The Clean Air Charter
A Business Guidebook

HKGCC

Hong Kong General Chamber of Commerce
香港總商會1861

BCE
BUSINESS COALITION ON THE ENVIRONMENT

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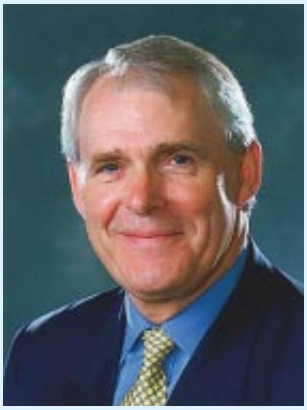
Quality environment is an issue close to the heart of the whole community. None of us tolerate foul air. As Asia's world city, Hong Kong should show the world our commitment to protecting the environment. The Government will take vigorous measures to make sustained improvement to air quality, hand in hand with the community. We are pleased to see the business sector stepping forward with the Clean Air Charter and publishing this Business Guidebook, which gives practical advice on how enterprises may help implement environment-friendly measures in their daily operations. We fully support this meaningful initiative.

We all live under the same sky. Let us work together with determination and shared responsibility for a cleaner and bluer sky.

The Honourable Donald Tsang
The Chief Executive, HKSAR



Through Project CLEAN AIR we have successfully brought together Government, business and the community, united in the common goal of supporting a collective clean air effort. The Clean Air Charter reflects the strong and growing commitment on the part of the business sector to contribute to cleaner air for all, but we can always do more. I encourage all members of the business community to implement clean production, operation and practice, and to work together so we can restore blue skies to Hong Kong and the Pearl River Delta.

David Eldon
Chairman, Hong Kong General Chamber of Commerce

Many local and international companies in Hong Kong have a shared common goal – we must foster economic growth in ways that also protect our environment. Therefore, it is time for us to go beyond signing the Clean Air Charter to put these commitments into practice. I believe that businesses will find this Guidebook useful in formulating their own clean air programmes.

James Graham
Convenor, Hong Kong Business Coalition on the Environment

Preface

Tackling air pollution requires the collective effort of the whole community. This is why the Hong Kong General Chamber of Commerce (HKGCC) and the Hong Kong Business Coalition on the Environment (BCE) launched Project CLEAN AIR, to engage the Government, the business sector and the community together in promoting the clean air message.

The Clean Air Charter is the focus of Project CLEAN AIR. The Charter comprises six statements, representing the business sector's voluntary commitment to reducing air pollution. The HKGCC and BCE regularly organise educational and outreach programmes to support Charter signatories and to help promote the Charter. This Business Guidebook is a general reference to provide advice on implementing the Charter commitments through air quality management.

Air pollutants come from many sources, and it is not the intention of this Guidebook to cover every aspect of air pollution in every industry. Instead, we focus on ways of reducing emissions from businesses in common situations. The guide provides information on management measures that can be adopted for energy consumption, transport and general manufacturing processes. While not everything in this document may be applicable to all, we believe that every company can find a way to get started immediately, whether it is an energy-saving measure in the office or a comprehensive emissions reduction plan.

Please sign the Clean Air Charter if you have not already done so, and put the guidelines and recommendations of this Guidebook into practice. A blue sky for Hong Kong and the Pearl River Delta is possible. Together, we can make a difference!

27 November 2006

www.cleanair.hk

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BCE
BUSINESS COALITION ON THE ENVIRONMENT
香港環境保護工商聯盟

大珠三角商務委員會
The Greater Pearl River Delta Business Council

CCPIT
中国国际贸易促进委员会

广东省环境保护产业协会
Guangdong Association of Environmental Protection Industry

HONG KONG-GUANGDONG BUSINESS COALITION ON THE ENVIRONMENT

Clean Air Charter

We recognise that improving air quality will require emissions reductions in the business community, and many of these reductions will result in additional business capital and/or operating costs. We support the development of fair, practical and cost-effective air quality management policy, and in addition:

Statement of Commitment	Implementation
We will voluntarily:	Signatories to this Charter undertake to implement appropriate measures to put their commitment into effect.
❶ Operate to a recognized world class standard, or the standards established by the Hong Kong / Guangdong governments on emissions of air pollutants, even if it is not a requirement to do so here.	Each participant can identify the relevant standard, and if not meeting it today, make plans to meet it. Participants with significant emissions should state which standard they are operating by, and how they are performing relative to that standard. Participants that are working towards a better standard can also disclose differences between their performance today and the better standards, as well as their plans and schedule for meeting it.
❷ Use continuous emissions monitors (CEMs) at significant sources, e.g. large and medium plants.	Each participant can identify their own significant sources, and if not monitoring today, make plans to do so. These participants should state their intentions.
❸ Publish information on energy and fuel use, as well as total emissions of air pollutants annually and timely, if emissions are significant.	Each participant can determine whether they have significant emissions, and if so, determine how to quantify them. They should publish information on their energy and fuel use, as well as air pollution emissions, as part of their regular environmental reporting, or as a special environmental report on air quality.
❹ Undertake to adopt energy-efficient measures in their operations.	Each participant can identify energy-efficient measures and formulate a plan to implement these measures in their business operations.
❺ Identify and encourage business-relevant measures to be taken on days when air pollution is high.	Each participant can determine how they can reduce emissions on days of high pollution, such as promoting use of public transportation, by working with their customers or vendors to reduce emissions elsewhere in the value chain, by substituting a different process, material or equipment at their own facilities, or by re-scheduling things that could be done at another time.
❻ Share air quality expertise in business with others.	Participants that have expertise, particularly on any of the above items, can host visits or make other arrangements for their staff to share what is relevant to others.

In support of the implementation of this Charter, the Hong Kong – Guangdong Business Coalition on the Environment will help identify general measures for item 5 above, and facilitate or coordinate sharing of relevant expertise for item 6 above. The Coalition would also collect information that participants wish to make public under items 1, 2, 3 and 4 above, and share it in an organised way with the community. In helping private enterprises comply with this Charter, the Coalition recognises the specific needs of small and medium enterprises for support in technology and capacity building.

ENDORSEMENT

Signature: _____ Name: (Mr/Mrs/Ms/Dr) _____

Title: _____ Tel: _____ Fax: _____

Email: _____ Date: _____

Company: (English) _____ (Chinese) _____

Address: _____

Please sign and return a copy to:

(Hong Kong) Hong Kong General Chamber of Commerce, 22/F United Centre, 95 Queensway, Hong Kong Tel: 852-25299229 Fax 852-25279843
(Guangdong) China Council for the Promotion of International Trade - Guangdong Sub-Council
Room 969, Central Hotel Office Building, Jichang Rd, Guangzhou, China Tel: 8620-86597060 Fax: 8620-86577278

Executive Summary

Protecting our air is the responsibility of every business!

The Clean Air Charter is a campaign that seeks the business community's involvement on a wholly voluntary, best effort basis. As businesses vary from sector to sector, the Charter is a statement of general principles to encourage the implementation of an energy and emissions reduction programme in accordance with the individual nature of each company.

Charter's Commitments	Relevant to Business Sectors
1. Operate to a recognised world class standard, or the standards established by the Hong Kong / Guangdong governments on emissions of air pollutants, even if it is not a requirement to do so here.	Industrial operations, power plants and businesses with direct emissions
2. Use continuous emissions monitors (CEMs) at significant sources, e.g. large and medium plants.	Large/medium industrial operations and power plants
3. Publish information on energy and fuel use, as well as total emissions of air pollutants annually and timely, if emissions are significant.	All businesses
4. Undertake to adopt energy-efficient measures in their operations.	All businesses
5. Identify and encourage business-relevant measures to be taken on days when air pollution is high.	All businesses
6. Share air quality expertise in business with others.	All businesses

Air emissions reduction and energy conservation measures can be easily implemented and incorporated into daily business operations. To help businesses get started, this Guidebook introduces an Energy/Emissions Management (EEM) System that provides step-by-step guidance on how to reduce air emissions and energy consumption.

Specifically, the Guidebook provides:

- An approach, and associated references, to enable readers to identify their companies' contributions to air emissions and energy consumption;
- A strategy for establishing corporate emissions reduction or energy saving targets with the support of senior management;
- Examples of energy saving and air emissions control measures; and
- A system for monitoring and reporting performance.

An overview of the EEM Strategy is illustrated in the following flowchart. The EEM Strategy can be implemented on its own or as part of a company's Environmental Management System (EMS).

Taking Action to Save Our Air

1. GETTING STARTED

To get the EEM Strategy or process started, an Energy/Emissions Management (EEM) Team should be formed. The EEM team will be responsible for establishing and managing the EEM strategy or process. This section provides information on how to set up an EEM Team.

