{Global Warming Potential}$$


For step-by-step guidance on calculation, please refer to Appendix A: Reporting Table Templates for Carbon Emissions.

EMISSION FACTOR

A factor which identifies the per kilogram carbon dioxide equivalent (CO₂-e) arising from a particular activity.

Most of the emission factors are provided in the Carbon Audit Guidelines, or available in the latest Annual Reports/Sustainability Reports of the respective organisations.

The emission factor of electricity consumed is available from the Sustainability Reports of CLP Group¹, or The Hongkong Electric Co. Ltd², depending on where your office is located

For example, if the electricity consumption of an office located in New Territories is 10,000kWh in 2014, the emission factor of CLP in 2014 (i.e. 0.64 kgCO₂-e/kWh) should be used. [2014 GHG emission (tonnes CO₂-e): =10,000 kWh (activity data) x 0.64kgCO₂-e/kWh (emission factor) x 1 (global warming potential of CO₂) = 6.4 tonnes CO₂-e]

GLOBAL WARMING POTENTIAL

Global warming potential (GWP) is a quantified measure of the globally averaged relative radioactive forcing impacts of a particular GHG. Carbon dioxide was chosen as the reference gas and its GWP is set to 1.

The GWP of the major GHG covered in the Carbon Audit Guidelines are:

- carbon dioxide (CO₂): 1
- methane (CH₄): 21
- nitrous oxide (N₂O): 310

1. Sustainability Reports of CLP Group
<https://www.clpgroup.com/en/sustainability/sustainability-reports>

2. Sustainability Reports of The Hongkong Electric Co. Ltd.
<https://www.hkelectric.com/en/corporate-social-responsibility/sustainability-reports>

STEP V. Report and Disclose

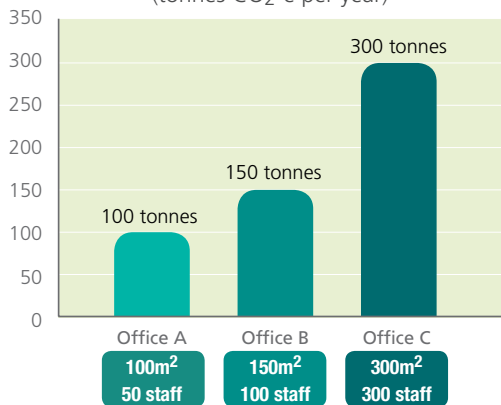
Communicating your carbon footprint helps engage your stakeholders (employees, customers and public) and improve your organisation's image.

You can use an appropriate ratio indicator to represent or benchmark your normalised carbon footprint in proportion to a

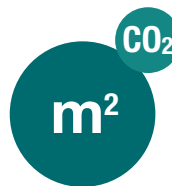
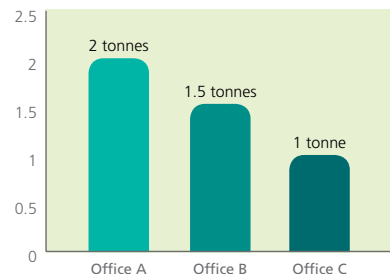
defined operational measuring unit, for example, GHG emissions per internal floor area (IFA) or GHG emissions per employee are some ratio indicators suitable for offices

For more benchmarking references, please refer to Appendix B: Performance Indicator References for Energy Consumption.

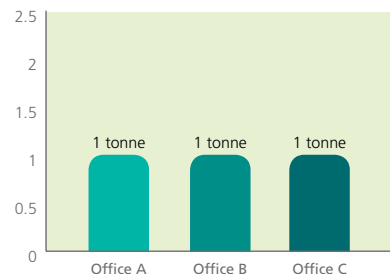
Total Carbon Emissions
(tonnes CO₂-e per year)



Normalised Total Carbon Emissions
(tonnes CO₂-e per year per employee)



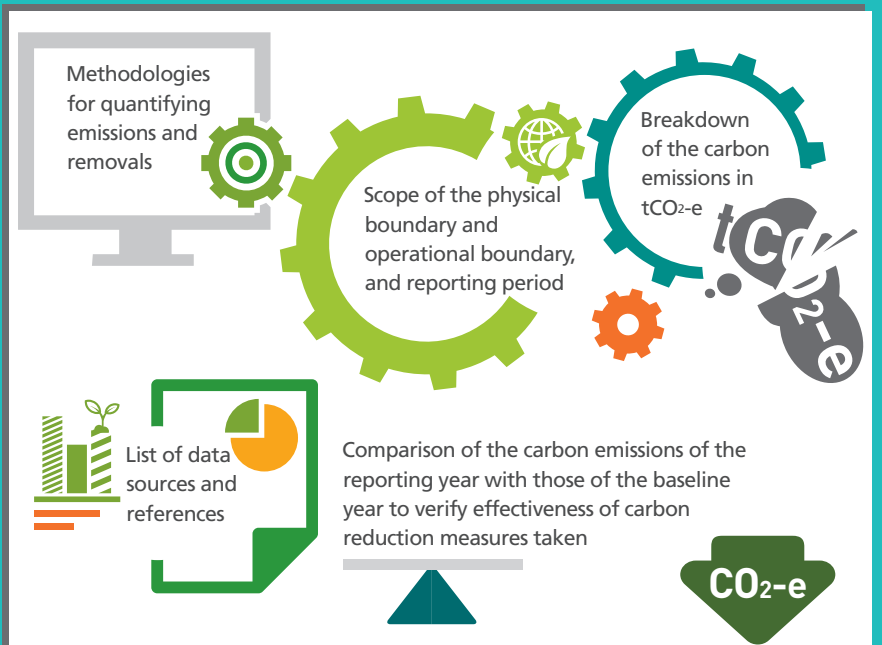
Normalised Total Carbon Emissions
(tonnes CO₂-e per year per m²)



Examples of other suitable ratio indicators for companies / offices

- tonnes CO₂-e per HK\$ revenue
- tonnes CO₂-e per HK\$ Earnings Before Interest, Tax, Depreciation and Amortisation (EBITDA)

An audit report may include the following information:



For more details please refer to Appendix C: Sample Carbon Audit Report.

SEEK INDEPENDENT VERIFICATION

You can add credibility to your audit report findings through employing a qualified 3rd party to verify whether the carbon audit process adheres to the principles of relevance, completeness, consistency, transparency and accuracy.

WAYS OF CARBON DISCLOSURE

- Communicate through annual report, sustainability report, or the Environmental, Social and Governance (ESG) report as required by HKEx
- Submit data to HKSAR Government's carbon footprint repository (applicable to listed companies)
- Submit data to international organisation such as CDP



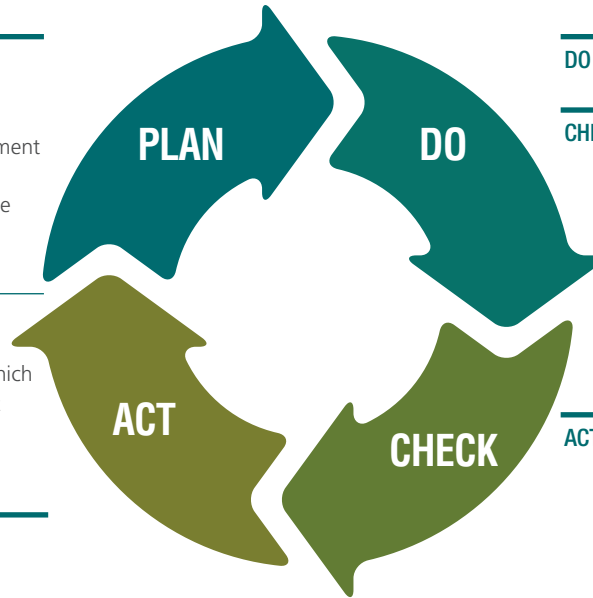


WHAT'S NEXT AFTER CARBON AUDIT? CARBON MANAGEMENT

An office needs good carbon and energy management for continual improvement in carbon reduction. The ISO (the International Organisation for Standardisation) specifies a Plan-Do-Check-Act (PDCA) management framework to incorporate carbon and energy management into daily organisation practices.

