GUIDE TO
LOW CARBON SWIMMING POOLS

Practical Guide on
Carbon Audit and Management

Climate Ready@HK 氣候變化香港行動

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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 swimming pools.

A wide range of measures are also illustrated to facilitate leisure facilities management to reduce carbon emissions and to save operation cost.

Read on if you want to:

- cut your energy bills;
- improve your facility environment;
- engage your visitors on low carbon actions; 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.

Table of Content

Introduction

In this chapter we explain what carbon audit is and the benefits of doing so for swimming pools

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 DIOXIDE EQUIVALENT (CO_2-e)

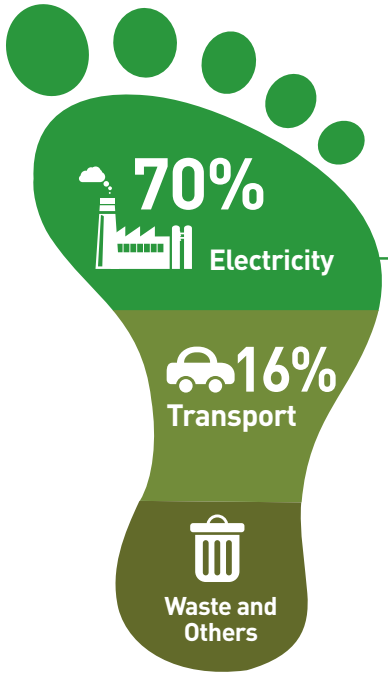
It is the unit of measurement which allows the six types of GHG emissions governed under the Kyoto Protocol to be compared on a like-for-like basis relative to CO_2. It can be derived by multiplying the emissions of each of the six GHG by its respective 100-year global warming potential (GWP).

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 swimming pools, account for nearly 90% of electricity consumption. If swimming pools pursue better electricity consumption management and improve energy efficiency, this will not only cut their energy costs, but also effectively reduce Hong Kong's overall carbon emissions.

HK's GHG Emissions by Sector in 2014*



90% Buildings

- HK's Total GHG Emissions in 2014:
  44,900 kilotonnes CO_2-e
- HK's Emission per Capita in 2014:
  6.2 tonnes CO_2-e

* 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 swimming pools to calculate the GHG emissions from the operation and to identify areas of improvement.

Read the Guidelines at:
https://www.climateready.gov.hk/page.php?id=56&lang=1

To lead by example, the Government has:

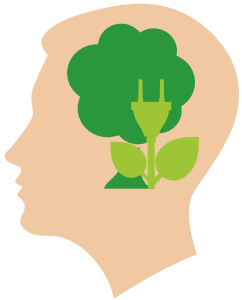
- Rolled out energy-cum-carbon audits for more than 120 Government buildings and public facilities, including 10 Swimming Pools;
- Encouraged major Government buildings to carry out regular carbon audit to track the effectiveness of carbon reduction efforts;
- Conducted a "paper approach" carbon audit 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.

Reduce Operational Cost

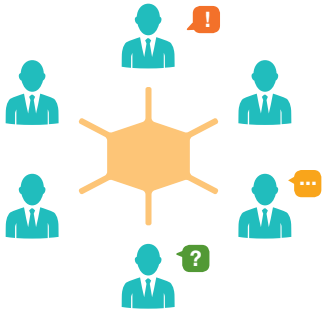
Improve Facility's Image

Demonstrate Environmental Responsibilities

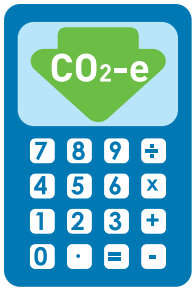
Managing And Reducing Your Carbon Footprint Can Bring About Many Advantages



Raise Staff Awareness



Meet Users' 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 swimming pool complexes 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 swimming pool 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 swimming pool concerned.

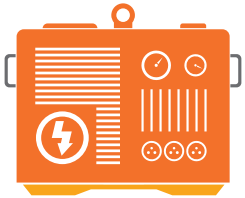
OPERATIONAL BOUNDARY

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

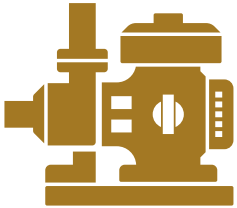
STEP II. Identify Emission Sources

SCOPE 1: DIRECT EMISSIONS AND REMOVALS

Stationary source combustion:
e.g. Towngas heaters and boilers



Stationary source combustion:
e.g. Emergency electricity generators



Stationary source combustion:
e.g. Petrol vacuum suction pumps

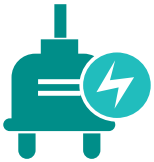
Mobile source combustion:
e.g. Pool's vehicles

