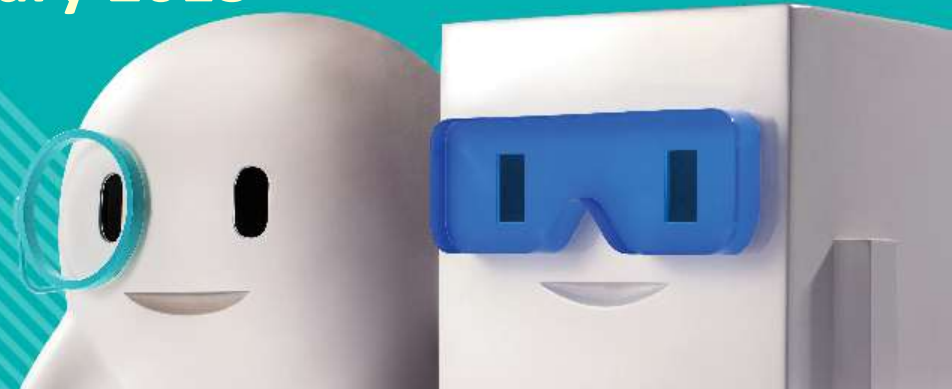


CUHK Jockey Club Initiative Gaia - Environment and Climate Change Forum Series: Carbon Audit and Reduction



Kenny Wong
Principal Consultant
Hong Kong Productivity Council
25 January 2013



Hong Kong Productivity Council (HKPC)

HKPC is a multi-disciplinary organization established for promoting increased productivity in Hong Kong through research and development, consultancy, training and technology transfer service for enhancing the human resource, management and technology for a wide range of organizations

Environmental Management Division (EMD)

EMD of HKPC is specifically to provide environmental management and engineering services to both private and public sectors. One of our focus areas is to provide energy and carbon management consultancy service to various sectors in improving their environmental performance



Business Operation and Carbon Emissions

- Every company generates carbon emissions through different types of activities, e.g. use of electricity in offices, use of gas and fuel for running your business, staff commuting, etc.
- Increasing public awareness on corporate social responsibility to strengthen the need of environmental protection

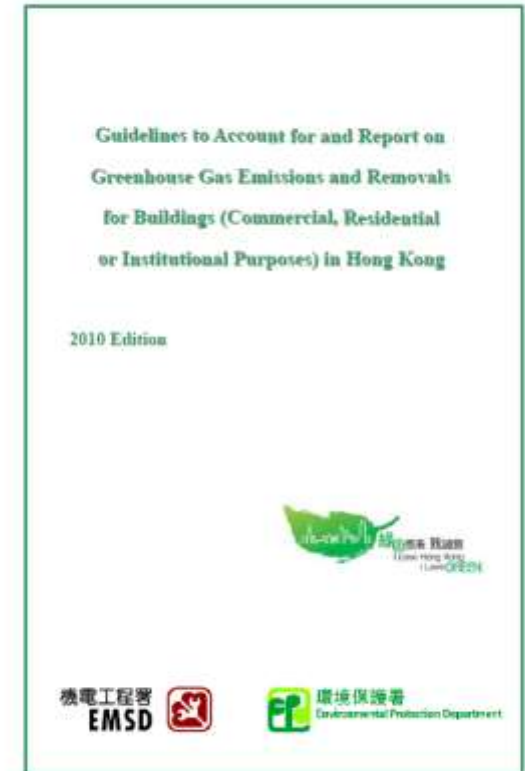


Source: <http://www.carbonica.org/business/zero-footprint-business.aspx>



Carbon Audit

- Carbon audit is a systematic approach to identify and quantify Green House Gases (GHGs) generated in an organization or building within a defined system boundary
- Performing carbon audit helps to formulate action plan to tackle with the GHGs emission at organizations



Benefits of Carbon Audit for Business

- According to the Carbon Trust, around $\frac{3}{4}$ of the employees would like to work for company which has concerns to the environment. Employee with higher satisfaction to the company can enhance productivity and staff loyalty
- Consumers are also showing increasing interests of purchasing environmentally friendly products and services