Establishing an Energy and Emissions Management (EEM) Team

The EEM Team will take the lead in:

(1) Identifying their company's air emissions and energy consumption
(2) Establishing energy/emissions reduction targets,
(3) Developing energy/emissions reduction plans,
(4) Implementing the reduction plans,
(5) Conducting regular energy/emissions audits,
(6) Comparing audit findings with reduction targets, and
(7) Reviewing energy/emissions reduction targets.

The EEM Team should comprise, at a minimum, an EEM Manager supported by an EEM Team that includes representation from different departments.

Appointing an EEM Manager

The duties of the EEM Manager should include:

- Liaising with top management on the company's strategy on energy/emissions reduction;
- Developing and reviewing EEM Strategy;
- Establishing the energy/emissions reduction targets;
- Facilitating and driving implementation of the EEM Strategy with support of top management;
- Raising awareness of, and providing advice to, staff on emissions/energy reduction measures; and,
- Monitoring and improving the effectiveness of the EEM Strategy.

It is important that the EEM manager is appointed by senior management and he or she receives the full support of the senior management team. The individual selected should:

- Have sufficient influence and authority to implement the EEM Strategy across the organisation;
- Be familiar with the operation of different departments within the organisation; and
- Have a good understanding of the need to reduce energy consumption and emissions.

Setting up an EEM Team

The EEM Team should include representatives from different departments across the organisation. Members of the Team should take responsibility for managing EEM issues under the chairmanship of the EEM Manager.

The duties of the EEM Team should include:

- Providing skills, knowledge and expertise to support the implementation of the EEM programme;
- Collecting and collating information to develop and monitor the EEM Strategy;
- Raising staff awareness of, and enthusiasm for, emissions reduction and energy saving measures;
- Driving implementation of measures to reduce emissions and minimise energy consumption;
- Providing information and training to staff; and
- Evaluating and reporting on the effectiveness of the Strategy with the support of the EEM Manager.

2. UNDERSTANDING YOUR COMPANY

Before establishing reduction targets or developing an implementation programme, it is important to understand your company's air emissions and energy consumption. This section provides guidance and references on how to evaluate your company's air emissions and energy consumption and how to conduct an initial audit of operations.

Identifying Emissions Sources

Energy Consumption

Saving energy reduces air emissions. Electricity and fuel consumption can be used to quantify energy consumption. This information can be gathered from your utility and fuels bills. If this information is not routinely kept, establishing a system to do so is an important first step in quantifying your energy consumption.

1 unit of electricity consumed is equal to 1 kilowatt hour (kWh) and 1 unit of gas consumed is equal to 48 megajoules (MJ) for Towngas or 46 MJ for liquefied petroleum gas (LPG). These conversion factors are useful for quantifying energy consumption on a common basis across different sectors and estimating corresponding direct and indirect air emissions.

Air Emissions

Industrial operations, vehicles and power plants are the main "direct" air pollution sources in the PRD region. Offices are also an "indirect" air pollution source as the electricity consumed by these operations results in air emissions from power plants.

Sulphur dioxide (SO_2), nitrogen oxides (NO_x), particulate matter (PM) and volatile organic compounds (VOCs) are key air pollutants in the PRD region. The Hong Kong Special Administrative Region Government (HKSAR Government) and the Guangdong Provincial Government reached a consensus in April 2002 to reduce emissions of SO_2, NO_x, PM and VOCs by 40%, 20%, 55% and 55%, respectively, by 2010, using the emissions levels at 1997 as a base. Therefore, this section focuses on quantifying SO_2, NO_x, PM and VOCs emissions.

Selective key air pollutant emissions sources are summarised below.

Emissions Sources	Air Pollutants			
	Sulphur Dioxide (SO_2)	Nitrogen Oxides (NO_x)	Particulate Matter (PM)	Volatile Organic Compounds (VOCs)
Fuel Consumption				
Coal and oil-fired power plants	✓	✓	✓	
Diesel oil-fired generators, boilers and furnaces	✓	✓	✓	
Vehicles				
Motor vehicles	✓[a]	✓	✓	✓
Marine vessels	✓	✓	✓	
Petrol filling stations				✓
Typical Manufacturing Industries (emissions from processes) [b]				
Cement	✓	✓	✓	
Chemical				✓
Construction	✓	✓	✓	
Electronics				✓
Plastics			✓	✓
Printing				✓
Textiles	✓	✓	✓	✓
Toys			✓	✓
Indirect Source				
Office	✓[c]	✓[c]	✓[c][d]	✓[e]

Notes:
(a) Motor vehicle fuel sold in Hong Kong has a low sulphur content. Much of the diesel sold on the Mainland does not.
(b) Many different industries operate in Hong Kong and the Pearl River Delta region. These are just some of the more common industry sectors.
(c) SO_2 and NO_x emissions are generated from energy consumed in offices.
(d) PM emissions in offices also include dusts from ventilation systems, paper, photocopiers, printers, etc.
(e) VOCs in offices come from cleaning agents, chemical usage, paints, furnishing, etc.

Quantifying Air Emissions

Energy Consumption

Electricity, Towngas or liquefied petroleum gas (LPG) are the common sources of energy used in Hong Kong. "Indirect" air emissions from offices can be estimated by considering the quantity of electricity consumed, as identified from monthly electricity bills, and using typical emissions factors.

Electricity

Nitrogen oxides (NO_x), sulphur dioxide (SO_2) and particulate matter (PM) are the major air pollutants generated from power stations. A reduction in electricity used will reduce air emissions from power stations. To estimate indirect emissions from electricity usage in Hong Kong, the following equations can be used.

EMISSIONS ESTIMATION FROM USE OF HONG KONG ELECTRICITY

NO_x = electricity used (no. of units**) x 1.3 (g/kWh)
SO_2 = electricity used (no. of units**) x 2.1 (g/kWh)
PM = electricity used (no. of units**) x 0.1 (g/kWh)

EXAMPLE OF EMISSIONS ESTIMATION

Emissions estimation from the electricity bill from the office of "ABC" in Hong Kong.

Meter Number	Present Reading	Previous Reading
1020188	360345	358746

Multi Factor		Units Consumed
10		15990
	Total	15990

NO_x = 15,990 x 1.3 (g/kWh) = 21 kg
SO_2 = 15,990 x 2.1 (g/kWh) = 34 kg
PM = 15,990 x 0.1 (g/kWh) = 1.6 kg

*** 1 unit (in the electricity bill) = 1 kWh*
Reference to CLP Social and Environmental Report 2005 and HEC Environment, Quality, Health and Safety Report 2005

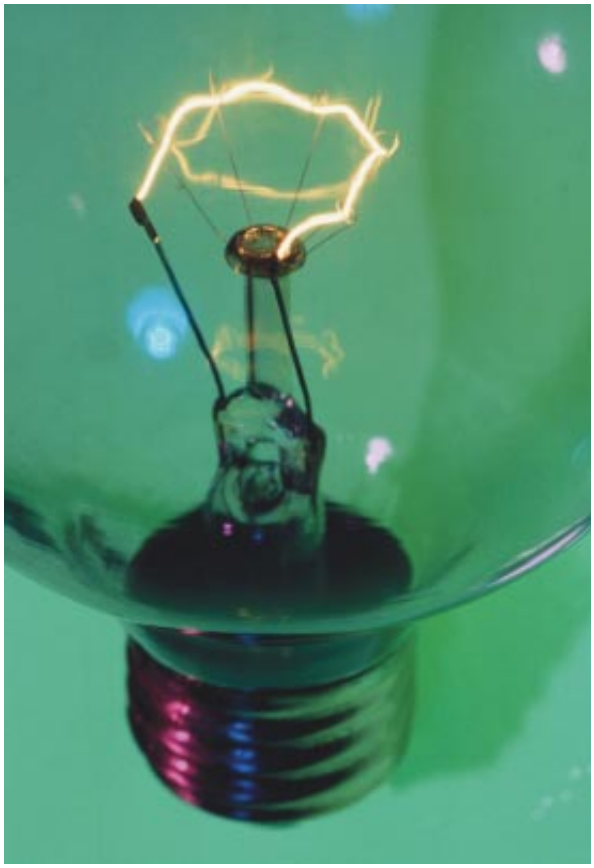
Towngas/Liquefied Petroleum Gas (LPG)

Apart from electricity consumption, gaseous fuel is also another common energy source in Hong Kong. NO_x is the main air pollutant resulting from gaseous combustion. NO_x emissions can be estimated using the following equation.

EMISSIONS ESTIMATION FROM GASEOUS FUEL CONSUMPTION

[Towngas]
NOx = no. of unit x 48 (MJ) x 8.92 (kg/106 MJ of gas)
[LPG]
NOx = no. of unit x 46 (MJ) x 8.92 (kg/106 MJ of gas)

Reference to Towngas Environment, Quality, Health and Safety Report 2005



Vehicle Movement / Idling

NO_x and PM are the main air pollutants generated from vehicle movements on roads and idling. Different sizes and types of vehicle engines produce different levels of air pollutants. Estimating air emissions from vehicle fleets is complex and would require more detailed information on the vehicle type, engine condition, fuel used, and running pattern, etc. To provide a simple way, total distance travelled and idling time can be used to conduct rough estimations of vehicle emissions.