Fugitive emissions from air conditioning/refrigeration systems/ fi e extinguishers

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

* 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



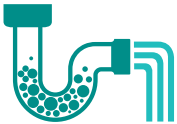
Electricity purchased

Towngas purchased

SCOPE 3: OTHER INDIRECT EMISSIONS (Optional To Include)

Paper waste disposal

Fresh water consumption



Sewage discharge

Emissions from hired transportation

Swimming Pools Energy Consumption

The common sources of energy use of swimming pools are:

— Space heating, ventilation and air conditioning (HVAC);
— Boilers for hot water;
— Lighting; and
— Filtration system.

Swimming pools require high ventilation rates to remove moisture caused by pool water evaporation. The pool water is also continuously pumped through the filtration system.

In UK, swimming pools are the major energy consumer in sports and leisure sector — specifically the processes for heating the pool water and ventilating the pool hall which consumed up to 65% of the energy in these centres. Looking at the way energy is managed can provide rooms of energy savings.

STEP III. Data Collection

Once the emission sources are identified, the swimming pools 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 swimming pool's vehicles)

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 swimming pool

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

Hired transportation for passengers or for delivery of goods or services procured by the pool

STEP IV. Apply Emission Factors for Calculation

The carbon footprint (measured in tonnes of CO_2-e) is calculated by multiplying the activity data by the respective emission factor and the global warming potential (GWP) of the respective GHG emitted:

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 (CO_2-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 Group[1] or The Hongkong Electric Co. Ltd[2], depending on where your swimming pool is located.

For example, if the electricity consumption of a swimming pool located in New Territories is 10,000kWh in 2014, the emission factor of CLP in 2014 (i.e. 0.64 kgCO_2-e/kWh) should be used. [2014 GHG emission (tonnes CO_2-e): =10,000 kWh (activity data) x 0.64kgCO_2-e/kWh (emission factor) x 1 (global warming potential of CO_2) = 6.4 tonnes CO_2-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 (CO_2): 1
- methane (CH_4): 21
- nitrous oxide (N_2O): 310

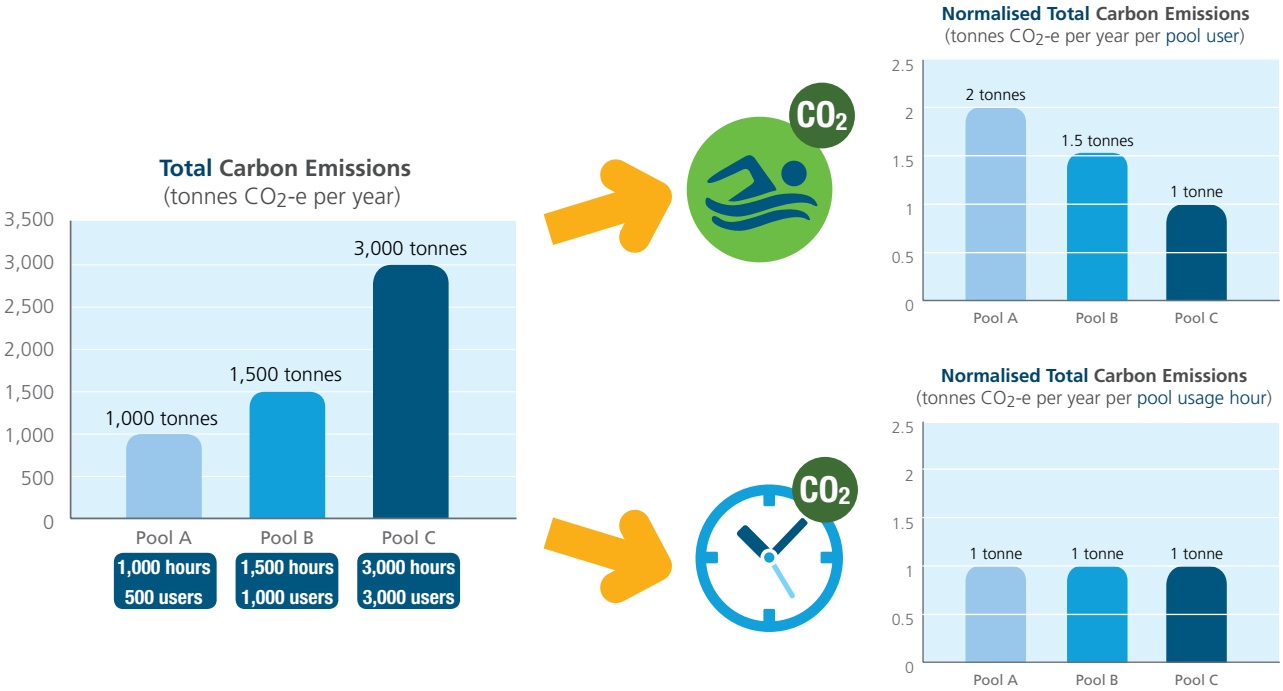
1. Sustainability reports of CLP Group
   https://www.clpgroup.com/en/sustainability/sustainability-reports
2. Sustainability reports of The Hongkong Electric Co. Ltd.
   https://www.hkelectric.com/en/corporate-social-responsibility/sustainability-reports