Carbon Management Framework

PLAN	STEP 1 Establishing a Carbon Management Policy <ul style="list-style-type: none">• Demonstrate the organisational commitment to carbon management• Set objectives and targets for improvement against the baseline
	STEP 2 Establishing a Carbon Reduction Plan <ul style="list-style-type: none">• A plan to achieve the targets, which may include better management practices, minor hardware retrofitting and engineering improvement works



DO	STEP 3 Implementing the Carbon Reduction Plan
CHECK	STEP 4 Conducting Regular Carbon Audit <ul style="list-style-type: none">• Systematic procedures for monitoring of carbon emissions and the effectiveness of reduction measures• Make adjustment when the organisation is not progressing well towards the objectives
ACT	STEP 5 Maintaining the Carbon Reduction Plan <ul style="list-style-type: none">• Audit findings should be reviewed by management to ensure the measures are adequate and effective for continual improvement• Communicate reduction success with stakeholders

Checklist for Conducting Carbon Audit



The owner and/or operator can complete this checklist to gauge the readiness of a particular premises/building/facility for conducting carbon audit.



Yes / No / Not Applicable

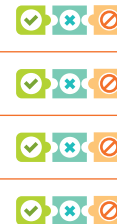
FACILITIES INFORMATION (ESSENTIAL INFORMATION)

- 1 Is the following information/data available?
 - a) Gross Floor Area, m²
 - b) No. of occupants
 - c) Facility layout plan or floor plan to show owned/controllable indoor, outdoor and communal area



SCOPE 1: DIRECT EMISSIONS AND REMOVALS

- 2 If there is any machine or equipment in the premises operated by fuel, is there any record of the type and amount of fuel consumed by these machines or equipment for the last 12 months?
- 3 If there is any vehicle or vessel associated with the operation of the premises, is there any record of the type and amount of fuel consumed by these vehicles/vessels for the last 12 months?
- 4 Any record of type (i.e. HFC/PFC) and amount of refrigerants consumed by the air-conditioning/refrigeration equipment in the premises for the last 12 months?
- 5 Any record of new trees planted/removed from the premises? (Only apply to trees that can grow taller than 5 m in height)





Yes / No / Not Applicable

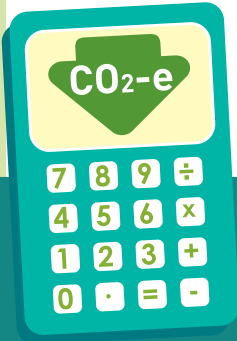
SCOPE 2: ENERGY INDIRECT EMISSIONS

6	Any electricity bill of the premises for the last 12 months?			
7	Any Towngas bill of the premises for the last 12 months?			
8	Optional Information: Any meter installed to measure electricity consumption at different floors/zones?			
9	Any purchase of Renewable Energy Certificates from power companies?			
10	Any individual electricity consumption record for below electrical appliances?			
	<input type="checkbox"/> Air-conditioning	<input type="checkbox"/> Office lighting	<input type="checkbox"/> Office equipment	
	<input type="checkbox"/> Escalator	<input type="checkbox"/> Elevator	<input type="checkbox"/> Chiller	
11	Any inventory of below equipment?			
	<input type="checkbox"/> Office lighting	<input type="checkbox"/> Office equipment	<input type="checkbox"/> Servers	

SCOPE 3: OTHER INDIRECT EMISSIONS (OPTIONAL)

12	Any receipt/record of amount of paper stored, used and recycled in the premises for the last 12 months?			
13	Any water bill of the premises for the last 12 months?			
14	Any purchase record showing quantity and size of carboys for drinkable water consumption?			
15	Any record of overseas business travel of staff for the last 12 months showing means of transportation, number of trips, origin and destination?			
16	Any record of flight carbon offsetting?			














How to Reduce Carbon Emissions

In this chapter we introduce feasible measures and information that would make carbon reduction and savings possible for office managers. Many of them are simple, straightforward actions that won't cost you anything.








Reduction Potential		Capital Investment		Ease of Implementation
	Significant		Significant or long term	 Relatively complex transformation or hardware installation/Involve many stakeholders/Implement upon "end of life" of existing installations
	Moderate		Moderate	 Need careful planning before implement due to potential impact to operation
	Minor		Minor	 Ready-to-implement housekeeping measures which cause no disruption to operation
		Nil	No Cost	































Carbon Reduction Initiatives	Reduction Potential	Capital Investment	Ease of Implementation
		Nil to 	
Lighting System			
• Switch off lighting when rooms are not in use		Nil	
• Maximise use of natural light as far as practicable		Nil	
• Keep light fixtures and lamps clean to maximise their efficiency		Nil	
• Use mirror reflectors to redirect most of the light emitted towards the area to be illuminated			
• Separate light switches for different light zones			
• Use electronic ballasts to replace electromagnetic ballasts			
• Use quasi-electronic ballasts (QEB) that works with the original electromagnetic ballast to light up the existing T8 fluorescent tube, while avoiding the operational constraints of replacing the luminaries			
• Install motion sensors in areas not frequently used			
• Install dimmers where possible to adjust light intensity			
• De-lamping for the areas with higher-than-required lighting level		Nil	
• Adopt energy efficient lighting (e.g. T5 fluorescent lamps and LED)			

An office of a garment manufacturing company has saved HK\$34,000 in a year by replacing existing halogen lamps with LED, and the payback period is as short as 2 years.

A T5 with electronic ballast saves 30% of CO₂ compared with a T8 fitted with electromagnetic ballast.

It is a misunderstanding that turning lights off and then back on uses more energy than leaving them on all the time.

Carbon Reduction Initiatives	Reduction Potential	Capital Investment	Ease of Implementation
	 to 	Nil to    	 to   
Heating, Ventilation and Air Conditioning (HVAC) System			
• Avoid installing air-conditioners with direct sunlight exposure		Nil	
• Establish a policy for optimal use of air-conditioners		Nil	
• Clean the filters/fan coil units regularly			 
• Place weather strips on doors and windows to prevent leakage of conditioned air			 
• Carry out regular leakage checks and replacement of pressure gauges, pressure hose and connectors of air compressors to reduce possible leakage of refrigerants			 
• Set the air conditioning systems at a minimum of 25.5 degrees Celsius		Nil	
• Switch off air-conditioning when rooms are not in use		Nil	
• Apply anti-ultraviolet films on windows to reduce heat gain		 	 
• Use low-e glass to block heat-generating ultraviolet light		 	 
• Use variable speed drives to vary the flow of pump and fan systems according to the actual air-conditioning demand		 	 
• Use Variable Refrigerant Volume (VRV) to optimise refrigerant flow		  	  
• Adopt Central Control and Monitoring System (CCMS) or Building Management System (BMS)		  	  
• Use split-type air conditioners with Grade 1 Energy Efficiency Label		 	 
• Adopt water-cooled air conditioning systems		  	  
























