The HKSAR Environmental Protection Department (EPD) has developed a comprehensive EMFAC model to estimate vehicle emissions. Further information on the EMFAC model can be found at EPD's Website: *www.epd.gov.hk/epd/english/environmentinhk/air/guide_ref/emfac.html*.

EMISSIONS ESTIMATION FROM VEHICLE MOVEMENT / IDLING

While Travelling

Air Emissions = [kilometres travelled] x [average emissions factor for different vehicle type (g/km)]

Air Pollutant	NO_x	PM
Average Fleet Vehicle Emissions (g/km travelled)		
Passenger Car	0.9	Negligible
Light Goods Vehicle	1.6	0.3
Heavy Goods Vehicle	8.2	0.6

Example:
A light goods vehicle running 20 km a day,
NO_x emissions = 20 x 1.6 = 32 g ; PM emissions = 20 x 0.3 = 6 g

While Idling

Air Emissions = [Idling time (min)] x [average emissions factor for different vehicle type (g/min)]

Air Pollutant	NO_x	PM
Average Emissions Factor (g/min of idling)		
Passenger Car	0.2	Negligible
Public Light Bus / Passenger Van /Light Goods Vehicle	0.5	0.05
Heavy Goods Vehicle / Non-franchised / Franchised Bus	2.0	0.05

Example:
A heavy goods vehicle idling to unload goods for 10 minutes,
NO_x emissions = 10 min x 2.0 g/min = 20 g ; PM emissions = 10 min x 0.05 g/min = 0.5 g

Reference to Energy Consumption Indicators (HKSAR Electrical and Mechanical Services Department), Traffic Census 2005 (HKSAR Transport Department), and Emissions Inventory Guidebook 2005 (European Environment Agency)

Industrial Operations

Power plants and industrial operations contribute to the local air pollution problem in Hong Kong and the Pearl River Delta (PRD). Industrial processes and back-up diesel generators produce a variety of different air pollutants.

Power Plants in PRD Region

Emissions from power plant operating in Hong Kong have been discussed in the above section. In the PRD region, there are a large number of government and privately owned power plants operating. As noted above, NO_x, SO_2 and PM are the main air pollutants from these power plants.

In China, power plants are mostly coal-fired. The emissions levels of SO_2 from power plants depend in part on the sulphur content of the coal used as well as the nature and type of emissions controls installed, which can vary significantly between power plants. The following equations can be used to estimate pollutant emissions from electricity consumed in the PRD.

EMISSIONS ESTIMATION FROM ELECTRICITY IN MAINLAND CHINA

NO_x = electricity used (kWh) x 1.4 (g/kWh)

SO_2 = electricity used (kWh) x 2.1 (g/kWh)

PM = electricity used (kWh) x 0.2 (g/kWh)

Reference to Study of Air Quality in the Pearl River Delta Region, Environmental Protection Department, HKSAR

Diesel Backup Generators

Diesel generators are usually used as backup for power generation in manufacturing industries. Air pollutants will be generated from the combustion of diesel oil and NO_x is the main air pollutant. The emissions of NO_x can be estimated based on the installed capacity of the generator and an emissions factor. The following simplified formula could be useful for estimating NO_x emissions.

EMISSIONS ESTIMATION FROM A DIESEL BACKUP GENERATOR

NO_x = installed generator capacity (hp) x 0.014 (kg/hp-hr) x operating hour (hr)

Source : Compilation of Air Pollutant Emissions Factors, AP-42, 5th Edition, U.S. Environmental Protection Agency

Diesel Boiler

Diesel boilers are usually used to provide heat and steam for the manufacturing processes such as dyeing. NO_x and SO_2 are the main air pollutants generated from the combustion of diesel oil. Such emissions can be estimated based on the diesel oil consumption, sulphur content in diesel oil and the well-established emissions factors. The following simplified formula could be useful for estimating NO_x and SO_2 emissions.

EMISSIONS ESTIMATION FROM A DIESEL BOILER

If power rating < 293 kW

NO_x = diesel oil consumption (litre) x 2.2 g/litre

SO_2 = diesel oil consumption (litre) x 17 g/litre x sulphur content in diesel oil (%)

Source : Compilation of Air Pollutant Emissions Factors, AP-42, 5th Edition, U.S. Environmental Protection Agency

Industrial Process

Different types of industrial processes will produce different types of air emissions. The U.S. Environmental Protection Agency (EPA) developed a *Compilation of Air Pollutant Emissions Factors, AP-42, 5th Edition (AP-42)* in 1995, which is a comprehensive guidebook to assist facility operators to understand:

- The types of air pollutants generated by specific activities;
- Methodologies for estimating emissions factors; and
- Suitable air pollution control measures and associated removal efficiencies.

The AP-42 covers a number of industrial activities including:

- External combustion sources such as boilers;
- Solid waste disposal such as landfills;
- Stationary internal combustion sources such as gas turbine engines;
- Evaporation loss sources;
- Petroleum industries;
- Organic chemical process industries;
- Liquid storage tanks;
- Inorganic chemical industries;
- Food and agricultural industries;
- Wood products industries;
- Mineral products industries such as concrete batching and stone crushing;
- Metallurgical industries such as aluminium manufacturing.

For further details: *www.epa.gov/ttn/chief/ap42*

Volatile Organic Compounds (VOCs)

VOCs are a family of chemical compounds that possess high vapour pressure and low water solubility. Many VOCs are human-made and are used in the manufacturing of paints, inks, adhesives, pharmaceuticals and refrigerants.

A "Joint Study on Pearl River Delta Region Air Quality" completed in 2002 identified paints, the printing industry, VOC-containing consumer products and motor vehicles to be the major VOC emissions sources in the PRD. VOCs are mainly emitted from the solvent evaporation and the level of VOC emissions depends on the composition of the products and solvent. For example, VOC emissions will be higher from solvent-based paint or printing inks than their water-based equivalents.

The HKSAR Government proposed in late 2004 a scheme to require mandatory registration and labelling of the VOCs in paints, printing inks and selected consumer products for sale in Hong Kong. However after extensive consultation, the Government has amended the initial proposal to be a more direct and effective control scheme.

In the 2006 Policy Address on 11 October 2006 the HKSAR Chief Executive, Mr Donald Tsang, announced that legislation to restrict the VOC content of printing materials, paints and consumer products will be introduced, based on stringent U.S. and California standards. The new regulation will impose maximum limits on the VOC content of selected products in phases from 1 April 2007. This will enhance significant reduction of VOC emissions. During the transitional periods, paints not complying with the future VOC limits will be required to carry a bilingual advisory label.

Conducting An Initial Audit

Before defining the EEM objective and establishing the reduction target, you should know the current position of your company, i.e., how much energy is consumed and how many emissions are produced by your operation. Carrying out an initial energy and emissions audit is essential to gather the background data of the company.

The types of data to be gathered should include:

General Information	• No. of staff • Working hours • Floor area
Information related to air emissions	• Number of operating stacks • Types of fuel used (i.e., diesel, natural gas, LPG, etc.) • Monthly fuel consumption rate (litre/month or m^3/month) • Operating hours of each stack • Any air control measures (i.e., air filter, wet scrubber, cyclone, activated carbon, etc.)
Information related to energy consumption	• Number and types of office equipment (i.e., printers, computers, photocopiers, fax machines, etc.) • Power rating of industrial equipment (kilowatts, horsepower, etc.) • Operating hours of each equipment • Type and number of fluorescent tubes / light bulbs • Electricity bills for the past twelve months • Gas bills for the past twelve months • Number of air conditioning units • What type of air conditioning system (i.e., window-mounted type, split type, water-cooling tower, etc.)
Information related to vehicular emissions	• Total number of company cars and trucks by type and size of vehicle • Total kilometres travelled by cars and trucks by type and size of vehicle

The gathered data can be used to estimate the energy consumption and air emissions based on the equations and references presented above. In addition, the benchmarking system of the HKSAR Electrical and Mechanical Services Department (EMSD), as described in the next section, also provides guidance on how to estimate energy consumption.

The initial audit should be carried out by the EEM Team. The gathered data should be recorded and kept on file to enable tracking of performance. A sample template for undertaking an initial audit can be found in *Appendix A*.

Energy Audit – An Effective Energy Management Tool

"To many SMEs, energy audit sounds like a technical term, but it is simply an examination of existing energy consuming systems and housekeeping practices to ensure that energy is being used efficiently," Mr Eddie Wu, Energy Services Manager of CLP Power Hong Kong Limited (CLP Power) said. "You can always find room for improving energy efficiency by just walking around your offices or premises and conducting a site survey according to the Energy Audit Guidelines, which is available from various sources such as the Government's website."