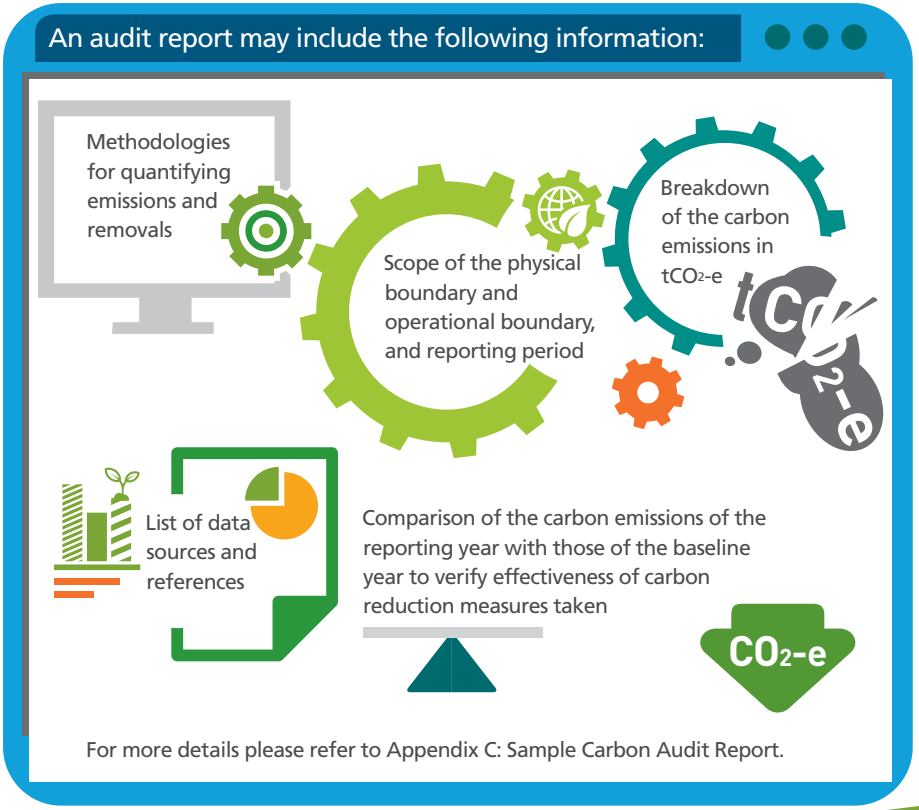
STEP V. Report and Disclose

Communicating your carbon footprint helps engage your stakeholders (staff, users and communities) about the swimming pool's impact to climate change and motivate them to take carbon reduction measures.

You can use an appropriate ratio indicator to represent the swimming pool's carbon footprint in proportion to a defined operational measuring unit, for example, GHG emissions per pool usage hour or GHG emissions per pool user are some ratio indicators applicable for pools.

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





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.