Benefits of Carbon Audit for Business

- Therefore, performing carbon audit can provide the business with a sustainable image, maintain and attract sales from consumers who are aware of the environment
- Green companies are also tend to have a better management, and are more efficient and profitable than their competitors



Source:
<http://www.bronxgreenbusiness.com/>

Energy and Carbon Audit for HKPC Building

- HKPC has been actively promoting energy efficiency, cleaner production, and low carbon economy over the past two decades
- We are also vigorously fulfilling our corporate social responsibility by reducing the carbon footprint of our headquarters building in Hong Kong



Measures Taken before the Audit

Energy Savings - Chiller Plant Retrofit

A major retrofit of chiller plant using water cooled chiller was carried out:

- Installed new evaporative condensing system
- New chillers including new chiller plant control system
- Around 35% of the annual energy consumption for chiller plant was reduced



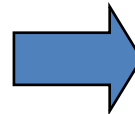
Measures Taken before the Audit

Retrofit for Better Colour Rendering and Energy Efficiency

- Improve light reflection and utilization
- Improve colour rendering and maintain adequate lighting levels



Before



After

Measures Taken before the Audit

- Rescheduling of operation of air-conditioning and lighting system to shorten daily operation time
- Reducing the need for round the clock air-conditioning provisions for some laboratories

Energy Conservation and Carbon Reduction Initiatives of HKPC Building

- For further reducing the carbon footprint of HKPC Building, HKPC conducted an Carbon-cum-Energy Audit for HKPC Building in 2009 with series of carbon reduction measures were implemented subsequently

Carbon Footprint

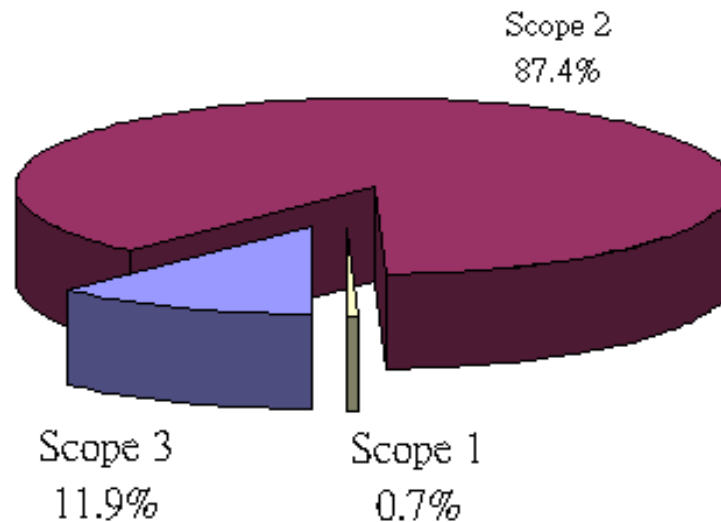


Category		GHG Emissions (tonnes CO _{2e} /year)	% share
Scope 1	Direct combustion of fuel by cars	28.5	
	Direct combustion of fuels by emergency generators and in laboratories/workshops	4.5	
	Chiller refrigerant leakage ^(note 1)	0	
	GHG emissions from laboratories/ workshops	0.2	
	Sub-total	33.2	
Scope 2	Air-conditioning system	1,973.5	
	Lighting system	503.4	
	Electricity consumption in laboratories & workshops	463.0	
	Office equipment	331.5	
	Other electricity consumption	668.6	
	Towngas consumption	0	
	Sub-total	3,940	
Scope 3	Generation of waste paper	272.9	
	Water consumption	11.1	
	Sewage water discharge	4.6	
	Staff overseas trip by flight	160.7	
	Staff commuting to work and local official travelling	354.7	
	Sub-total	804	
Grand total		4,777.2	100%

Energy-cum-carbon Audit for HKPC Building in 2009

With the plantation of trees and recycling of waste paper, the building was able to achieve a carbon reduction of 2.1 and 267 tonnes of CO_{2e} respectively

The total GHG emission of this building (with offset) in 2008 was estimated at 4,508.1 tonnes of CO_{2e}