Carbon Reduction Initiatives	Reduction Potential	Capital Investment	Ease of Implementation
	to 	Nil to   	 to   
Paper Consumption			
<ul style="list-style-type: none"> Reuse paper or use paper on both sides, wherever possible 		Nil	
<ul style="list-style-type: none"> Set the computers and printers to default duplex and economical modes 		Nil	
<ul style="list-style-type: none"> Disseminate information by electronic means wherever possible to reduce paper use 		Nil	
<ul style="list-style-type: none"> Use smaller fonts and line spacing for documents that must be printed 		Nil	
<ul style="list-style-type: none"> Use e-fax to screen junk fax 		Nil	
<ul style="list-style-type: none"> Monitor printing volume regularly and set print quota for users as far as practicable 		Nil	
<ul style="list-style-type: none"> Purchase printing paper, toilet paper and paper towels with recycled content 		 	 
<ul style="list-style-type: none"> Use electronic systems to substitute paper-based office administration systems 		 	 

A Grade 1 air conditioner saves up to 29% of energy and CO₂ comparing to a Grade 5 model. Up to \$480 in electricity cost can be saved per year.



Solar reflective window curtains can save between 4-5% of annual air conditioning electricity costs.

Wait at least 3 minutes before restarting air conditioners after switch-off to allow refrigerant pressure to equalise before restarting.

Carbon Reduction Initiatives	Reduction Potential	Capital Investment	Ease of Implementation
	 to 	Nil to   	 to   
Water Consumption			
• Fix dripping taps immediately		Nil	
• Reduce water pressure to the lowest practical level		Nil	
• Recycle and reuse grey water for cleaning and irrigation		Nil	 
• Carry out regular leakage tests on concealed piping and check for overflowing tank			
• Use products with Grade 1 Water Efficiency Labels, such as showers, water taps, washing machines, urinal equipment and flow controllers.		 	 
• Use dual-flush toilets		  	 
• Use faucets and urinals with infrared sensors		 	 
• Install automatic sensor water taps		 	 
Waste Generation			
• Provide more recycling bins and facilities			
• Reduce use of disposable and non-recyclable products		 	
• Use recycled toner/ink cartridges		 	
• Evaluate the usage of material to avoid overstock		 	

An office has adopted an e-procurement system, which helps saving up to 30 printing pages per transaction, and reducing CO₂ emissions by 35 kg annually.























Use water-saving throttles can reduce water savings by 20%.

Using an electric fan with the air conditioner can achieve better cooling effect in an energy efficient way.

Carbon Reduction Initiatives	Reduction Potential	Capital Investment	Ease of Implementation
	 to 	Nil to   	 to   
Company Vehicle			
<ul style="list-style-type: none"> Keep company fleet properly tuned: inefficient car will use more fuel and emit more pollutants 		Nil	
<ul style="list-style-type: none"> Maintain correct tyre pressure by regular inspection and inflation 		Nil	
<ul style="list-style-type: none"> Ensure no idling vehicles with running engines 		Nil	
<ul style="list-style-type: none"> Offer low carbon driving training sessions (e.g. avoid sudden acceleration) to drivers 			
<ul style="list-style-type: none"> Adopt electric or hybrid vehicles 		  	  
Staff Commuting			
<ul style="list-style-type: none"> Encourage use of public transportation 		Nil	
<ul style="list-style-type: none"> Encourage car pool among staff 		Nil	
Staff Engagement			
<ul style="list-style-type: none"> Encourage staff to join environmental activities organised by green groups 		Nil	
<ul style="list-style-type: none"> Select “low carbon menu” or low-carbon ingredients for corporate entertainment 		Nil	
<ul style="list-style-type: none"> Encourage the use of staircase instead of taking the lift 		Nil	
<ul style="list-style-type: none"> Offer regular environmental training sessions to colleagues 			

A company has reduced fuel consumption by 20% through adopting environmentally friendly vehicles with better efficiency.






















Standby power accounts up to 10% total electricity use in commercial sector, which constitutes for 1% of global CO₂ emissions. Switch off or plug off after use.

Carbon Reduction Initiatives	Reduction Potential	Capital Investment	Ease of Implementation
		Nil to 	
Printing Equipment			
<ul style="list-style-type: none"> Use timer or switch off printers completely during non-operating hours 			
<ul style="list-style-type: none"> Deploy "pull printing" solutions, which allow employees to print documents on any multifunction devices (MFD) in the workgroup and ensure the document is only released for printing when the staff has authenticated themselves at the device. This helps reduce the proportion of printout never being collected by the user who initiated the printing 			
<ul style="list-style-type: none"> Use energy efficient MFDs to reduce stand-alone printers/copiers 			
Information and Communications Technology (ICT) Equipment			
<ul style="list-style-type: none"> Set the computers to automatic standby/sleeping mode when idling 		Nil	
<ul style="list-style-type: none"> Switch off ICT equipment completely during non-operating hours 		Nil	
<ul style="list-style-type: none"> Adopt sub-metering systems to monitor energy end use of server system 			
<ul style="list-style-type: none"> Install Wi-Fi loggers to monitor the temperature and humidity in the data centre 			

A MFD with Energy Label can reduce the annual electricity at inactive stage by about 50%.

An office of a property consulting company has saved >50% of hardware maintenance cost and >30% of toner cartridge consumption by replacing individual printers with MFD.

A data centre has adopted energy-efficient immersion cooling, which helps avoid 4,200 tonnes of CO2 annually.

Carbon Reduction Initiatives	Reduction Potential	Capital Investment	Ease of Implementation
Information and Communications Technology (ICT) Equipment		Nil to 	 to 
<ul style="list-style-type: none"> Use a higher supply temperature of chilled water (12.8 degree Celsius or higher) to improve the efficiency of the chiller plant for cooling the data centre 		Nil	
<ul style="list-style-type: none"> Consolidate servers into one single server with higher capacity to reduce energy consumption and spacing need 			
<ul style="list-style-type: none"> Arrange server racks in “hot” and “cold” aisles configuration to prevent hot and cold air from mixing, and hence improve cooling efficiency of the data cent e. 			
<ul style="list-style-type: none"> Purchase ICT appliances which meet the Energy Efficiency Label requirements of the Electrical and Mechanical Services Department (EMSD) 			
<ul style="list-style-type: none"> Adopt computer equipment virtualisation to reduce energy consumption and hardware installation. For example, through Infrastructure as a Service (IaaS) or Platform as a Service (PaaS) via cloud computing, computer infrastructure or computing solution platform are offered as a service package and users do not need to purchase hardware/ software resources 			
<ul style="list-style-type: none"> Adopt water cooled racks to cool servers and appliances instead of using air cooling 			
















Carbon Reduction Initiatives	Reduction Potential	Capital Investment	Ease of Implementation
		Nil to 	
Business Travel			
<ul style="list-style-type: none"> Choose direct flights for unavoidable business tri 			
<ul style="list-style-type: none"> Use video conferencing for online presentations and conferences to substitute unnecessary overseas business travel 			
Event Organisation and Management			
<ul style="list-style-type: none"> Organise events at locations easily accessible by public transportation 		Nil	
<ul style="list-style-type: none"> For catering, select low carbon food ingredients or locally grown/produced food to reduce food mileage 		Nil	
<ul style="list-style-type: none"> Avoid use of disposable utensils in events 		Nil	
<ul style="list-style-type: none"> Minimise product packaging 		Nil	
<ul style="list-style-type: none"> Optimise route planning for transportation and goods delivery 		Nil	

An office of an import & export company has saved 5 tonnes of CO₂ and HK\$10,000 per month by implementing a management policy to switch off the chiller plants after 9pm.