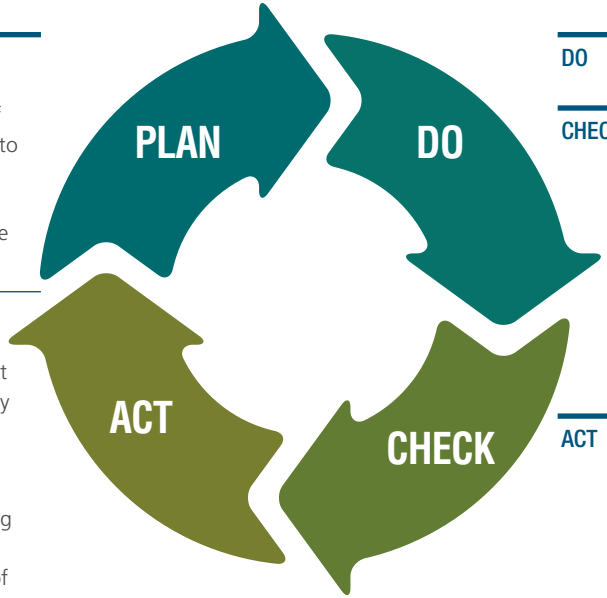
WAYS OF CARBON DISCLOSURE

- Communicate with staff through internal newsletter
- Communicate with users and communities through notices, posters or website
- For government pools, disclose the carbon audit results and findings in the Bureaux/Departments' annual Environmental Performance Report

WHAT'S NEXT AFTER CARBON AUDIT? CARBON MANAGEMENT

Swimming pools need good carbon 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

- Demonstrate the commitment of management of swimming pool to carbon management
- Set objectives and targets for improvement against the baseline

STEP 2 Establishing a Carbon Reduction Plan

- Establish a plan to achieve the set objectives and targets, which may include better management practices, minor hardware retrofitting, and engineering improvement works or retrofitting with more energy efficient installations upon "end of life" of existing installations

DO

STEP 3 Implementing the Carbon Reduction Plan

CHECK

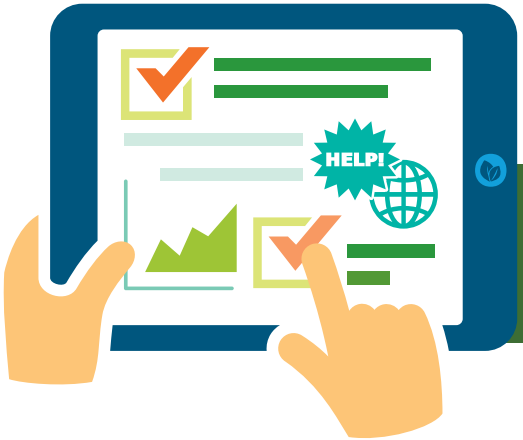
STEP 4 Conducting Regular Carbon Audit

- Set up systematic procedures for monitoring of carbon emissions and effectiveness of the reduction measures
- Make adjustments when the swimming pool is not progressing well towards the reduction objectives

ACT

STEP 5 Maintaining the Carbon Reduction Plan

- Review audit findings by the management of swimming pool to ensure its continuing suitability, adequacy and effectiveness for continual improvement
- Communicate reduction success with staff, users and communities



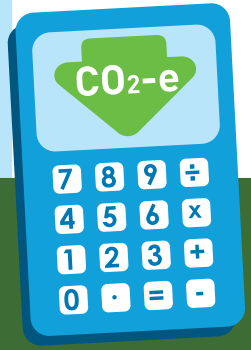
Checklist for **Conducting Carbon Audit**

To gauge the readiness of a swimming pool for conducting carbon audit, the management and/or administrator can complete the below checklist for quick assessment and start gathering the information as listed to facilitate an effective carbon audit process.

		Yes / No / Not Applicable
	FACILITIES INFORMATION (ESSENTIAL INFORMATION)	
1	Is the following information/data available? a) Gross Floor Area, m^2 b) No. of staff c) No. of users d) Facility layout plan or floor plan to show owned/controllable indoor, outdoor and communal area e) Facility opening hours, usage hours record or visitor record f) Type (e.g. competition pools, diving pools), capacity and volume of pools	
	SCOPE 1: DIRECT EMISSIONS AND REMOVALS	
2	If there is any machine or equipment in the swimming pool 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 self-owned vehicle associated with the operation of the swimming pool, is there any record of the type and amount of fuel consumed by these vehicles 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 swimming pool for the last 12 months?	
5	Any record of new trees planted/removed from the swimming pool? (Only apply to trees that can grow taller than 5m in height)	

Yes / No / Not Applicable

	SCOPE 2: ENERGY INDIRECT EMISSIONS	
6	Any electricity bill of the swimming pool for the last 12 months?	
7	Any Towngas bill of the swimming pool 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?	
	☐ Air-conditioning ☐ Lighting ☐ Equipment (e.g. filtration system	
	☐ Escalator ☐ Elevator ☐ Chiller	
11	Any inventory of below equipment?	
	☐ Lighting ☐ Equipment ☐ Servers	
	SCOPE 3: OTHER INDIRECT EMISSIONS (OPTIONAL)	
12	Any receipt/record of amount of paper stored, used and recycled in the swimming pool for the last 12 months?	
13	Any water bill of the swimming pool 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 swimming pools. 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	