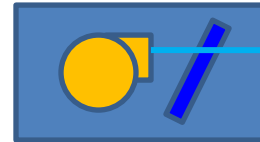


Carbon Emission Reduction Measures

- ▣ The short term measures as implemented in 2009/2010 after the audit, such as switching off all unnecessary electrical equipment, replacement of incandescent lamps, installing socket timers, etc. have helped HKPC further reducing an annual electricity cost HK\$162,000 at a total cost of HK\$25,400, i.e. payback period of only 2 months
- ▣ 3 medium term measures have been implemented from 2010 for an investment of \$226,000 and annual energy saving of HK\$81,000, i.e. payback of 3.3 years

Demand Ventilation Control

- Fresh Air Control for 3 Fresh Air Units at locations that are not always occupying:-
- Helps to reduce
 - Excessive fresh air supply and air-conditioning energy
 - Fan power



Retrofit Tungsten Reflector Lamp with LED Reflector Lamp

- About 200 nos. of tungsten reflector lamp retrofitted with LED lamp
- Helps to reduce:-
 - Internal Heat Gain and Air-conditioning Energy Consumption
 - Lamp electricity consumption

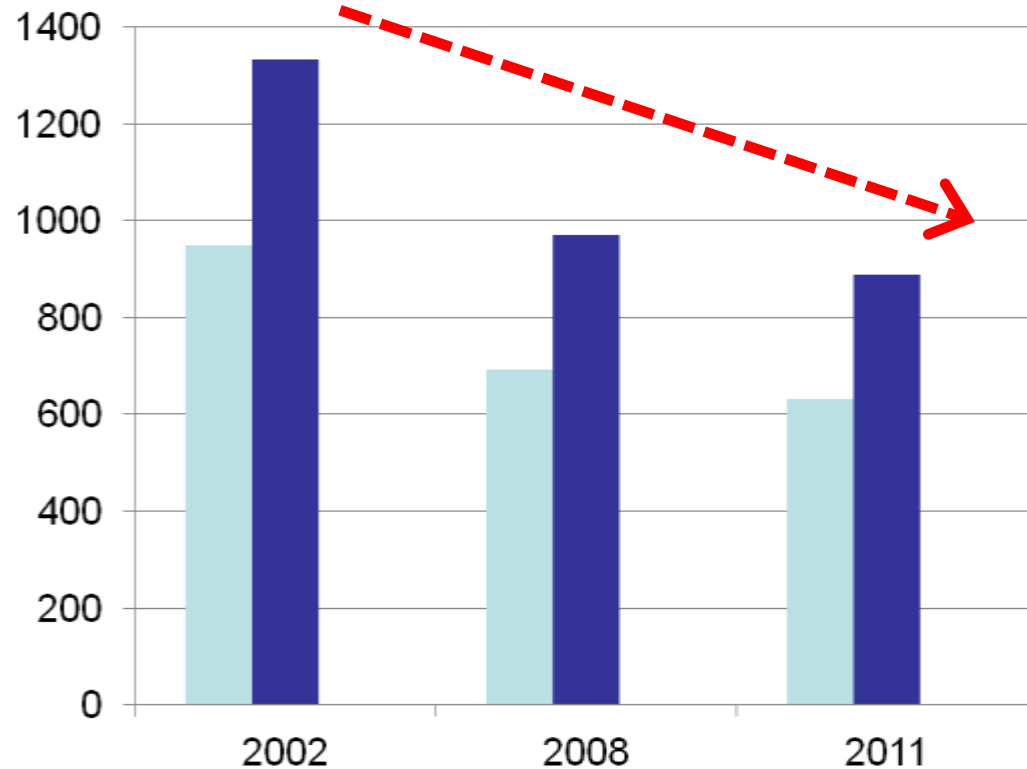


Retrofit Exit Sign with T5 Lamps

- 80 nos. of exit signs
- Direct retrofit the existing T8 lamps with T5 lamps converter
- Helps to reduce:-
 - Lamp energy consumption
 - Internal heat gain