Since 1999, CLP Power has dedicated an Energy Services Team to conduct energy audits for more than 500 large commercial and industrial customers, helping them increase energy efficiency and achieve tangible energy savings. Amongst them is a large property management company which manages many office towers, hotels, service apartments and shopping arcades, a case illustrated by Mr Wu.

"On lighting and hot water supplies, the property management company installed over 20,000 electronic ballasts, phased out several aging gas or diesel boilers and switched to the highly energy efficient and emission-free heat pump water heating systems. On power supply, capacitor banks have been installed to improve the power factor. On air-conditioning, the customer was advised to use fresh water cooling towers for chiller heat rejection. Total energy savings from all these initiatives are as high as 5 million kWh a year."

Energy audit is similar to financial accounting. It is a quick way to assess and analyse energy performance, identify obvious energy wastage and opportunities for energy savings that help reduce emissions.

"Through auditing, customers are made aware of their potential areas of energy inefficiency," Mr Wu continued to explain. "During the visits to customers' premises, we gave various advice to clients, ranging from housekeeping management to installation of energy-efficient equipment. Our experience shows that through energy audit, most users can identify the potential to save 5-10% on overall energy costs."

Many energy saving practices are just simple steps. For example, replacing T12 or T10 fluorescent tubes with T8 or T5 energy efficient fluorescent tubes can improve 10% to 30% energy efficiency; using LCD monitor can save more than 50% of the electricity than that of the CRT monitor; regular cleaning of condenser tubes, cooling coils and air filters can help maintain cooling efficiency; using energy efficient equipment (e.g. equipment affixed with Energy Label) can reduce energy consumption.

Other than energy audits, CLP Power has actively contributed to raising energy saving and environmental awareness through various programmes such as community-based education activities and regular seminars or conferences to share international and local energy practices with SMEs.

3. DEVELOPING ENERGY/EMISSIONS MANAGEMENT SYSTEM

Depending on the scale of your operations and the resources available it may be necessary to prioritise certain areas for initial action. Prioritisation criteria could include your main areas of energy use and/or significant emissions sources. Alternatively, benchmarks can be an effective way of identifying areas that could be readily addressed and hence prioritised.

Assessing Your Company's Position by Benchmarking

Initial audit findings can be used to benchmark operations against industry standards. Benchmarks can also be used as a basis for establishing achievable reduction targets.

The Energy Indicator (EI) and Benchmarking System developed by the EMSD is an effective tool to establish benchmarks. The tool:

- Provides data on energy/emissions levels within particular industrial sectors, processes or building types;
- Allows organisations to compare their own performance with that of others in equivalent situations; and
- Provides advice on measures to improve energy efficiency.

The Benchmarking System can be used as a basis for identifying energy efficiency and hence indirect emissions reduction opportunities. By using information such as total electricity and fuels consumed, building floor areas, the number of computers, the number of staff, operating hours, etc., the System allows users to benchmark their company against similar operations in their industry sector online.

The EMSD System is currently available for 11 common industry groups in Hong Kong, as follows:

- Offices
- Commercial Outlets
- Hotels and Boarding Houses
- Universities, Post-secondary Colleges and Schools
- Hospitals and Clinics
- Private Cars
- Light Good Vehicles
- Medium Goods Vehicles
- Heavy Goods Vehicles
- Private Light Buses and
- Non-Franchised Buses

The EIs of each group are summarised in *Appendix B.*

Use of the online system (*www.emsd.gov.hk/emsd/eng/pee/ecib.shtml*) provides users with information on how efficiently they are using energy compared to average operations in Hong Kong, and hence allows for the identification of realistic energy reduction targets. Companies can use the EMSD's benchmarking system and associated EIs to review their current performance.

Establishing Targets

Once areas for improvement have been identified, the EEM Team can establish specific energy consumption and air emissions targets. The targets should be **SMART**:

- **S**pecific: they say exactly what you mean.
- **M**easurable: you can prove that you've reached them.
- **A**chievable: you can reach them within a specified timeframe.
- **R**ealistic: they are about actions you can take.
- **T**ime-related: they have deadlines.

Example of **SMART** targets for energy efficiency and air emissions are provided below:

- *Reduce energy consumption by X% within Y year(s)*
- *Reduce NO_x emissions from diesel generators by X% by January 200Y*

No idea where to start? A benchmark can help

Businesses often find it difficult to evaluate whether their energy consumption and emission conform to environmental standards. A benchmarking system can certainly help.

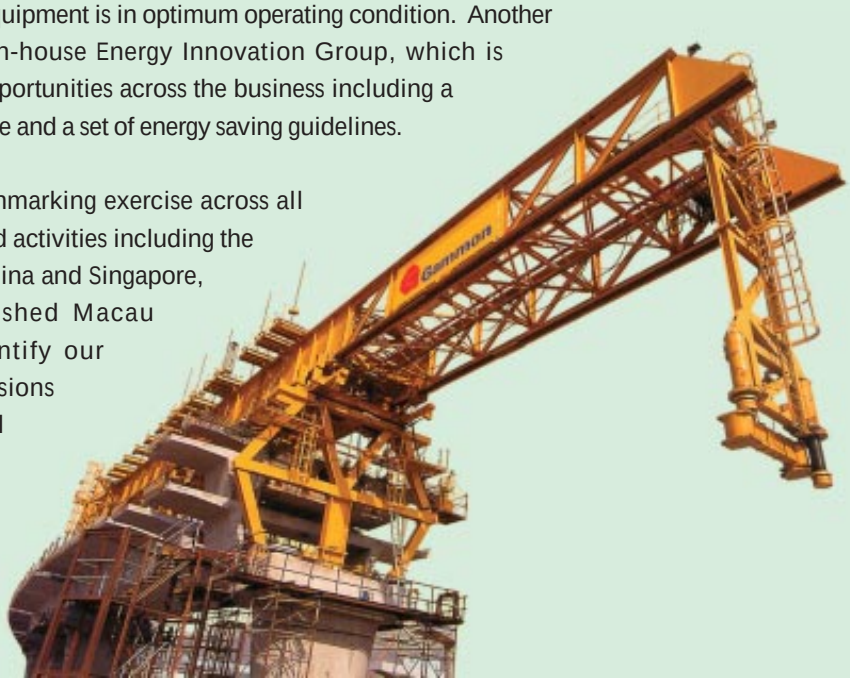
"Basically, benchmarking refers to comparing current performance against other similar operations." Mr Peter Rawlings, Environmental Manager of Gammon Construction Ltd, explained. "When you purchase a new car and compare its kilometres per litre against other cars, that is benchmarking – you are seeing how something performs when compared to others."

In 2003, Gammon began to benchmark the environmental performance of its Hong Kong operations by firstly collecting a comprehensive and representative data set. This involved all project sites, requiring all to return monthly environmental data forms with information on electricity and diesel consumption, waste generation and water usage. The 2003 data was then standardised and utilised to generate a series of key performance indicators (KPI's) that were used for future monitoring of other operations. Subsequent yearly data is compared through the KPI's to track improvements and changes in performance.

"The KPI's cover fuel consumption by our plant, equipment and vehicles, which is an indirect measure of exhaust emissions, and other indirect emissions from electricity consumption and the materials and chemicals we procure," Mr Rawlings elaborated. "We have also established an in-house working group comprising representatives from our different operating units to develop an action plan to reduce our air quality impacts arising from transportation, on-site plant usage, electricity consumption and chemicals usage."

For example, Gammon has the largest plant fleet in Hong Kong, comprising over 1,300 pieces of plant assets. To manage and minimise environment impacts, a comprehensive Preventive Maintenance Programme has been developed and implemented, providing a baseline level of performance for the plant fleet so as to ensure that all plant and equipment is in optimum operating condition. Another example is the creation of an in-house Energy Innovation Group, which is investigating energy efficiency opportunities across the business including a prototype energy-efficient site office and a set of energy saving guidelines.

"In 2005, we extended the benchmarking exercise across all areas of Gammon's operations and activities including the main offices, support services, China and Singapore, as well as our newly established Macau operation. We now also quantify our equivalent carbon dioxide emissions and our use of Montreal Protocol substances, and year 2005 marked our first year in fully reporting on greenhouse gases across all of our regional businesses," Mr Rawlings said.



Managing Energy Efficiency by Objectives and Targets

Mr Andrew McCusker

"Energy efficiency is also business efficiency," MTR Corporation's Operations Director, Mr Andrew McCusker said.

Energy management is particularly important to MTR which transports some 2.5 million passengers every day, moving them around 53 stations with over 100 trains. Given such high volume of people and mechanical movement, the optimisation of energy is viewed as a continual process to achieve the long-term goal of improved cost efficiency and operational excellence.