Sector-specific Carbon Reduction Initiatives for Swimming Pools

Sector-specific Carbon Reduction Initiatives	Reduction Potential	Capital Investment	Ease of Implementation
	to	Nil to $$$	to
Lighting System			
• Adopt energy efficient lighting (e.g. LED for floodlight, underwater pool light)		$$	
Heating, Ventilation and Air Conditioning (HVAC) System			

• Maintain optimal temperatures according to the use*:
  • Pool halls: 1 degree Celsius above water temperature to minimise evaporation of pool water
  • Changing areas: 20 to 25 degree Celsius
  • Reception and offices: 25.5 degree Celsius
		Nil	

• Adopt variable speed drives (VSD) in motors of ventilation fans, pumps or pool water system		$$$	

* Source from Carbon Trust — Sports and Leisure: Introducing Energy Saving Opportunities for Business https://www.carbontrust.com/media/39352/ctv006_sports_and_leisure_sector_overview.pdf

Sector-specific Carbon Reduction Initiatives	Reduction Potential to	Capital Investment Nil to $$$	Ease of Implementation to
Water Consumption			
• Encourage shortening of showering time		Nil	
• Install drinking fountain machines with pressure on buttons or automatic shut-off timer		$$	
• Use products with Grade 1 Water Efficiency Labels, such as showers, water taps, washing machines, urinal equipment and flow controllers		$$	
• Provide warm or room temperature water for showering service		Nil	

Sector-specific Carbon Reduction Initiatives	Reduction Potential	Capital Investment	Ease of Implementation
	to	Nil to $$$	to
Swimming Pool Management			

• Maintain optimal water temperatures according to the pool type*:
  • Training and competition: 25 — 27 degree Celsius
  • Conventional: 28 degree Celsius (maximum temperature)
  • Spa: 40 degree Celsius (maximum temperature)
		$	

• Train staff on the control of optimal pool temperature		$	
• Schedule backwashes of the pool filter to remove its foulants to maintain efficiency		$	
• Switch off wave machines, water spouts and fountains completely after operating hours		Nil	
• Install a thermal insulation cover for spa pool and jacuzzi		$$	
• Install a thermal insulation cover for heated pool		$$$	
• Adopt energy efficient pumps for filling in and emptying water		$$$	

* Source from Carbon Trust — Sports and Leisure: Introducing Energy Saving Opportunities for Business https://www.carbontrust.com/media/39352/ctv006_sports_and_leisure_sector_overview.pdf

General Carbon Reduction Initiatives	Reduction Potential	Capital Investment	Ease of Implementation
	to	Nil to $$$	to
Lighting System			
• Switch off lighting when zones are not in use		Nil	
• Switch off exterior lighting in the daytime		Nil	
• Maximise use of natural light as far as practicable		Nil	
• Keep light fixtures and lamps clean to maximise their efficiency		Nil	
• Use mirror reflectors to redirect most of the light emitted towards the area to be illuminated		$$	
• Consider a lower and appropriate lighting level for corridors, storerooms, toilets and showers in changing rooms and car parks		Nil	
• Separate light switches for different light zones		$	
• Use electronic ballasts to replace electromagnetic ballasts		$	
• Use quasi-electronic ballasts (QEB) that work with the original electromagnetic ballast to light up the existing T8 fluorescent tube, while avoiding the operational constraints of replacing the luminaries		$	
• Install occupancy/motion sensors in areas not frequently used (e.g. storerooms)		$$	
• Install light sensors to optimise the use of artificial lighting when there is sufficient natural daylight (e.g. at entrance queuing areas)		$$	
• De-lamp for areas with higher-than-required lighting level		Nil	
• Adopt energy efficient lighting (e.g. T5 fluorescent lamps and LED)		$$	