Achieved Savings of HKPC Building

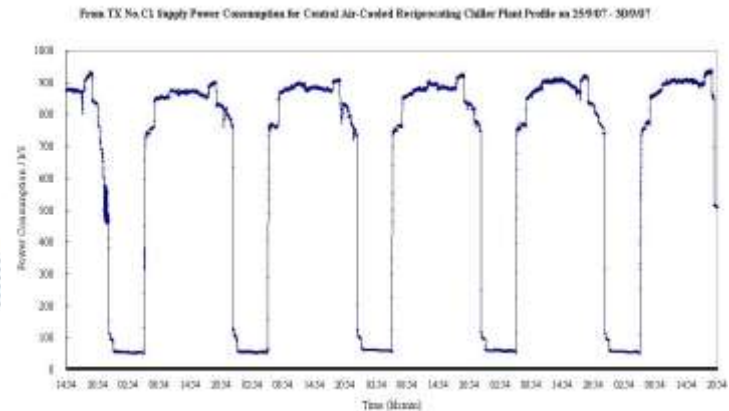


	kWh (mil)	MJ/ sqr. m
2002	9.5	1,294
2008	6.9	971
2011	6.3	884

Note: the average value for the category of whole building (single tenant) for office use is 1,270.6 MJ/m²/year

Energy Audit for a Shopping Centre

- Major energy consuming systems including air-conditioning and ventilation system, lighting system, as well as power distribution systems were the main focus areas of the investigation so as to identify the corresponding energy saving potentials.
- By studying the historical energy consumption data, systems operation and site measurement, energy conservation measures were identified and categorized with its cost implication



Achievement

Saving of HK\$1,200,000 per year (equivalent to an annual GHG reduction of 1000 tonnes of CO_{2e}) was achieved on executing some little or no cost implication measures

- Chiller plant sequencing improvement
- Identify and reduce unnecessary operation and energy consumption
- Improve lighting efficiency of the signage and decoration



Web-based FREE Carbon Management Tools

- CGCC-CMT
- For office operation



CGCC-CMT

Home Introduction Carbon Management Tool Glossary Useful Links Upcoming Event

FREE Carbon Management Tool

How many tonnes of carbon emitted by your company last year?

Click Here to Start

What was the employee number of your company last year?

4402 persons

Employee number includes permanent and temporary staff.

Developer: 香港中華總商會 The Chinese General Chamber of Commerce

Sponsor: 環境保護署 Environmental Protection Department

Implementation Agent: 香港生產力促進局 Hong Kong Productivity Council



Web-based FREE Carbon Management Tools

- Carbon Manager
- For household, catering, retail, and other building operations



Sustainable Development
The Government of the Hong Kong Special Administrative Region

GovHK 香港政府一站通 繁體版 簡體版 SEARCH SITE MAP

Council for Sustainable Development Carbon Manager

Home
Introduction
Carbon Manager
Glossary
Useful Links
News & Events
Contact us

Carbon Manager

The Carbon Manager is a piece of self-explanatory and step-by-step software which features interactive accounting on users' carbon footprints, provisions of both general and specific carbon reduction and energy conservation advices, and benchmarking on users' energy consumptions against the norm in Hong Kong.

It serves as a platform for promoting Hong Kong as a green and low carbon city.

[Click here to start](#)

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Web-based FREE Carbon Management Tools

Objectives of these tools:

- Arouse public attentions on energy saving and carbon reduction in various sectors
- Help users to assess their energy consumption and carbon emissions status
- Help users to formulate feasible energy saving and carbon reduction plans

Case Study – Catering

- The tool helped a Chinese restaurant to identify carbon footprint and actual potential for carbon emissions reduction and energy conservation