Obviously, the railway operations managed by MTR is a huge network. Traction and air-conditioning are the two major areas of MTRC's electricity consumption. In addressing the electricity need of moving trains and the supporting infrastructure, the company has used the advanced technology to improve the energy efficiency. The installation of chopper system and the replacement of traditional motor alternators with solid state inverters has improved the energy efficiency by 17% and 10% respectively. As for air conditioning, individual cars are managed by a weight cell to adjust the temperature according to passenger-load. Platform screen doors, while enhancing the safety of passengers, also help reduce air-conditioning cost by 10%.

Many other energy saving measures have been taken ranging from ventilation to lighting. One of the most recent initiatives is the installation of LED lighting in car saloons under a trial scheme in cooperation with a local university.

For such highly mechanical and complicated business involving 6,500 employees, it has not been an easy task for the management to motivate everyone in the MTR Corporation, including the frontline staff, to work towards a common goal.

The key to MTR's success is to set objectives and targets, which will be incorporated into business plans. "Even if it is a trivial objective of say half a percentage of energy and if the management follows on that objective, people will have that in their business plan," said Mr McCusker. With clear business plans, managers and department heads are all well informed of the targets and know where to start, he added.

The Review Group of Energy Consumption has been set up to establish energy reduction targets and develop management plan. Under the Committee there are a number of task forces and working groups across different departments to ensure that the company's targets are well understood by all staff.

According to Mr McCusker, the Corporation needs to create a culture of continual improvement, by giving recognition and reward to staff who have contributed to energy saving practices, so that staff will wholeheartedly take part in the programmes and campaigns.

Developing An Action Plan

After establishing reduction targets, an Action Plan should be developed. Responsibility and timelines for implementing the actions should be defined. Responsibilities for action should not be limited to the EEM Team. Some actions, for example, turning off computers and lights, will require the support of many staff members. The action plan will therefore need to include internal communication and raising awareness.

For actions that may take longer to implement, consideration should be given to setting interim goals and metrics for tracking progress. For example, due to cash flow constraints, the replacement of CRT with LCD monitors within small enterprises may need to be staggered over a longer time frame and an interim target of replacing 40% by year end may be appropriate.

Section 4 provides some examples and references for the types of actions that can be included within EEM action plans.

Consideration should also be given to identifying audit and performance monitoring schedules within the action plan. Some actions may require regular monitoring to ensure implementation, while overall progress against targets might just be measured on a semi-annual or annual basis. Further discussion on audit and reporting is provided in section 5.

Example of an Action Plan

Reduction Target	Responsible Person	By when
e.g. replace all conventional fluorescent tubes with energy efficient tubes in area A	AB Cheung	31/3/07
1.		
2.		
3.		

Sustain Energy Saving Programme by Adopting Knowledge-based Approach

Swire Cooling Towers at Festival Walk – The largest conversion from air-cooled to water cooled air-conditioning plant at that time.

"To implement an energy saving programme, three key factors are critical, top management's support, committed staff and knowledge." Ir Cary Chan, Head of Technical Services of Swire Properties said. "To get buy-ins, we need to be able to use information and knowledge to demonstrate to top management the tangible and non-tangible values of implementing energy reduction measures".

Swire Properties' investment portfolio in Hong Kong comprises mainly office and retail premises, as well as serviced apartments and other luxury residential accommodation, totaling about 1.16 million m^2 of gross floor area. Together they consumed over 220 million kWh of electricity in 2005 at a cost of about HK$250 million. In comparison with 2002, a saving of 11 million kWh of electricity per year was achieved after the implementation of energy saving programme.

"In 2002, we consolidated our company-wide energy saving efforts by formalising an energy task force, the Technical Efficiency Team to manage energy issues, develop and monitor energy conservation measures," Ir Chan said. "Air conditioning and lighting systems are two of the key areas we focus on since their electricity consumption represented over 80% of that of a commercial building."

The energy saving measures they've taken range from simple, low cost measures to more capital and knowledge intensive initiatives.

Relatively simple energy saving initiatives were then taken, for example, to replace lighting supplies with more energy efficient equipment such as T-5 tubes, and to review operation schedules so that lighting equipment was used only where and when necessary. On the other hand, the retrofit of air conditioning plants from air-cooled to water-cooled, and from constant air volume to variable air volume systems, required more investments. For air-conditioning systems, estimating annual energy savings is a challenging task as the efficiencies and hence the energy consumption of air-conditioning plants depend on a lot of variables such as outdoor temperatures, humidity, occupancies, etc. which are changing from hour to hour and day to day.

"Before implementing any energy reduction measures, past operating data are collected for at least a whole year to construct the relationship between the air-conditioning plants' efficiencies and the various changing factors. Such becomes our knowledge to our systems and forms the basis for our feasibility studies and our three year energy saving plans. To sustain our energy saving programme, we have adopted a knowledge-based approach through the continuous capturing and analysing of data in order to explore new opportunities for improvements. By adopting this approach, we have successfully derived and implemented a number of control strategies in the past two years, resulting in substantial energy reduction. Two notable ones are static pressure reset for variable air volume systems and the variable primary chilled water flow system at Festival Walk," Ir Chan said.

To move forward, the company is in the process of building a large database to capture and store all operating data from the Building Management Systems. Software is being developed in-house to automatically analyse data from the database to identify/diagnose faults of the air-conditioning plants and monitor its efficiencies. By making use of their knowledge base, the Technical Efficiency Team is able to generate more optimisation strategies.

This proves the old proverb – " Knowledge is Power." In Swire's case, knowledge saves energy, continually.

4. IMPLEMENTING ENERGY / EMISSIONS REDUCTION MEASURES

The Clean Air Charter lists six key areas in which businesses can make a difference to reduce air pollution. Although many of these reductions may result in additional business capital and/or operating costs, every business should look into their business nature, develop a fair, practical and cost-effective air quality management policy.

7-7-7 Care-for-Air Public Guideline

The HKGCC and the BCE have developed the "7-7-7 Care-for-Air" Guideline for the general public to take immediate, practical steps to contribute to improving air quality at home, at work and while travelling, especially when the Air Pollution Index is high.

Make That Little Effort at Home

1. Switch off unnecessary domestic appliances - make use of natural light and ventilation.
2. Don't use standby mode - turn off appliances completely when not in use.
3. Set a comfortable room temperature - don't over cool or over heat.
4. Avoid using the tumble drier.
5. Don't use products containing VOCs, e.g. paints, hair and personal care sprays, etc.
6. Reduce direct emissions from cooking, e.g. thaw food in the fridge before cooking, postpone your BBQ, etc.
7. Don't smoke.

Make That Little Extra Effort at Work

1. Activate "sleep" mode in office equipment during office hours, including photocopiers, scanners and printers.
2. Don't use standby mode after working hours - turn off unnecessary equipment completely including the computer.
3. Minimise photocopying to reduce ozone emissions.
4. Wear clothing that keeps you comfortable in the office.
5. Make conference calls or use other electronic media to reduce travelling for business meetings.
6. Adopt flexible working hours to reduce emissions caused by traffic congestion.
7. Use products with zero or low VOCs during renovations.

Make That Little Extra Effort on the Road

1. Reduce unnecessary travel.
2. Use the stairs wherever possible to save energy.
3. Walk or ride a bicycle for short journeys.
4. Use public transport.
5. Plan your travel or carpool to avoid single-passenger car trips.
6. Stop using vehicles that emit black smoke.
7. Don't leave the engine idling.

Offices and Workplaces

Various organisations have provided tips that are relevant to reducing energy consumption in commercial premises in Hong Kong. Below are some examples of practical measures.

Ventilation and Air Conditioning Systems

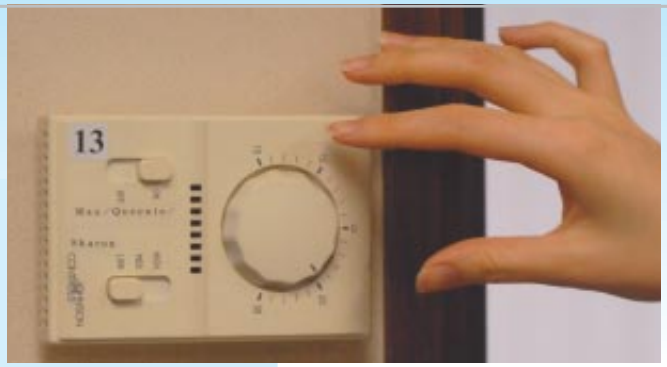
Energy and emissions reduction measures for ventilation and air conditioning include:

- Setting the temperature of air-conditioned rooms to a comfortable temperature;
- Cleaning air-conditioning systems and dust filters regularly;
- Using water-cooled air conditioning systems instead of the air-cooled type;
- Encouraging staff to wear suitable clothing (e.g. allowing staff not to wear suits);
- Installing thermometers to monitor the room temperature; and
- Installing carbon dioxide (CO_2) sensors to monitor indoor air freshness and to control the operation of the fresh air intake.