General Carbon Reduction Initiatives	Reduction Potential	Capital Investment	Ease of Implementation
	to	Nil to $$$	to
Heating, Ventilation and Air Conditioning (HVAC) System			
• Avoid installing air-conditioners with direct sunlight exposure		Nil	
• Clean filters/fan coil units regularly		$	
• Place weather strips on doors and windows to prevent leakage of conditioned air		$	
• Carry out regular leakage checks and replacement of pressure gauges, pressure hose and connectors of air compressors to reduce possible leakage of refrigerants		$	
• Ensure system operating hours match with the actual requirements which may vary throughout the day		Nil	
• Set timers to operate the HVAC system only when it is occupied		$	
• Apply anti-ultraviolet films on windows to reduce heat gain		$$	
• Use low-e glass to block heat-generating ultraviolet light		$$	
• Use Variable Refrigerant Volume (VRV) to optimise refrigerant flow		$$$	
• Adopt Central Control and Monitoring System (CCMS) or Building Management System (BMS)		$$$	
• Adopt water-cooled air conditioning system		$$$	
• Install automatic doors instead of open doors to avoid escape of cooled air		$$$	
• Use thermal wheels or heat pipes to facilitate heat recovery between the air intake and exhaust air		$$$	
• Use automatic tube cleaning systems in condenser		$$$	
• Install high efficiency Electronically-Commutated Permanent Magnet Motor (ECPM) for chillers to save energy		$$$	

General Carbon Reduction Initiatives	Reduction Potential	Capital Investment	Ease of Implementation
	to	Nil to $$$	to
Paper Consumption			
• Reuse paper or use paper on both sides, wherever possible		Nil	
• Set computers and printers to default duplex and economical modes		Nil	
• Disseminate information by electronic means wherever possible to reduce paper use		Nil	
• Use smaller fonts and line spacing for documents that must be printed		Nil	
• Use e-fax to screen junk fax		Nil	
• Monitor printing volume regularly and set print quota for users as far as practicable		Nil	
• Purchase printing paper, toilet paper and paper towels with recycled content		$$	
• Use electronic system to substitute paper-based office administration systems		$$	

It is wrong to set the thermostat too low in order to cool the swimming pool as quick as possible. The temperature will drop and overshoot, which causes waste of energy.

General Carbon Reduction Initiatives	Reduction Potential	Capital Investment	Ease of Implementation
	to	Nil to $$$	to
Water Consumption			
• Fix dripping taps immediately		Nil	
• Reduce water pressure of shower facilities to an appropriate level		Nil	
• Recycle and reuse grey water for cleaning and irrigation		Nil	
• Carry out regular leakage tests on concealed piping and check for overflowing tank		$	
• Use products with Grade 1 Water Efficiency Labels, such as showers, water taps, washing machines, urinal equipment and flow controllers.		$$	
• Use dual-flush toilets		$$	
• Use faucets and urinals with infrared sensors		$$	
• Install automatic sensor water taps		$$	
• Install drinking fountain machines with pressure on buttons or automatic shut-off timer		$$	

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.

Taking shower instead of bath save 50% hot water and CO_2.

A continuously-switched on vending machine can cost over HK$3,000 of electricity bill a year.

General Carbon Reduction Initiatives	Reduction Potential	Capital Investment	Ease of Implementation
	to	Nil to $$$	to
Waste Generation			
• Reduce use of disposable and non-recyclable products		$	
• Use recycled toner/ink cartridges		$$	
• Provide more recycling bins and facilities		$$	
Vehicle Hiring and Management			
• Appoint transportation contractors with vehicles meeting the latest EURO emission standard		Nil	
• Instruct contractors to keep their fleet properly tuned: inefficient vehicles will use more fuel and emit more pollutants		Nil	
• Instruct contractors to maintain correct tyre pressure by regular inspection and inflation		Nil	
• Ensure no idling vehicles with running engines		Nil	
• Adopt electric or hybrid vehicles		$$$	
Staff Commuting			
• Encourage use of public transportation		Nil	
• Encourage car pool among staff		Nil	

General Carbon Reduction Initiatives	Reduction Potential	Capital Investment	Ease of Implementation
	to	Nil to $$$	to
Boilers and Pipework			
• Maintain boilers regularly		$	
• Insulate boilers, hot water tanks, pipes and valves properly to prevent heat escaping		$$	
• Install energy efficient boilers for heating water		$$$	
Electrical Equipment			
• Use timer or switch off printers completely after office hours		$	
• Use energy efficient multi-function devices (MFD) to reduce stand-alone printers/copiers		$$	
• Replace relatively lower efficiency water pump motors to high efficiency motors (e.g. Class EFF1		$$$	
• Purchase energy efficient vending machines		$$$	

A T5 with electronic ballast saves 30% of CO_2 compared with a T8 fitted with electromagnetic ballast.

A Grade 1 air conditioner saves up to 29% of energy and CO_2 comparing to a Grade 5 model. Up to $480 in electricity cost can be saved per year.