Bigger does not mean better. An oversized air conditioner is less energy efficient, more expensive and have a shorter lifespan due to constant starting and stopping.

An office has reduced 11% of annual energy consumption by adopting an ISO 50001 Energy Management System.



Carbon Reduction Initiatives	Reduction Potential	Capital Investment	Ease of Implementation
Renewable Energy Demonstration		Nil to 	
<ul style="list-style-type: none"> Install sunlight tracking bulbs to transmit solar energy to support the lighting of space 			
<ul style="list-style-type: none"> Install solar panels on roof top or thin film transparent type solar cells on windows 			
<ul style="list-style-type: none"> Install vertical or horizontal wind turbines for generating electrical energy 			
<ul style="list-style-type: none"> Purchase Renewable Energy Certificates 			



Case Studies of Carbon Reduction Initiatives adopted in Government Buildings and Public Facilities



Case Study 1: Service-on-demand escalator

Installation of service-on-demand escalators in the building, including both automatic start/stop and two-speed controls

Energy Saving:

Up to 52% and 14% energy saving for the automatic start/stop and two-speed controls escalators respectively.*



Service-on-demand escalators with passenger sensing post

Case Study 2: Variable speed drive

Adoption of variable speed drive (VSD) in Heating, Ventilation and Air Conditioning (HVAC) system

Energy Saving:

Around 5% of total energy saving of the premises depends on the operational characteristics.*



VSD installed in HVAC system

Case Study 3: High efficiency type air-cooled chillers

Replacement of existing air-cooled chillers by high efficiency type air-cooled chillers

Energy Saving:

Around 20% of total energy saving of the premises depends on the operational characteristics.*



High efficiency air-cooled chiller

* Variation of energy saving level depends on the size and operational characteristics of the premises.



Case Studies

In this chapter we highlight exemplary practices of carbon management in the Government/private sector



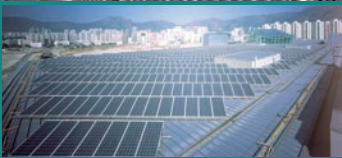
1. EMSD Headquarters

Profile

- The new EMSD Headquarters Building at Kowloon Bay opened in 2005
- The building exhibited an excellent showcase of sustainable development through renovating the structure of a former air cargo terminal building into an office-cum-workshop building with environmentally friendly design and application of advanced energy efficient technologies

Major Features

- Solar photovoltaic panel system comprising over 2,300 number of photovoltaic panels on rooftop capable of generating 350kW peak renewable power
- Other renewable installations include building integrated photovoltaic panel, sun tracking photovoltaic system, solar hot water system and solar lamp pole
- Maximise the use of natural daylight including adoption of sun pipes to illuminate building internal areas
- One of the pioneers to use high energy efficiency oil-free chiller to reduce energy consumption in air-conditioning
- Setting up of green walls in building internal and external for environmental improvement
- Recycle rainwater and waste water by rainwater harvesting system and grey water recycling system for irrigation and toilet flushin



2. Office of SOCAM Development Limited



Profile

- An awardee of the Carbon Reduction Certificate (Type II – Office-based organisations/operational units within Hong Kong) of the Hong Kong Green Organisation Certification
- Achieved a remarkable 16% of reduction of absolute carbon dioxide in 2013 comparing with the baseline of 2012

Key Initiatives

- Wise use of natural light and extensive application of LED, T5 or compact fluorescent lamp with energy label
- Establishment of clear light zoning and application of light sensor in rarely accessed areas
- Effective communication with property management office to optimise use of central air-conditioning system and temperature
- Adoption of multi-function devices (with printing, scanning, photo-copy, fax) to substitute individuals devices
- Extensive use of electronic information system and channels to reduce paper use
- Use of video conferencing equipment to reduce business trips
- A special task force has been established to support the green manager to improve the environmental management of the office operation
- Green tips were regularly delivered through signage, posters, emails, bulletin boards, newsletter and intranet

Conserving our office's resources
for a sustainable future for all.

Tam Chi Piu
CSR Environmental Subgroup Secretary

Useful Resources



A. General References (in alphabetical order)

- Carbon Audit Toolkit for Small and Medium Enterprises in Hong Kong
 ↳ http://www6.cityu.edu.hk/aerc/sme/images/sme_eng.pdf
- Carbon Reduction Certificates Scheme of Hong Kong Awards for Environmental Excellence (HKAEE)
 ↳ http://www.hkaee.gov.hk/english/category/carbonless_cert/28.html
- ISO 14064-1:2006 Greenhouse gases — Part 1: Specification with guidance at the organisation level for quantification and reporting of greenhouse gas emissions and removals
 ↳ http://www.iso.org/iso/catalogue_detail?csnumber=38381
- Greenhouse gas emissions and carbon intensity
 ↳ https://www.climate.gov.hk/files/pdf/HKGGHG_CarbonIntensity_201612.pdf
- Greenhouse gas emissions by sector
 ↳ https://www.climate.gov.hk/files/pdf/HKGGHG_Sectors_201612.pdf
- Greenhouse gas emission trend
 ↳ https://www.climate.gov.hk/files/pdf/HKGGHG_Trend_201612.pdf

- Guidelines to Account for And Report on Greenhouse Gas Emissions and Removals for Buildings in Hong Kong
↳ <https://www.climateready.gov.hk/page.php?id=56&lang=1>
- HK EE Net
↳ <http://ee.emsd.gov.hk/eindex.html>
- The GHG Protocol — Corporate Accounting and Reporting Standard
↳ <http://www.ghgprotocol.org>



B. Office Specific References (in alphabetical order)

- Carbon Trust — Creating an Awareness Campaign Guide
↳ <https://www.carbontrust.com/resources/guides/energy-efficiency/c-creating-an-awareness-campaign-download/>
- Low-carbon Office Operation Programme of WWF-Hong Kong
↳ <https://loop.wwf.org.hk>



C. Carbon Calculators

There is a wide range of calculators available which help individuals and organisations to measure their carbon footprints. These calculators also provide useful information about carbon reduction. Some examples (in alphabetical order) are provided below:

For general use internationally

- Calculation Tools — The Greenhouse Gas Protocol Initiative
↳ <http://www.ghgprotocol.org/calculation-tools>



For local household and personal use

- Carbon Calculator — Hong Kong And China Gas Company Limited
 ↘ <http://www.lowcarbonaction.com/en/footprint.aspx>

For local household

- Carbon Calculator — The Hongkong Electric Co. Ltd
 ↘ <https://www.hkelectric.com/en/customer-services/carbon-calculator>

For local household, retail, catering, school and office

- Carbon Manager — The Council for Sustainable Development
 ↘ <http://carbon-manager.hkpc.org/website/eng/index.asp>

For local enterprises, especially SMEs

- CGCC-Carbon Management Tool — The Chinese General Chamber of Commerce
 ↘ <http://cmt.cgcc.org.hk/eng/home.html>

For local household and personal use

- One Tonne Challenge Calculator — Kadoorie Farm and Botanic Garden (KFBG) Corporation
 ↘ <http://www.climatechange.hk/eng/join-now.aspx>

For buildings of commercial, residential or institutional purposes

- Electronic version (Excel) of template for conducting carbon audit and for reporting the findings
 ↘ <https://www.carbon-footprint.hk/node/52>

An electronic version of this reporting template is available from EPD's Carbon Footprint Repository (CFR) Website: <https://www.carbon-footprint.hk/node/52>

The electronic version has built in all the emission factors and formulas for calculating GHG emissions arising from different sources, and that EPD will review and update the relevant emission factors used in this electronic version on a regular basis.