Tip:

If the temperature of an air-conditioned room were set one degree higher, the electricity consumption would be reduced by 10%.

Source:
Health, Safety and Environmental Report 2004
Towngas Website: www.towngas.com



Reduce Emissions from Air-Conditioning

In Hong Kong, power used for air-conditioning accounts for 1/3 of the total consumption. If the temperature of all air-conditioned venues is raised by one degree Celsius, we can save more than 300 million units of electricity a year. This means the population can save $300 million in electricity tariffs, reduce about 200,000 tonnes of carbon dioxide, 800 tonnes of sulphur dioxide, 400 tonnes of nitrogen oxides and 30 tonnes of respirable suspended particulates annually.

Given such a high level of energy consumption for air-conditioning, workplace temperature should be adjusted to a comfortable level, but not excessive, to encourage energy conservation and to reduce emissions. Companies should make reference to the relevant standard recommended by the HKSAR Government, i.e. setting air-conditioning temperature at 25.5℃ during the summer months.

Source: HKSAR Government

Use of Water-cooled Evaporative Chiller

In 2004, The Hong Kong and China Gas Company Limited (Towngas) saved over 500,000 kWh at their North Point Headquarters by becoming the first commercial organisation in Hong Kong to replace air-cooled condensers with water-cooled evaporative chillers. Other initiatives such as keeping the office temperature between 23-27℃ and implementing a chiller sequencing programme also help to further reduce the electricity consumption.

Source: Health, Safety and Environmental Report 2004, Towngas Website: www.towngas.com

Office Equipment

Actions that you can take to reduce energy consumption or emissions into the air associated with office equipment include:

- Replacing electrical appliances and office equipment with more energy-efficient models with an Energy Label (see *Appendix C*);
- Turning monitors off during lunch hours and at the end of the day, or when you are away from the workplace;
- Activating the "sleep" mode in office equipment during office hours for photocopiers, scanners and printers; and
- Turning unnecessary equipment off (including computers).

Think twice before you make copies
Use energy efficient equipment

Office indoor air quality will be affected by emissions in a poor ventilated printing room. Therefore, office equipment, such as photocopiers and laser printers, should be placed in the area with good ventilation. To reduce emissions, you are also advised to:

- Think twice before you copy or print – how many you need and don't copy/print too much.
- Avoid fault printing by checking the operation condition and mode setting before pressing the button.
- Photocopy on both sides of paper and shrink the size of a document if possible.

If you are looking for photocopiers or printers, look for ones that are recognised as being energy efficient. Products with the ENERGY STAR, for example, meet strict energy efficiency guidelines set by the US Environmental Protection Agency and US Department of Energy.

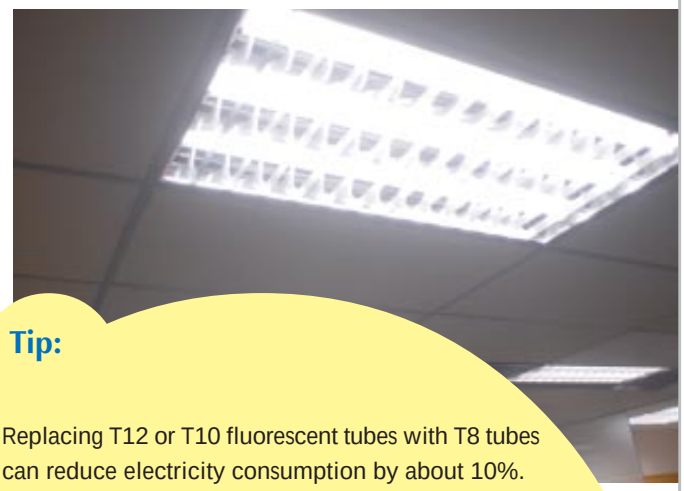
In addition to energy-saving appliances, an emulsion aggregation toner that uses 35% less energy than conventional toners has been developed, thus minimising carbon dioxide emissions.

Source: Fuji Xerox Hong Kong

Lighting

Measures to reduce energy consumption or emissions from lighting include:

- Replacing conventional fluorescent tubes or light bulbs (e.g., T12 or T10 fluorescent tube) with energy efficient models;
- Upgrading existing lighting systems by installing quasi-electronic ballast (QEB);
- Using shorter fluorescent tubes for over-illuminated areas;
- Reducing the number of fluorescent tube for over-illuminated areas;
- Installing occupancy sensors to control lighting in areas that are used infrequently, (e.g. conference rooms);
- Making use of daylight whenever possible; and
- Turning lighting off if it is not needed (e.g. during lunchtime and after work). Place "Save Energy" stickers near the switch as a reminder.

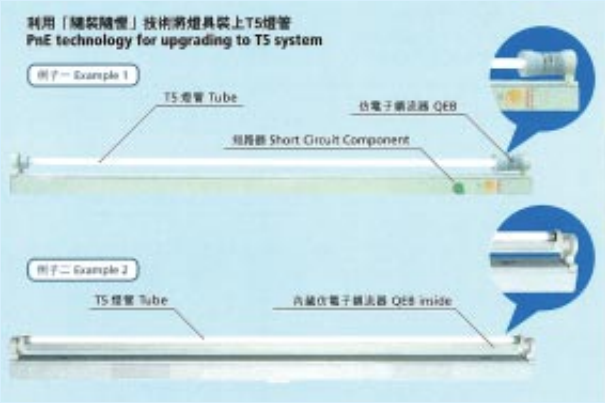


Tip:

- Replacing T12 or T10 fluorescent tubes with T8 tubes can reduce electricity consumption by about 10%.
- Replacing electromagnetic ballasts in T12, T10 or T8 fittings with electronic ballasts can reduce about 20-25% of electricity consumed.
- Replacing T12, T10 or T8 fluorescent light fittings (with electromagnetic ballasts) with T5 fluorescent light fittings (with electronic ballasts) can reduce about 30% to 40% of electricity consumed.
- Replacing incandescent light bulbs with compact fluorescent lamps (CFL) can reduce energy consumption by 70%-80%.
- Using shorter tubes can save 30% to 60% on electricity consumption.
- Reducing the number of fluorescent tubes can cut electricity consumption by about 33%.

Upgrading T8 tubes to the T5 system with a Quasi-Electronic Ballast (QEB)

For upgrading lighting to the T5 system, a T8 tube can be replaced with a T5 tube together with a Quasi-electronic Ballast (QEB) attached as an end cap or inside a fitting.



The energy savings and payback period for a real example are shown below:

From	To	Energy Savings (%)	Payback Period (Yrs)	Resulting Lighting Level (compared to existing lighting level) (%)
1200 mm T8 (Electromagnetic ballast (EMB))	T5 system with (Quasi Electronic Ballast)	33	3.5	118
3 x 1200 mm T8 (EMB)	2 x T5 with Redirection	56	1.8	89

Source: Retrofit with Energy Efficient Fluorescent Lighting System (www.emsd.gov.hk)

Case Study: Wing's Trading Co. Ltd.

Wing's Trading Co. Ltd. occupies a typical office in Kwun Tong. The first floor is used as an office and has an area of approximately 7,000 m^2. The third floor is used for storage and as a show room. Office cooling is provided by both a water-cooling tower and window-mounted or split-type air conditioners.

The company does not make any significant direct emissions into the air from this site, however, as with all offices, the consumption of energy will contribute indirectly towards emissions to air from power stations, through the use of energy. Wing's Trading has a good understanding of the importance of saving energy and the company is implementing the following measures to reduce the energy consumption during their operations:

1. During lunchtime, lighting at workstations is turned off and the "sleep" mode for office equipment is activated.
2. Only authorised persons are permitted to adjust the room temperature.
3. Water-cooling type air conditioning systems are used instead of air-cooling type systems.
4. Energy-saving light bulbs are used in the pantry.
5. Air-conditioners in the pantry are switched off outside the lunch hour and fans are used instead for ventilation.
6. Only a limited number of light bulbs are switched on in the pantry outside the lunch hour to minimise the energy usage.
7. Air-conditioners and lights are switched off in meeting rooms when these are not in use.

The above measures are general and can be applied to all offices.

Every Member of Staff Needs to Contribute

A "Clean-air Drama" played by children at JEC's Group Briefing session

"Every member of staff should contribute to environmental protection," Mr James Graham, Chief Executive of Jardine Engineering Corporation (JEC) said. "Therefore, we launched the JEC Clean Air Campaign Award to mobilise colleagues with information and action to protect the environment."