General Carbon Reduction Initiatives	Reduction Potential	Capital Investment	Ease of Implementation
	to	Nil to $$$	to
Lifts & Escalators			
• Shut down idled lifts when during off peak hours		Nil	
• Shut off ventilation fans for idled lift car		$	
• Use Variable Voltage Variable Frequency (VVVF) controllers or energy optimisers to optimise energy consumption and reduce wear and tear of lift system		$$$	
• Install automatic start/stop control or two-speed control to vary the escalator speed according to the passenger flow		$$	
• Reduce escalator step load by replacing heavy escalator steps by glass fibre material		$$$	
• Reduce escalator motor load by adopting non-metallic or plastic-based materials in power transmission chains		$$$	
• Install energy re-generation systems in elevators to convert potential energy generated from the movement of the elevators to electrical energy		$$$	

Avoid overheating of pool water which can cause excessive water evaporation, and increased ventilation would be needed.

In UK, a pool cover can help reduce heat losses by 10-30% of the total pool energy use. The ventilation efforts can also be reduced due to a smaller rise of humidity.

Never leave air-conditioning on during overnight. It only takes a small fraction of electricity to reach the optimal temperature at the start of the day of a swimming pool.

General Carbon Reduction Initiatives	Reduction Potential	Capital Investment	Ease of Implementation
	to	Nil to $$$	to
Facility Greening			
• Plant trees		$$	
• Set up green roof and/or green walls		$$$	
Staff and Visitor Engagement			
• Affix energy saving, water saving and paper saving labels to raise staff and visitors' awareness		Nil	
• Encourage staff to join environmental activities organised by green groups		Nil	
• Encourage the use of staircase instead of taking the lift for inter-floor traffic		Nil	
• Train staff with basic carbon audit techniques to facilitate the continual monitoring of carbon emission of venue		$	
• Promote carbon reduction to staff and visitors through organising energy saving/carbon reduction campaigns		$	
• Provide practical staff uniforms to enable staff to work under suitable temperatures		$$	

General Carbon Reduction Initiatives	Reduction Potential	Capital Investment	Ease of Implementation
	to	Nil to $$$	to
Catering Facilities			
• Reduce use of disposable and non-recyclable eating utensils		Nil	
• Educate staff and visitors to waste no food		Nil	
• Offer "low carbon menu" or locally grown/produced ingredients		$	
• Keep fridge and freezer doors shut and defrost regularly		$	
• Install food waste composters for converting food waste into fertilisers		$$$	
• Install retrofit night covers on chilled display carbinets		$	
Renewable Energy Demonstration			
• Install sunlight tracking bulbs to transmit solar energy to support the lighting of space		$$$	
• Install solar panels on roof top or thin film transparent type solar cells on windows		$$$	
• Install vertical or horizontal wind turbines for generating electrical energy		$$$	
• Purchase Renewable Energy Certificates		$$	

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:

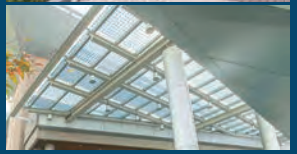
Around 20% of total energy saving of the premises depends on the operational characteristics.*

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 and environmental management of selected swimming pools



1. Kwun Tong Swimming Pool Complex

Profile

- The new Kwun Tong Swimming Pool Complex was opened in 2013
- Kwun Tong Swimming Pool Complex demonstrates successful sustainable design with high building performance

Major Features

- Building integrated photovoltaic panel system with an area of over 86 square metres forming part of glass canopy roof for generating 7.8kW renewable power
- Installation of solar hot water system and solar lamp poles
- Use of recycled rainwater by rainwater collection system for irrigation
- Provision of open landscape deck ramping around the complex

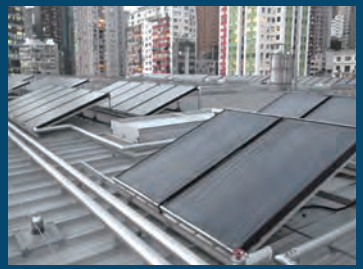
2. Victoria Park Swimming Pool Complex

Profile

- The redeveloped Victoria Park Swimming Pool was opened in mid-September 2013
- The pool was awarded the Gold Award of 2012 Hong Kong Awards of Environmental Excellence (HKAEE) —Construction Sector, in recognition of the extensive adoption of green features

Key Initiatives

- Adoption of solar-powered water heating system, with 146 solar panels installed on the rooftop, for showering
- Establishment of a rainwater collection system to collect rainwater for irrigation
- Installation of glass ceiling to allow natural illumination to save a considerable amount of electricity for indoor lighting