Table 1: GHG Emissions from Stationary Sources

Step 1	Step 2			Step 3	Step 4	Step 5	Step 6	Step 7	Step 8
A	B	C	D	E	F	G	H	I	J
Source description with location (e.g. boilers, furnaces, ovens and emergency electricity generator etc.)	Fuel Information			CO ₂ emission factor <small>Note 2</small>	CO ₂ emissions in tonnes of CO ₂ equivalent $((B \times E) / 1000)$	CH ₄ emission factor <small>Note 3</small>	CH ₄ emissions in tonnes of CO ₂ equivalent $((B \times G) / (1000 \times 1000) \times \text{GWP} \text{ Note 4})$	N ₂ O emission factor <small>Note 3</small>	N ₂ O emissions in tonnes of CO ₂ equivalent $((B \times I) / (1000 \times 1000) \times \text{GWP} \text{ Note 4})$
	Fuel used		Fuel type <small>Note 2</small>						
	Amount	Unit <small>Note 1</small>							
Total									

Please insert more rows as necessary

IMPORTANT: Combustion of Towngas from stationary sources should also be reported in Table 1 (refer to Tables 1-1 to 1-3 for the emission factors) as it falls into the category of direct emissions. Indirect emission of purchased Towngas should be calculated in Table 5.

Note 1: Select the appropriate fuel unit

Note 2: Select the appropriate fuel type and the corresponding emission factor (from Table 1-1) for calculation

Note 3: Refer to Table 1-2 for calculating CH₄ emissions and Table 1-3 for N₂O emissions.

Note 4: Global Warming Potential (GWP) of CH₄ is 21 while it is 310 for N₂O

Emission Factors for Stationary Combustion Sources

Table 1-1 CO₂ Emission Factor by fuel type

Fuel Type	Emission Factor	Unit
Diesel Oil	2.614	kg/litre
LPG	3.017	kg/kg
Kerosene	2.429	kg/litre
Charcoal	2.970	kg/kg
Towngas	2.549	kg/Unit

Table 1-2 CH₄ Emission Factor by fuel type

Fuel Type	Emission Factor	Unit
Diesel Oil	0.0239	g/litre
LPG	0.0020	g/kg
Kerosene	0.0241	g/litre
Charcoal	5.5290	g/kg
Towngas	0.0446	g/Unit

Table 1-3 N₂O Emission Factor by fuel type

Fuel Type	Emission Factor	Unit
Diesel Oil	0.0074	g/litre
LPG	0.0000	g/kg
Kerosene	0.0076	g/litre
Charcoal	0.0276	g/kg
Towngas	0.0099	g/Unit

* For the most updated figures, please refer to <https://www.climateready.gov.hk/page.php?id=56&lang=1>

Table 2: GHG Emissions from the Mobile Sources

Step 1	Step 2		Step 3	Step 4	Step 5	Step 6	Step 7	Step 8
A	B	C	D	E	F	G	H	I
Source description <i>(by different vehicle and fuel types)</i>	Fuel Information		CO ₂ emission factor <small>Note 1</small>	CO ₂ emissions in tonnes of CO ₂ equivalent $((B \times D) / 1000)$	CH ₄ emission factor <small>Note 2</small>	CH ₄ emissions in tonnes of CO ₂ equivalent $((B \times F) / (1000 \times 1000)) \times \text{GWP}$ <small>Note 4)</small>	N ₂ O emission factor <small>Note 3</small>	N ₂ O emissions in tonnes of CO ₂ equivalent $((B \times H) / (1000 \times 1000)) \times \text{GWP}$ <small>Note 4)</small>
	Amount of fuel used (in litres)	Fuel type						
Road Transport								
Navigation								
Aviation								
Total								

Please insert more rows as necessary

Notes for GHG Emissions from Mobile Source

Note 1: Refer to Table 2-1 for CO₂ emission factors for different vehicle and fuel type.

Note 2: Refer to Table 2-2 for CH₄ emission factors for different vehicle and fuel type.

Note 3: Refer to Table 2-3 for N₂O emission factors for different vehicle and fuel type.

Note 4: Global Warming Potential (GWP) of CH₄ is 21 while it is 310 for N₂O.

Emission Factors for Mobile Combustion Sources

Table 2-1 CO₂ Emission Factor

Fuel Type	Emission Factor	Unit
Diesel Oil (DO)	2.614	kg/litre
Unleaded Petrol (ULP)	2.360	kg/litre
Liquefied Petroleum Gas (LPG)	1.679	kg/litre
	3.017	kg/kg
Gas Oil (For Ships only)	2.645	kg/litre
Kerosene (Including Jet Kerosene)	2.429	kg/litre

Table 2-2 CH₄ Emission factor

Vehicle Type	Fuel Type	Emission Factor	Unit
Motorcycle	ULP	1.422	g/litre
Passenger Car	ULP	0.253	g/litre
	DO	0.072	g/litre
Private Van	ULP	0.203	g/litre
	DO	0.072	g/litre
	LPG	0.248	g/litre
Public Light Bus	DO	0.072	g/litre
	LPG	0.248	g/litre
Light Goods Vehicle	ULP	0.203	g/litre
	DO	0.072	g/litre
Heavy Goods Vehicle	DO	0.145	g/litre
Medium Goods Vehicle	DO	0.145	g/litre
Ships	Gas Oil	0.146	g/litre
Aviation	Jet Kerosene	0.069	g/litre
Other Mobile Machinery	DO	0.0239	g/litre
	LPG	0.0036	g/litre
		0.006	g/kg
	Kerosene	0.0241	g/litre

* For the most updated figures, please refer to <https://www.climateready.gov.hk/page.php?id=56&lang=1>

Table 2-3 N₂O Emission Factor

Vehicle Type	Fuel Type	Emission Factor	Unit
Motorcycle	ULP	0.046	g/litre
Passenger Car	ULP	1.105	g/litre
	DO	0.110	g/litre
Private Van	ULP	1.140	g/litre
	DO	0.506	g/litre
	LPG	0.000	g/litre
Public Light Bus	DO	0.506	g/litre
	LPG	0.000	g/litre
Light Goods Vehicle	ULP	1.105	g/litre
	DO	0.506	g/litre
Heavy Goods Vehicle	DO	0.072	g/litre
Medium Goods Vehicle	DO	0.072	g/litre
Ships	Gas Oil	1.095	g/litre
Aviation	Jet Kerosene	0.000	g/litre
Other Mobile Machinery	DO	0.007	g/litre
	LPG	0.0000	g/litre or g/kg
	Kerosene	0.0076	g/litre

Table 3: GHG Emissions (HFC and PFC) arising from Refrigeration/Air-conditioning Equipment (Operating Process)

Step 1 A	Step 2 B	Step 3 C	Step 4 D	Step 5 E	Step 6 F	Step 7 G
Type of refrigerant ^{Note 1}	Amount of refrigerant at the beginning of the reporting period (kg)	Amount of refrigerant purchased during the reporting period (kg)	Amount of refrigerant disposed (through environmentally responsible means) during the reporting period (kg)	Amount of refrigerant at the end of the reporting period (kg)	GWP of refrigerant ^{Note 2}	GHG emissions (HFC and PFC) in tonnes of CO ₂ equivalent $((B + C - D - E) \times F/1000)$
Total						

Please insert more rows as necessary.