Carbon Manager

Preparation Checklist

Information Collection

Carbon Footprinting

Detailed Analysis

Carbon Footprinting > Catering Establishment

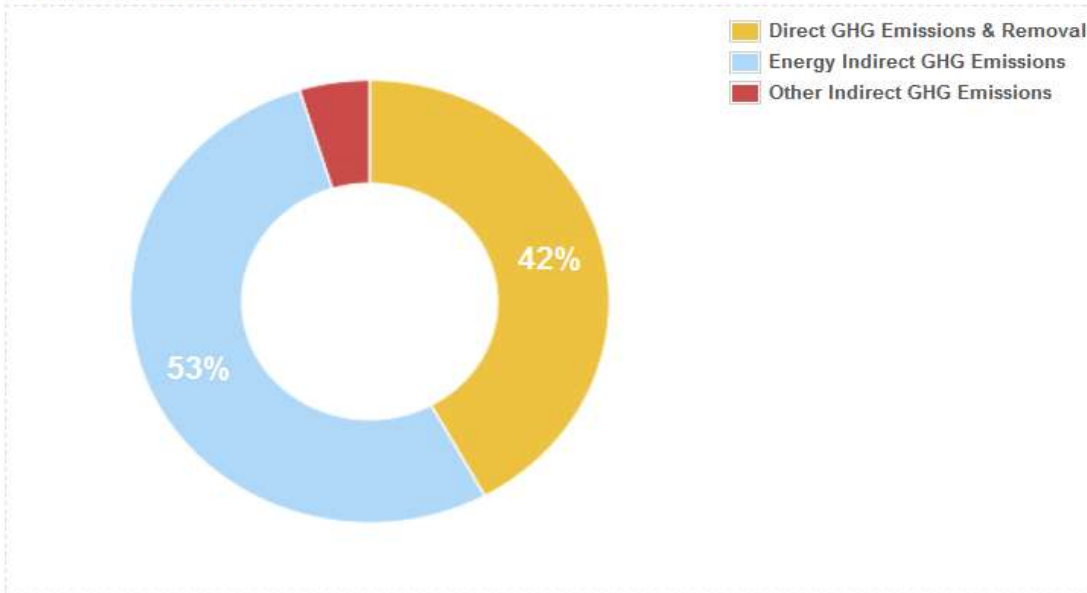
Carbon Footprinting Results

[Detailed Analysis >>](#)

Details:

Scope	CO ₂ equivalent* emissions
Scope 1: Direct GHG Emissions & Removal	178.71 tonnes
Scope 2: Energy Indirect GHG Emissions	226.31 tonnes
Scope 3: Other Indirect GHG Emissions	20.17 tonnes

Emission Chart:



Your total carbon dioxide equivalent* Emission : 425.19 tonnes

Greenhouse Gases Reduction Advice

Space Conditioning Systems

Space conditioning equipment consumed the most energy if you are the owner of the equipment. It can take up to 70% of the total electricity consumption. Here are some advices which can help to reduce energy consumed by the space conditioning system:

- Switch off the air conditioners when not in use.
- Set the air temperature at 25.5°C as it is noted that every 1°C rise of temperature can save around 6% of electricity on air conditioners.
- Use water cooled type central plant air conditioners rather than air cooled central plant air conditioners. This substitution can save 20% or more electricity.
- Close windows and doors to prevent the mixing of cool air indoor with hot air outdoor.
- Switch on air conditioners when necessary and reduce the number of use during cooler days.
- Try to reduce the operation hours of air conditioners. 5% electricity can be saved by reducing the operation hours by 1 hour.
- Choose air conditioners with Grade 1 Energy Efficiency Label (EEL) which can

Detailed Analysis

Welcome, TMChan A A A 繁體 | 简体 Logout Print

Carbon Manager

Preparation Checklist Information Collection Carbon Footprinting **Detailed Analysis**

Detailed Analysis > Catering Establishment

Detailed Analysis



The Detailed Analysis mode intends to analyze the energy consumption performance in respect to yours end-use equipment of your premises. It serves to analyze yours energy consumption performance, explore energy conservation and carbon reduction potentials for your premises. The analyzed result shows the energy consumption performance as compared with others in the same group and overall energy/cost savings potential.

The end-use systems as concerned in the analysis cover all major equipment for use in hot water, lighting, refrigerating and air-conditioning etc. You may choose all or any equipment used in the premises for the analysis.

Based on your input, energy consumption performance result, energy conservation and carbon reduction suggestions will be provided.