Useful Resources

A. General References (in alphabetical order)

- 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.climateready.gov.hk/files/pdf/HKGHG_CarbonIntensity_201612.pdf

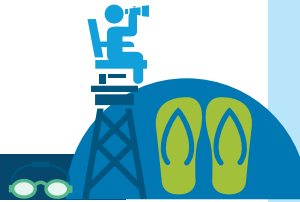
- Greenhouse gas emissions by sector
  ↘ https://www.climateready.gov.hk/files/pdf/HKGHG_Sectors_201612.pdf

- Greenhouse gas emission trend
  ↘ https://www.climateready.gov.hk/files/pdf/HKGHG_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. Swimming Pool Specific References (in alphabetical order)

- Carbon Trust — Sports and Leisure: Introducing Energy Saving Opportunities for Business
  ↘ http://www.carbontrust.com/resources/guides/sector-based-advice/sports-and-leisure

- Green Sports Alliance
  ↘ http://greensportsalliance.org/

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

Reporting Table Templates for Carbon Emissions

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 Note 2	CO_2 emissions in tonnes of CO_2 equivalent ((BxE)/1000)	CH_4 emission factor Note 3	CH_4 emissions in tonnes of CO_2 equivalent ((BxG)/(1000x1000) x GWP Note 4)	N_2O emission factor Note 3	N_2O emissions in tonnes of CO_2 equivalent ((BxI)/(1000x1000) x GWP Note 4)
	Fuel used		Fuel type Note 2						
	Amount	Unit Note 1							
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 CH_4 emissions and Table 1-3 for N_2O emissions.
Note 4: Global Warming Potential (GWP) of CH_4 is 21 while it is 310 for N_2O

Emission Factors for Stationary Combustion Sources

Table 1-1 CO_2 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 CH_4 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 N_2O 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 *(by different vehicle and fuel types)*	Fuel Information		CO_2 emission factor Note 1	CO_2 emissions in tonnes of CO_2 equivalent ((BxD)/1000)	CH_4 emission factor Note 2	CH_4 emissions in tonnes of CO_2 equivalent ((BxF)/(1000x1000) x GWP Note 4)	N_2O emission factor Note 3	N_2O emissions in tonnes of CO_2 equivalent ((BxH)/(1000x1000) x GWP Note 4)
	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 CO_2 emission factors for different vehicle and fuel type.
Note 2: Refer to Table 2-2 for CH_4 emission factors for different vehicle and fuel type.
Note 3: Refer to Table 2-3 for N_2O emission factors for different vehicle and fuel type.
Note 4: Global Warming Potential (GWP) of CH_4 is 21 while it is 310 for N_2O.

Emission Factors for Mobile Combustion Sources

Table 2-1 CO_2 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 CH_4 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

Table 2-3 N_2O 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

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

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

Step 1	Step 2	Step 3	Step 4	Step 5	Step 6	Step 7
A	B	C	D	E	F	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) x 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_2F_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 (CO_2, CH_4, HFC, PFC, SF_6 and N_2O). 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.climateready.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 is 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.

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 CO_2-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 CO_2-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 CH_4 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/M²/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/M²/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 Factor

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

Sample Carbon Audit Report

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 Jan2014 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	*e.g. XYZ Office Building*
Address	*e.g. XYZ Street, Hong Kong*
Gross Floor Area	*e.g. 10,000 m^2*
Number of Floor	*e.g. 6 (G/F, 1-5/F)*
Year Build	*e.g. 1984*
Number of staff	*e.g. 300 full time employee*
Floor Usage	*e.g. All area, excluding plant room, carparks and server rooms, operate from Monday to Friday except Public Holidays*

(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 emission;

(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_2O)	Hydrofluoro-Carbons (HFCs)	Perfluoro-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_2O)	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	26.083
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 CO_2 Equivalent
Total Scope 1 Removals : *e.g. 0.759* Tonnes of CO_2 Equivalent
Total Scope 2 Emissions : *e.g. 2,235.634* Tonnes of CO_2 Equivalent
Total Scope 3 Emissions : *e.g. 29.651* Tonnes of CO_2 Equivalent
Total other GHG Offsets/Removals: *e.g. 0* Tonnes of CO_2 Equivalent

GHG Performance in Ratio Indicator(s):
e.g. Emission per Total Gross Floor Area: 0.2303 tonnes CO_2-e/m^2/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 emission was reduced from 2,609.156 tonnes CO_2-e in 2013 to 2,303.806 tonnes CO_2-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 emission 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