Note 1: Enter the type of refrigerant of the equipment

Note 2: Refer to Table 3-1 for the Global Warming Potential (GWP) of the corresponding refrigerant

Table 3-1 Global Warming Potentials (GWP) of Common Refrigeration/Air-Conditioning Refrigerants ^{Note 1}

Gas or Blend	GWP	Information Source ^{Note 2}
HFC-23	11,700	A
HFC-32	650	A
HFC-125	2,800	A
HFC-134a	1,300	A
HFC-143a	3,800	A
HFC-152a	140	A
HFC-236fa	6,300	A
R-401A	18	B
R-401B	15	B
R-401C	21	B
R-402A	1,680	B
R-402B	1,064	B
R-403A	1,400	B
R-403B	2,730	B
R-404A	3,260	B
R-406A	0	B
R-407A	1,770	B
R-407B	2,285	B

Gas or Blend	GWP	Information Source ^{Note 2}
R-407C	1,526	B
R-407D	1,428	B
R-407E	1,363	B
R-408A	1,944	B
R-409A	0	B
R-409B	0	B
R-410A	1,725	B
R-410B	1,833	B
R-411A	15	B
R-411B	4	B
R-412A	350	B
R-413A	1,774	B
R-414A	0	B
R-414B	0	B
R-415A	25	B
R-415B	105	B
R-416A	767	B
R-417A	1,955	B

Gas or Blend	GWP	Information Source ^{Note 2}
R-418A	4	B
R-419A	2,403	B
R-420A	1,144	B
R-500	37	B
R-501	0	B
R-502	0	B
R-503	4,692	B
R-504	313	B
R-505	0	B
R-506	0	B
R-507 or R-507A	3,300	B
R-508A	10,175	B
R-508B	10,350	B
R-509 or R-509A	3,920	B
PFC-116(C ₂ F ₆)	9,200	A
PFC-14(CF ₄)	6,500	A

Note 1: Refrigerants, with components other than HFCs and PFCs, have been well-recognised to have effects on our climate systems. Nevertheless, the Guidelines only cover those which are in the group of Kyoto protocol recognised gases (CO₂, CH₄, HFC, PFC, SF₆ and N₂O). Hence, in the Guidelines, GWPs of all refrigerants other than HFCs and PFCs are considered to be zero.

Note 2: Information sources:

A: IPCC Second Assessment Report (1995)

B: "World Resources Institute (2005), *Calculating HFC and PFC Emissions from the Manufacturing, Installation, Operation and Disposal of Refrigeration & Air-conditioning Equipment (Version 1.0) – Guide to calculation worksheets*, World Business Council for Sustainable Development", in which the latter states that the source of reference is from ASHRAE Standard 34.

* For the most updated figures, please refer to <https://www.climate.gov.hk/page.php?id=56&lang=1>

Table 4: Direct GHG Removals from Newly Planted Trees

Step 1	Step 2	Step 3	Step 4	Step 5
A	B	C	D	E
Source description (Location of the trees planted)	No. of trees planted ^{Note 1} (unit)	No. of trees removed ^{Note 1} (unit)	CO ₂ removal factor ^{Note 2} (kg/unit/year)	CO ₂ removals in tonnes of CO ₂ equivalent ((B-C) x D/1000)
			23	
Total				

Please insert more rows as necessary

Note 1: Please input the no. of trees planted, and no. of trees removed which are able to reach at least 5m after the beginning stage of construction.

Note 2: The default figure for the removal potential of each unit of tree is suggested based on Hong Kong's location, woodland types, and estimated density of trees. The figure applicable to all trees commonly found in Hong Kong which are able to reach at least **5 metres in height** after the beginning stage of construction.
is

Table 5: GHG Emissions from Electricity Purchased from Power Companies

Step 1	Step 2	Step 3	Step 4		Step 5	
A	B	C ^{Note1}	D ^{Note2}		E	
Facility/source description (i.e. Area/facilities the electricity bill is reporting)	Amount of electricity as shown in electricity bill (in kWh)	Amount of electricity produced by renewable energy (RE) sources as shown in RE Certificate (in kWh)	Emission factor * (kg/kWh)		Indirect GHG emissions in tonnes of CO ₂ equivalent ((B-C)xD/1000)	
			Power company – specific	Territory-wide default value	Power company – specific	Territory-wide default value
Total						

Please insert more rows as necessary

Note 1: RE certificates are sold by the power companies for electricity generated by RE sources such that buyers can claim that their operations help reduce carbon emissions. These Certificates also represent the units of RE purchased by buyers.

Note 2: The reporting entity is required to account for GHG emissions associated with the electricity purchased in Hong Kong based on two emission factors. First, the reporting entity will quantify the emissions based on a territory-wide default value of **0.7kg/kWh**. Second, the reporting entity will quantify the emissions based on specific emission factors provided by its respective provider of electricity. In case that the specific emission factor for the reporting period is not available at the time of accounting, the latest specific emission factor from the power company may be used as an approximation. These specific emission factors are available from the power companies' websites. For reference, the table below indicates the emission factors of the two power companies in Hong Kong for the past 7 years.

GHG Emission Factor for Different Power Companies in Hong Kong (in kg CO₂-e/kWh)

Power Company	2009	2010	2011	2012	2013	2014	2015
CLP [#]	0.56	0.54	0.59	0.58	0.63	0.64	0.54
HEC [*]	0.84	0.79	0.79	0.79	0.78	0.79	0.78

[#] Emission factors for CLP were derived from information in CLP Group's Sustainability Report.

^{*} Emission factors for HEC were derived from information in HEC's Sustainability Report.

* For the most updated figures, please refer to <https://www.climateready.gov.hk/page.php?id=56&lang=1>

Table 6: GHG Emissions from Towngas Purchased from the Hong Kong and China Gas Company (Towngas)

Step 1	Step 2	Step 3	Step 4
A	B	C	D
Facility/source description (i.e. Area/facilities the Towngas bill is reporting)	Amount of Towngas purchased (Unit ^{Note})	Emission factor (kg/Unit)	Indirect GHG emissions in tonnes of CO ₂ equivalent (B x C/1000)
Total			

Please insert more rows as necessary

Note: Each unit registered by gas meter represents that the town gas with a heat value of 48 MJ. Based on the information from the Hong Kong and China Gas Company, the emission factors for the past three years were derived as below. This factor only accounts for the emissions during the production of Towngas within the company. Reporting entity should report in Table 1 as well the GHG emissions associated with combustion of Towngas within the physical boundary under Scope 1.

In case that the emission factor for the reporting period is not available at the time of accounting, the latest emission factor from the Towngas company may be used as an approximation.

GHG Emission Factor (in kg CO₂-e/Unit of Towngas purchased)

Year	2009	2010	2011	2012	2013	2014	2015
Emission Factor	0.628	0.620	0.618	0.610	0.620	0.600	0.605

* For the most updated figures, please refer to <https://www.climateready.gov.hk/page.php?id=56&lang=1>

Table 7: Methane Generation at Landfill in Hong Kong due to Disposal of Paper Waste

Step 1	Step 2	Step 3	Step 4	Step 5	Step 6	Step 7
A	B	C	D	E	F	G
Source description (i.e. Area/floor)	Amount of paper in storage at the beginning of the reporting period (kg)	Amount of paper purchased during the reporting period (kg)	Amount of paper collected for recycling during the reporting period (kg)	Amount of paper in storage at the end of the reporting period (kg)	Emission factor (kg CO ₂ -e/ kg of waste) ^{Note}	Indirect emissions in tonnes of CO ₂ equivalent ((B + C - D - E) x F/1000)
					4.8	
Total						

Please insert more rows as necessary.