The awards cover three categories, namely Clean Air Technology, Best Outdoor Clean Air, and Best Indoor Clean Air awards. The Campaign is open to all JEC's 3,000 technical and general employees.

Forbes recently reported that a number of Hong Kong companies were forced to raise remuneration levels to attract expatriates put off by the air quality in Hong Kong. Hong Kong's status as the financial capital of Asia can and will be threatened if it loses its ability to retain key local and foreign executives. A survey conducted by A.C. Nielsen also showed that most executives knew of someone who had left or was thinking of leaving Hong Kong because of the deteriorating air quality. Together with buzzing media reports, the entire business and public community has become concerned with our polluted air.

Mr Graham looked at the issue from a different angle. "We should take action to protect our air and therefore the health of our people, starting with ourselves and the actions we can take," he said.

As one of the early signatories of the Clean Air Charter, JEC has pledged to reduce emissions by giving advice to clients as well as in its own operations on matters like fuel choices and use, regular maintenance and energy efficiency techniques, cut down on waste through effective recycling schemes in the office and workplaces, and adopt energy-efficient practices in daily businesses. To be a responsible corporate citizen, a number of proactive measures have been taken throughout the company.

"We have implemented an Environmental Management System in the third quarter of 2006, with the aim of achieving ISO 14001 certification by 2007," Mr Graham explained. "We encourage the sale of environmentally friendly products – as of July 2006, more than 39% of our clients purchased diesel generator sets which met the US's EPA Tier 1 Emissions Standards, while a further 6% required that Tier 2 standards were met. JEC also closely monitors to ensure that ultra low sulphur diesel is used in company's vehicles."

Within the company, JEC has also taken measures to reduce electricity usage. By way of example, energy saving T5 fluorescent tubes are used in place of conventional tubes, saving an estimated 38.6 MWh of electricity per year. Lights are switched off whenever possible – lighting at respective zones in the main office has to be manually turned on, whilst they are switched off by default after 7:45 pm daily. In line with government recommendations, JEC have maintained relative humidity and indoor air temperature at government recommended levels since August 2006 and regularly monitors the chilled water that it is using from the building owners in the premises that it occupies which helps to ensure that energy use is minimised for the cooling of its premises.

"Apart from the Awards, we ask each of our colleagues and associates to support the clean air initiative from top management to apprentices in the workplace. JEC will be reporting on the progress made in its support of the Clean Air Charter at the end of 2006," Mr Graham said.

Vehicles, Machinery and VOCs

Vehicle Movement / Idling

Measures to reduce emissions into the air and energy consumption associated with use of vehicles include:

- Replacing pre-EURO or EURO I/II type medium/ heavy goods vehicles with EURO IV type vehicles;

- Planning journeys to avoid congested roads, steep hills, road construction, etc.;
- Avoiding driving for short trips;
- Switching off engines when idling - Driving off as soon as possible after starting and switching off the engine if idling for a long time;

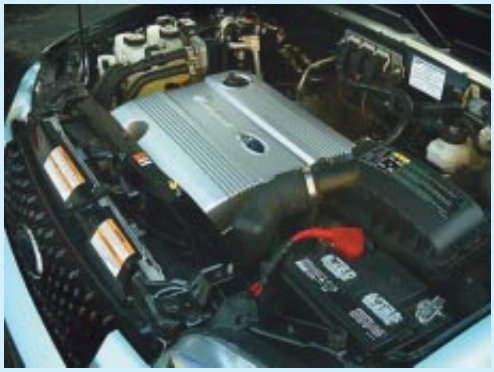
- Buying a fuel efficient car (*compare the fuel consumption of different cars before making a purchase decision. Ask the dealer for a fuel consumption rating of a car*);
- Considering alternative fuel vehicles (e.g., hybrid car);
- Walk or ride a bicycle for short journeys;
- Use public transport.

Tip:

According to the information from the Website of the City of Toronto, Canada, an idling diesel engine will burn about 2.5 litres per hour and an idling gasoline engine will burn about 3.5 litres per hour. It is estimated that ten seconds of idling uses more fuel than restarting the engine.

Hybrid Vehicles

Hybrid vehicles are more environmentally friendly than conventional vehicles and these types of vehicles are available on the Hong Kong market now. The technology uses a combination of a petrol engine and an electric motor drive to improve fuel efficiency and reduce emissions. Typical fuel consumption and emissions from hybrid vehicles are about 50% below equivalent, conventionally powered vehicles.



In the Policy Address 2006 announced on 11 October 2006, the HKSAR Chief Executive, Mr Donald Tsang proposed that a 30% reduction in first registration tax will be given to people purchasing vehicles with low emissions and high fuel efficiency (environmental friendly vehicle, such as hybrid vehicles), subject to a ceiling of $50,000 per vehicle.

Cleaning the Air in the Streets

In our busy streets, air pollution is mainly caused by motor vehicles, particularly diesel vehicles, such as trucks, buses and light buses. Pollutants such as particulates and nitrogen oxides are often trapped between the tall buildings that line the streets.

Obviously we need more green vehicles on the streets, especially on busy corridors. And there are practicable measures to reduce pollution from vehicles, as demonstrated by The Kowloon Motor Bus Company (1933) Limited (KMB).

As one of the largest public transport companies in Hong Kong, KMB makes around 2.8 million passenger trips daily. As at 31 October 2006, among the 4,037 buses in the KMB bus fleet, 3,450 buses achieve Euro II or above emission standards, with 450 and 563 buses achieving Euro III and close to Euro IV emission standards respectively. In early 2006, KMB took the lead to introduce two Euro IV double deck buses to Hong Kong. With the most advanced technology in environmental protection, the Euro IV engine reduces emissions of nitrogen oxides and particulates by 30% and 80% respectively when compared with the Euro III engine.

Since 2001, KMB has used ultra-low sulphur diesel (ULSD) in its entire fleet, significantly reducing exhaust emission levels of sulphur oxides, nitrogen oxides and particulates. Catalytic converters have been retrofitted on all KMB buses with pre-Euro or Euro I engines. With the catalytic converters and the use of ULSD, the exhaust emissions of pre-Euro or Euro I buses have been improved to Euro I and II engine standards respectively.

Buses equipped with Continuous Regeneration Traps (CRTs) can achieve a significant reduction in particulate matter and reduce smoke levels to virtually zero. Currently we have 563 Euro III-engined buses equipped with CRTs plus an exhaust gas recirculation device, which are able to meet emission standards at a level close to Euro IV engine standards.

Recently, KMB has also upgraded its Traffic Operations Management System for more efficient deployment of its "Euro buses". KMB notes the emission standards for all its buses and screens the database for all bus routes requiring emission standards at Euro II or above. Whenever there is an ad-hoc bus arrangement calling for replacement of any bus running on a busy corridor, the system will alert staff in the event of any mismatch involving a non-Euro II or above bus, thus guaranteeing that they select the appropriate bus type.

Currently, all KMB buses running on Yee Wo Street, Hennessy Road, Queensway and Des Voeux Road Central, and 90% of KMB buses operating on Nathan Road, are at Euro II or above standard.

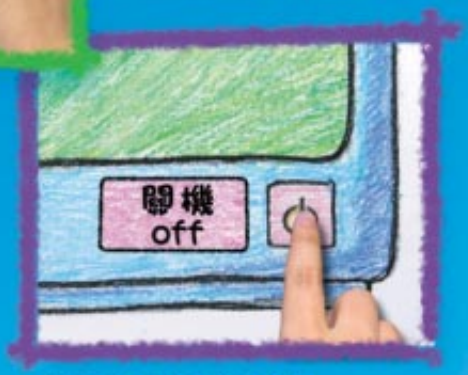
全城投入
為藍天打氣

Clean Air for a Cool Hong Kong

藍天行動 Action Blue Sky

www.epd.gov.hk

- 停車熄匙
  Turn off idling engines
- 選用環保私家車和提早更換舊型柴油商業車輛
  Select environmentally friendly vehicles and convert older diesel commercial vehicles into newer models in advance



- 電器不使用就關掉
  Switch off appliances when not in use

- 穿著輕便衣服
  Wear light clothing

- 選用不含揮發性有機化合物的產品
  Select products with no volatile organic compound contents

- 盡量乘搭公共交通工具
  Take public transport as much as possible

- 選用節省能源的電器
  Use energy-efficient appliances

環境保護署
Environmental Protection Department

Machinery and Equipment

Measures can be employed to reduce energy consumption from machinery and equipment include:

- Installing energy-efficient motors;
- Not using oversized motors, which are inefficient when running at part load (e.g., 85% load);
- Lubricating motors and drive bearings frequently to avoid overheating and power loss;
- Adhering to the maintenance schedules recommended by manufacturers;
- Cleaning heating coils in electric boilers regularly; and
- Reducing the number of lifts or escalators in service after normal working hours and on holidays.