Questions to be asked in this mode will require personnel who possesses relevant technical knowledge to answer.

Start ▶

Refrigerating Equipment

1. Refrigerator Coolers

Total number:

Capacity:



2. Freezers

Total number:

Capacity:



Carbon Manager

Preparation Checklist

Information Collection

Carbon Footprinting

Detailed Analysis

Detailed Analysis > Catering Establishment

<< Previous Scope

Next Scope >>

Save

Result

Hot Water Equipment

Space Conditioning Equipment

Refrigerating Equipment

Cooking & Kitchen Equipment

Lighting Equipment

Cooking & Kitchen Equipment

1. Traditional Gas Type Wok Ranges

Type of fuel: Towngas LPG

Total number:

Number of burners: ▾

Daily operating hours: ▾ hours a day



2. Portable Cassette Cookers

Total number:



3. Meat Slicers

Total number:

Blade diameters:



4. Vent Wash Exhaust Hoods

Total number:

5. Commercial Microwave Ovens

Total number:



<< Previous Scope Next Scope >>

Save Result

Hot Water Equipment Space Conditioning Equipment Refrigerating Equipment Cooking & Kitchen Equipment **Lighting Equipment**

Lighting Equipment

1.

Type	Length	Quantity
T8 Fluorescent Lamps (Equipped with Electronic Ballasts)	2 Ft	<input type="text" value="0"/>
	4 Ft	<input type="text" value="250"/>
	5 Ft	<input type="text" value="0"/>



What are the daily operating hours of the lamps? hours a day

2.

Type	Quantity	Average Power (W)
Incandescent Lamps	<input type="text" value="110"/>	<input type="text" value="55"/>



What are the daily operating hours of the lamps? hours a day

Detailed Analysis > Catering Establishment

Detailed Analysis Results

Result 1: Energy Consumption Performance

Your energy consumption performance (as compared with others having similar type of premises):

70%



Percentile: Your energy consumption performance is at the **70th** percentile of same group.

Note: 10th percentile is the best performer rank, 90th percentile is the least performing. The analysed result is derived based on the data collected through local energy consumption survey for the same premises group.

Result 2: Estimated Potentials on Energy Savings and Carbon Reductions

The energy saving potentials in accordance with the given information of your selected equipment are as follows:

Equipment	Total Expected Electricity Savings		Total Expected (Towngas or LPG)* Savings		Total Expected Carbon Reductions (Tonnes/annum)
	kWh/annum	HKD/annum	(Unit or kg)/annum	HKD/annum	
Hot Water Equipment	2,212	\$2,745	0	\$0	1.86
Space Conditioning Equipment	25,757	\$31,964	-	-	21.64
Cooking Kitchen Equipment	-	-	6,570	\$66,068	20.67
Lighting Equipment	19,389	\$24,062	-	-	16.29

Result 2.1: Suggestion Details

Hot Water Equipment	Our Suggestions	Total Expected Electricity Savings		Total Expected (Towngas or LPG)* Savings	
		kWh / annum	HKD / annum	(Unit or kg) / annum	HKD / annum
Electric Storage Water Heaters	- Using Grade 1 heaters	1,938	\$2,405	-	-
Electric Boiling Water Units (for provision of drinking water purpose)	- Disconnect power after business hours	274	\$340	-	-

Space Conditioning Equipment	Our Suggestions	Total Expected Electricity Savings	
		kWh / annum	HKD / annum
Packaged Type Air Conditioners	- Reset temperature set-point at 25.5 °C	25,757	\$31,964

Cooking & Kitchen Equipment	Our Suggestions	Total Expected (Towngas or LPG)* Savings	
		(Unit or kg) / annum	HKD / annum
Traditional Gas Type Wok Ranges	- Use swirl central flame stoves/ranges	3,285	\$33,034
	- Use premix type burners	3,285	\$33,034

Result 2: Estimated Potentials on Energy Savings and Carbon Reductions

The energy saving potentials in accordance with the given information of your selected equipment are as follows:

Equipment	Total Expected Electricity Savings		Total Expected (Towngas or LPG)* Savings		Total Expected Carbon Reductions Tonnes/annum
	kWh/annum	HKD/annum	(Unit or kg)/annum	HKD/annum	
Hot Water Equipment	2,212	\$ 2,745	0	\$ 0	1.86
Space Conditioning Equipment	25,757	\$ 31,964	-	-	21.64
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Result 2.1: Suggestion Details

Hot Water Equipment	Our Suggestions	Total Expected Electricity Savings		Total Expected (Towngas or LPG)* Savings	
		kWh / annum	HKD / annum	(Unit or kg) / annum	HKD / annum
Electric Storage Water Heaters	- Using Grade I heaters	1,938	\$ 2,405	-	-
Electric Boiling Water Units (for provision of drinking water purpose)	- Disconnect power after business hours	274	\$ 340	-	-

Space Conditioning Equipment	Our Suggestions	Total Expected Electricity Savings	
		kWh / annum	HKD / annum
Packaged Type Air Conditioners	- Reset temperature set-point at 25.5 °C/75°F	25,757	\$ 31,964



Effect Analysis

Measures to Implement	Total Electricity Consumed (kWh)	Electricity Cost (HK\$)	Total Towngas Consumed (Units)	Towngas Cost (HK\$)	Total Carbon Emissions (tonnes)
Before	220,000	273,020	70,000	703,920	425.2
After	172,642	214,249	63,430	637,852	364.7
Effect (%)	-21.5%	-21.5%	-9.4%	-9.4%	-14.2%

- Energy Consumption Performance after implementing the measures

Result 1: Energy Consumption Performance

Your energy consumption performance (as compared with others having similar type of premises):

60%



Percentile: Your energy consumption performance is at the **60th** percentile of same group.

Note: 10th percentile is the best performer rank, 90th percentile is the least performing. The analysed result is derived based on the data collected through local energy consumption survey for the same premises group.

Carbon Audits / Verifications for Various Buildings and Operations

Commercial Complex



Commercial Buildings



Sewage Treatment Works and Construction Sites



Hong Kong International Airport Building and Terminal 2



University Campus



Container Terminal

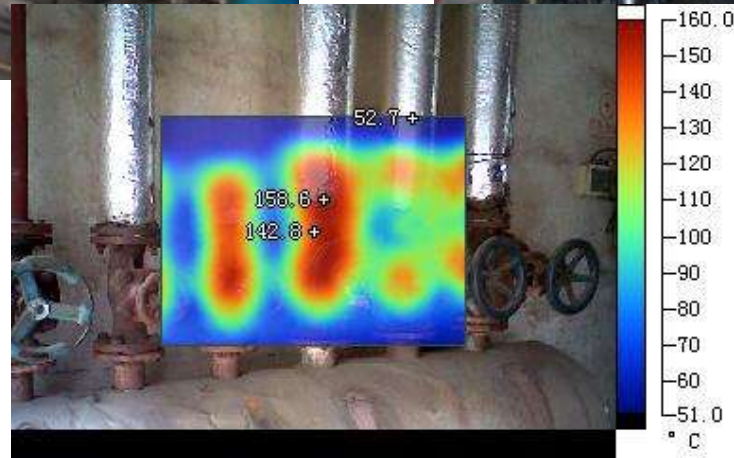


Nursing Home

Hospitals and Headquarters



Industrial plants



CarbonSmart Programme

- An incentive scheme to encourage local enterprises to enhance energy efficiency and reduce carbon emissions
- **Around 200 enterprises**, from office-based operations, retail, catering and other industry sectors will receive funding support from the Environment and Conservation Fund (ECF) to conduct carbon audit
- Helps to promote low-carbon economy in Hong Kong, and promotes collaboration between businesses and the environmental sector



Source: http://www.hkpc.org/index.php?option=com_content&view=article&id=3697&catid=152&Itemid=326&lang=en

Enhance Competitiveness

In addition to actual savings, business operators can look for external recognitions as a means to enhance its competitiveness

- Hong Kong Awards for Environmental Excellence
- Carbon"Less" Certificate
- EnergyWi\$e





Thank you!