Note: For simplifying the accounting process, the default emission factor assumes that the **total raw amount** of CH₄ emitted throughout the whole decomposition process of the paper waste disposed at landfills will be emitted into the atmosphere within the same reporting period as paper waste collected. In addition, the default value does not take into account the reduction in emission due to collection, recovery and utilisation of landfill gas due to the management practices at landfill

Table 8: GHG Emissions due to Electricity Used for Fresh Water Processing by Water Supplies Department

Step 1	Step 2	Step 3	Step 4
A	B	C	D
Source description (i.e. Area/facilities the water service bill is reporting)	Amount of water consumed as listed on the water service bill (m ³)	Emission factor (kg/m ³) ^{Note}	Emissions in tonnes of CO ₂ equivalent (B x C/1000)
Total			

Please insert more rows as necessary

Note: Emission factor of GHG emissions due to electricity used for processing fresh water = Unit electricity consumption of fresh water (from WSD) x Territory-wide default value (i.e. 0.7kg/kWh) of purchased electricity provided in Table 5.

In case that the unit electricity consumption for processing fresh water for the reporting period is not available at the time of accounting, the latest emission factor from table below may be used as an approximation.

GHG Emission Factor (in kg CO ₂ -e/m ³)						
Year	2009/10	2010/11	2011/12	2012/13	2013/14	2014/15
Emission Factor	0.410	0.415	0.440	0.414	0.402	0.407

* For the most updated figures, please refer to <https://www.climateready.gov.hk/page.php?id=56&lang=1>

Table 9: GHG Emissions due to Electricity Used for Sewage Processing by Drainage Services Department

Step 1	Step 2	Step 3	Step 4
A	B	C	D
Source description (i.e. Area/facilities the water service bill is reporting)	Fresh water consumption (m ³)	Default Emission Factor (kg/m ³) Note	Emissions in tonnes CO ₂ equivalent (B x C/1000)
Total			

Note: The default emission factor is determined according to the purpose of water used as follows:

Source description	Default Emission Factor (kg/m ³)
Restaurants and catering services	(0.7 x Emission Factor) assuming 70% of the fresh water consumed will enter the sewage system.
Other commercial, residential and institutional purposes	(1.0 x Emission Factor) assuming 100% of the fresh water consumed will enter the sewage system.

In which emission factor is the emission factor of GHG emissions due to electricity used for processing fresh water derived from the following equation
 Emission Factor = Unit electricity consumption of processing sewage (from DSD) x Territory-wide default value (i.e. 0.7kg/kWh) of purchased electricity provided in Table 5

In case that the unit electricity consumption for processing sewage for the reporting period is not available at the time of accounting, the latest emission factor from table below may be used as an approximation.

GHG Emission Factor (in kg CO ₂ -e/m ³)						
Year	2009/10	2010/11	2011/12	2012/13	2013/14	2014/15
Emission Factor	0.172	0.170	0.170	0.167	0.169	0.181

* For the most updated figures, please refer to <https://www.climateready.gov.hk/page.php?id=56&lang=1>

Reference Benchmark for Energy Utilisation Index of Commercial Sector

Principal Group 1 – Restaurant and Retail

SUBGROUP ⁽¹⁾	ANNUAL ENERGY CONSUMPTION PER AREA ⁽²⁾ (MJ/M ² /ANNUM)
B1: Chinese Restaurant	4636
B2: Non-Chinese Restaurant	4060
B3: Fast Food Shop	6622
B4: Bar	1536
B5: Other Eating and Drinking Place	5729
B6: Arcade/Basement/Upper Floor Shop	1479
B7: Street Front/Ground Floor Shop	1778

Principal Group 2 – Accommodation

SUBGROUP ⁽¹⁾	ANNUAL ENERGY CONSUMPTION PER AREA ⁽²⁾ (MJ/M ² /ANNUM)
B8: Hotel	898
B9: Guest House	1326
B10: Home for the Aged	1872
B11: Service Apartment	702

Principal Group 3 – Hospital and Clinic

SUBGROUP⁽¹⁾	ANNUAL ENERGY CONSUMPTION PER AREA⁽²⁾ (MJ/M²/ANNUM)
B12: Hospital	1131
B13: Clinic	1709
B14: Private Dental Clinic	379
B15: Medical Laboratory	639

Principal Group 4 – Educational Services

SUBGROUP⁽¹⁾	ANNUAL ENERGY CONSUMPTION PER AREA⁽²⁾ (MJ/M²/ANNUM)
B16: University	752
B17: Post-secondary College	185
B18: Adult Education/Tutorial/Vocational Course	630
B19: Secondary School	214
B20: Primary School	186
B21: Kindergarten	427
B22: Special Education School	120

Principal Group 5 – Warehouse

SUBGROUP⁽¹⁾	ANNUAL ENERGY CONSUMPTION PER AREA⁽²⁾ (MJ/M²/ANNUM)
B23: Refrigerated Warehouse	1282
B24: Non-refrigerated Warehouse	85

Principal Group 6 – Office Flatted Factory

SUBGROUP⁽¹⁾	ANNUAL ENERGY CONSUMPTION PER AREA⁽²⁾ (MJ/M²/ANNUM)
B25: Office Flatted Factor	518

Principal Group 7 – Central Services for Shopping Arcade

SUBGROUP⁽¹⁾	ANNUAL ENERGY CONSUMPTION PER AREA⁽²⁾ (MJ/M²/ANNUM)
B26: Central Services for Shopping Arcade	2302

Principal Group 8 – Private Office

SUBGROUP⁽¹⁾	ANNUAL ENERGY CONSUMPTION PER AREA⁽²⁾ (MJ/M²/ANNUM)
B27: Central services for building (multiple tenants) with central air-conditioning supply for tenants	476
B28: Central services for building (multiple tenants) without central air-conditioning supply for tenants	155

Principal Group 9 – Government Office

SUBGROUP⁽¹⁾	ANNUAL ENERGY CONSUMPTION PER AREA⁽²⁾ (MJ/M²/ANNUM)
B32: Whole building (multiple users)	985

Note:

- (1) Definition of each subgroup can be refer to http://ecib.emsd.gov.hk/en/glossary_cmc.htm
- (2) Stakeholders are encouraged to consider these energy utilisation indexes as one way, but not the only way, of improving their energy performance with respect to the past. Comparisons of indicators between business operations within the same sector should be made with caution. Businesses in the same subgroup may be operating under different economic, environmental and operational constraints, causing different energy performance. The business processes in different business subgroups are inherently varied resulting in different achievable energy performance levels. The energy utilisation indexes are derived from studies on a limited size of samples within the population of respective energy-consuming groups. These indicators should not be construed as representative energy consumption levels of the population, nor as territory-wide standards which businesses in the respective energy-consuming groups should comply with.

Source: EMSD's Energy Utilisation Indexes and Benchmarks for Residential, Commercial and Transport Sectors
<http://ecib.emsd.gov.hk/en/index.htm>

1. Name of the reporting entity: *e.g. XYZ Office Building*

2. Description of the reporting entity:
Some possible descriptions are:
 - (a) Building management with a single responsible occupier;
 - (b) Building management with all end-users;
 - (c) Building management with some of the end-users (with details of the end-users participated);
 - (d) Building management only of a building of multiple responsible occupiers; and
 - (e) Others (with full details).

e.g. XYZ Office Building is the headquarters of XYZ Co. Ltd. The daily building management duty is borne by Administration Division.

3. The reporting period (with start and end dates): *e.g. 1st Jan 2014 to 31st Dec 2014*

4. Scope of physical boundary chosen
 - (a) Location of the building(s): *e.g. XYZ Street, Hong Kong*
 - (b) Description of the purpose of the building(s) or physical boundary chosen:
e.g. Area to be reported is the total indoor and outdoor areas from the ground floor to the roof of XYZ Office Buildings

(c) Building Information:

Building Name	<i>e.g. XYZ Office Building</i>
Address	<i>e.g. XYZ Street, Hong Kong</i>
Gross Floor Area	<i>e.g. 10,000 m²</i>
Number of Floor	<i>e.g. 6 (G/F, 1-5/F)</i>
Year Build	<i>e.g. 1984</i>
Number of staff	<i>e.g. 300 full time employees</i>
Floor Usage	<i>e.g. All areas, excluding plant room, carparks and server rooms, operate from Monday to Friday except Public Holidays</i>

(d) Description of areas excluded in the audit: *e.g. Commercial tenants in G/F are excluded from this carbon audit.*

5. Scope of operational boundary chosen

(a) Description of Scope 1 activities included and excluded:

e.g. Testing of emergency generator, mobile sources, GHG removal by tree planting, fugitive emissions;

(b) Description of Scope 2 activities included and excluded:

e.g. Consumption by purchased electricity;

(c) Description of Scope 3 activities included:

e.g. Paper waste disposed at landfills, consumption of fresh water, treatment of wastewater

6. Methodologies

- (a) List of activities for which simplified methodologies and conversion factors in the Guidelines are used for quantification
- (b) Details (including necessary reference) of other methodologies and conversion factors used for quantification
- (c) Details of any changes in methodologies and conversion factors since the last report
- (d) Details on any re-calculation of previously reported emissions and removals because of changes in methodologies and conversion factors

e.g. The reporting and working procedures for calculating GHG emissions and removals as detailed in the “Guidelines to Account for and Report on Greenhouse Gas Emissions and Removals for Building(Commercial, Residential or Institutional Purposes) in Hong Kong – 2010 Edition” compiled by EPD and EMSD were adopted.

7. Conclusion

Information on GHG emissions and removals for *e.g. XYZ Office Building*

Reporting Period: *e.g. 01/01/2014 – 31/12/2014*

Scope of Emissions	Emissions by Gas Type (in tonnes of CO ₂ -equivalent)					
	Carbon dioxide (CO ₂)	Methane (CH ₄)	Nitrous oxide (N ₂ O)	Hydrofluo o- Carbons (HFCs)	Perfluo o- Carbons (PFCs)	Total
Scope 1 Direct Emissions						
Stationary Combustion Sources						
Internal Combustion Engines	1.438	0.00028	0.00126	N/A	N/A	1.440
Mobile Combustion Sources						
Road Transport	32.914	0.066	4.860	N/A	N/A	37.840
Fugitive Emissions						
Refrigeration	N/A	N/A	N/A	0	0	0
Scope 1 Emissions Total	34.352	0.06628	4.86126	0	0	39.280
Scope 1 Direct Removal						
Planting of Additional Trees	0.759	N/A	N/A	N/A	N/A	0.759
Scope 1 Removals Total	0.759	0	0	0	0	0.759

Scope of Emissions	Emissions by Gas Type (in tonnes of CO ₂ -equivalent)					
	Carbon dioxide (CO ₂)	Methane (CH ₄)	Nitrous oxide (N ₂ O)	Hydrofluoro-carbons (HFCs)	Perfluoro-carbons (PFCs)	Total
Scope 2 Energy Indirect Emissions						
Electricity Purchased						2,235.634 Note A
Towngas Purchased						0
Scope 2 Emissions Total						2,235.634
Scope 3 Other Indirect Emissions						
Methane Generation at Landfill due to Disposal of Paper Waste	N/A	26.803	N/A	N/A	N/A	26.803
Electricity for Processing Fresh Water						1.965
Electricity for Processing Sewage						0.883
Scope 3 Emissions Total	N/A	26.803	N/A	N/A	N/A	29.651
Other GHG Offsets/Removals	0	0	0	0	0	0
Net Emissions Total (Scope 1 Emissions Total + Scope 2 Emissions Total + Scope 3 Emissions Total – Scope 1 Removals Total – Other GHG Offsets/Removals)	-	-	-	-	-	2,303.806

(Note A: The emissions based on territory-wide default value is e.g. 2,235.634, while the emissions based on CLP emission factor is e.g. 2,044.008.)

Summary of Results

Total Scope 1 Emissions : e.g. 39.280 Tonnes of CO₂ Equivalent

Total Scope 1 Removals : e.g. 0.759 Tonnes of CO₂ Equivalent

Total Scope 2 Emissions : e.g. 2,235.634 Tonnes of CO₂ Equivalent

Total Scope 3 Emissions : e.g. 29.651 Tonnes of CO₂ Equivalent

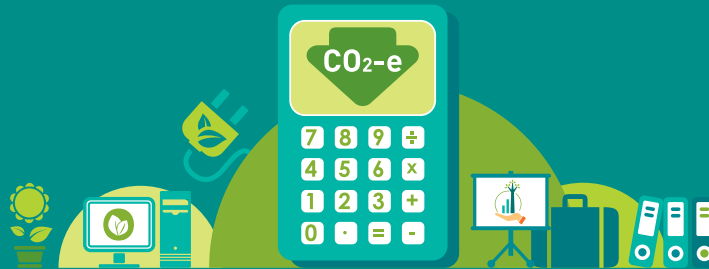
Total other GHG Offsets/Removals: e.g. 0 Tonnes of CO₂ Equivalent

GHG Performance in Ratio Indicator(s):

e.g. Emissions per Total Gross Floor Area: 0.2303 tonnes CO₂-e/m²/annum

8. Information on GHG offsets and programmes
 - (a) Description of GHG performance against internal and/or external benchmark (if any) including any ratio indicators used
 - (b) Scopes and areas identified to improve GHG performance
 - (c) Description of activities/programmes to improve GHG performance including provision of on-site renewable energy sources, purchase of Renewable Energy Certificates and on-site offsetting activities. For example, if the reporting entity can only quantify the amount of paper waste recycled, the amount of GHG avoided due to recycling of paper waste can be reported here.

e.g. We have completed the chiller replacement in Dec 2013. The carbon emissions were reduced from 2,609.156 tonnes CO₂-e in 2013 to 2,303.806 tonnes CO₂-e in 2014. We will complete the replacement works of all T8 fluorescent tubes to T5 fluorescent tubes in the XYZ Office Building by March 2016. These newly replaced fluorescent tubes are more energy saving than the existing tubes. As a result, the electricity consumption on the lighting facilities will be decreased and the GHG emissions from the building will hence be reduced.
9. Contact person of the reporting entity
e.g. Mr. XYZ (XYZ@XYZ.com)
10. Reference
e.g. "Guidelines to account and report Greenhouse Gas Emissions and Removals for Building of Commercial, Residential or Institutional Purposes in Hong Kong" 2010 revision



» <https://www.climateready.gov.hk/?lang=1>

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