Energy Saving for Lifts/Escalators

Hong Kong is densely populated with a high density of high-rise commercial and residential buildings. Therefore, lifts are essential for almost every building.

As lifts are used frequently, they are one of the facilities that consume the most energy in a building. To save energy, property management companies can switch some lifts to standby mode after office hours or during off-peak hours to reduce the number of lifts in use. Old model of lifts can be upgraded through a modernisation plan to install a modern Variable Voltage Variable Frequency (VVVF) motor drive system, so that the lifts are driven by microcomputer rather than traditional mechanical controls. After incorporating the VVVF motor drive system, it provides smoother acceleration and deceleration of the AC traction machine, and enables the lift to operate at a slower speed during a short running distance. Therefore, the energy consumption can be reduced. In addition, lighting and ventilation systems can be modified to enable automatic switch-off when the lifts are not in use, and this helps to save energy.

For escalators, sensors can be installed, so that the escalators can automatically stop when not in use to conserve energy.

Source: Chevalier International Holdings Ltd.

VOCs

The following practices can reduce VOC emissions:

- Avoiding use of aerosol consumer products such as hairspray, air freshener, deodorants, and insecticides which often use VOCs as their propellants. Non-aerosol consumer products are usually in pump, solid, liquid, gel, or roll-on forms;
- Avoiding use of solvent-based paints by selecting water-based paints as alternatives. If solvent-based products cannot be avoided, applying them with hand brushes or rollers instead of spray systems to reduce the use of thinners, which will also minimise overspray and wastage;
- Avoiding use of VOC-containing products such as organic cleaning solvents;
- Selecting "zero-VOC"/"non-VOC" products or those with a green label (e.g. awarded by the Green Council); and
- Storing VOC-containing products in air-tight containers.

VOCs Reduction by Using Soy-based Ink in the Printing Industry

The U.S. EPA launched a Waste Reduction and Innovative Technology Evaluation project, focused on the use of soy-based inks as a substitute for petroleum based inks in printers. Soy-based inks are produced from renewable resources and emit lower amounts of VOCs during the printing process. Results have shown that approximately 17% more petroleum-based inks were used on a per sheet printed basis. Significantly less volatile components were found in the soy-based inks (0.8%) than in the petroleum-based inks (4.6%).

Green Pagoda Printing Co. Ltd., a 40-year-old printing company, has replaced traditional ink with soy offset ink in some printing products. Though the cost of using soy offset ink is slightly higher than that that of traditional ink, the printing quality associated with soy offset is better, particularly where more than four colours are required.

General Production-type Businesses

There are some simple procedures that can help reduce emissions from production-type businesses. These include:

- Checking, cleaning and maintaining exhaust pipes regularly to avoid the accumulation of dust (which increases the energy efficiency of the system);
- Estimating emissions based on fuel consumption to monitor performance and to identify improvements;
- Monitoring air pollution control equipment regularly to ensure that the efficiency with which pollutants removed is kept at the designated level; and
- Installing suitable emissions control measures.

Air Control Measures

Wet scrubbers, adsorption by activated carbon, electrostatic precipitators, cyclones and fabric filters are the most common air pollution control equipment used to treat flue gas from emissions stacks. Different emissions control technologies and their applications are summarised below.

Emissions Control Technology	SO_2	NO_x	PM	VOCs
Wet Scrubber	✓	✓	✓	✓
Adsorption by activated carbom				✓
Electrostatic precipitator			✓	
Cyclone			✓	
Fabric filter			✓	

Cost-effective Measures for Cooling Air at Spunbond Nonwoven (S.Z.) Co. Ltd.'s Processing Workshop

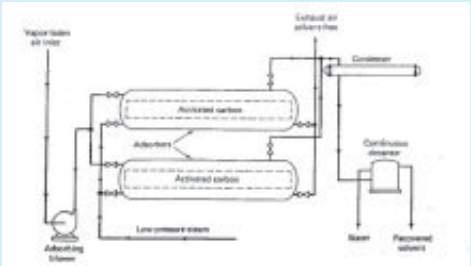
Spunbond Nonwoven (S.Z.) Co. Ltd is a non-woven cloth manufacturing factory. The total site area is about 14,500 m^2. Poly-propylene (PP) is the main raw material to manufacture non-woven cloth. PP is melted and then bonded as a cloth (this technology is called 'Spunbond'). Heaters are used in the process and mechanical ventilation fans are provided in the processing workshop. However, the temperature inside the processing workshop is still high due to the heat release from the melter.

In order to reduce the indoor air temperature at the processing workshop, Spunbond Nonwoven uses a cost-effective and innovative measure called a "Water Cooled Screen" to reduce the indoor air temperature. The double layer water-cooled screen is installed on the windows. A water pipe with sprinklers is installed at the top of the screen. The water is sprayed onto the screen at the top and is collected in a sump at the bottom, to be recirculated. Air passing through this screen is cooled by about 3-5℃.

Example of a wet scrubber

Wet Scrubber

Wet scrubbing systems can be used to control sticky emissions that would plug filter-type collectors. This type of pollution control equipment is used to control both particulate and gaseous emissions simultaneously, to control acidic/alkaline/odorous gases, to recover soluble dusts and powders.



Typical Solvent Recovery System using Activated Carbon Adsorption

Adsorption Using Activated Carbon

Adsorption means the attachment of molecules to the surface of a solid. Adsorbed materials are attached onto the surface of a material, like dust on a wall. Adsorption is mostly used to remove VOCs. Activated carbon is the most common adsorbent which is low-cost and can be regenerated.

Electrostatic Precipitator (ESP)

Electrostatic Precipitators (ESPs) are used to remove particulates from flue gases. Particles are given an electric charge by forcing them to pass through a corona (a region in which gaseous ions flow). The electrical field that forces the charged particles to the walls comes from electrodes maintained at high voltage in the centre of the flow lane. Once particles are collected on the plates, they must be removed from the plates without re-entraining them into the gas stream.

Example of an electrostatic precipitator in a factory

Example of a cyclone in a factory

Cyclone

Cyclones provide a low-cost, low-maintenance method for removing particulates from gas streams. The general principle of a cyclone system is that the particulate-laden gas is forced to change direction. As the gas changes direction, the inertia of the particles causes them to continue in the original direction and be separated from the gas stream.

Multiple cyclones have overall mass removal efficiencies of 70 – 90%. However, cyclone collection efficiencies fall off rapidly with particle size, so that control of fine particulates is limited.

Fabric Filter

Fabric filter collectors (baghouses) are another technology used for the removal of particulate matter. The technology is conceptually simple: by passing flue gas through a tightly woven fabric, particulates in the flue gas will be collected by the fabric by sieving and other mechanisms. Baghouses are capable removing 98% to over 99.9% of particulates.

Example of a bag filter in a factory

Without a sustainable environment, we won't be able to produce quality shirts

"Every year we produce 60 million shirts, made from pure cotton. Raw materials are provided by our cotton farm in Xinjiang," Mr Calvin Tsang, General Manager of Site Management and Administrative Services of Esquel Group's production base in Gaoming, said. "The quality of cotton we cultivate is critical to our business."

For this reason, environmental protection has been one of the key management philosophies of Esquel and the Group has made major efforts to reduce the environmental footprint of its operations throughout the world.

To ensure reliability of electricity and steam supply as well as increase energy efficiency for such a high annual production, Esquel has built its own coal-fired power plant near the production base. Emission control measures including electrostatic precipitator (ESP) and flue gas desulphurization (FGD) are implemented at the plant to reduce emissions of sulphur dioxide (SO_2) and particulate matter (PM). In addition, air emissions from the power plant are monitored with a continuous emissions monitoring system (CEMS) (*see Figure 1*). Real-time data including air pollutant concentrations, air flow parameters such as oxygen content, temperature, flowrate and pressure are obtained and stored in a database, which is also sent to the local authorities regularly for record.

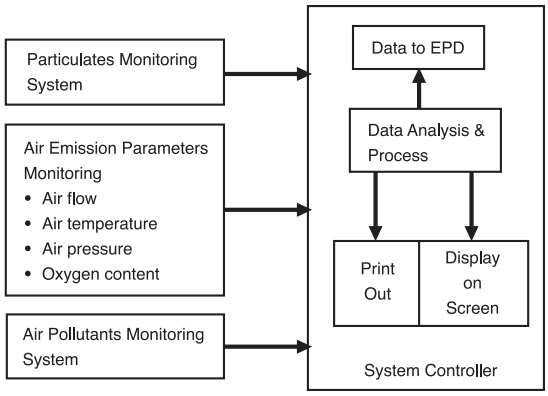


Figure 1

Figure 2

Apart from power generation emissions, production of textiles usually releases fine fibres and cotton dust, which become suspended in the air. A cyclone is a typical, commonly used and effective means for removing dust from such processes (*see Figure 2*) with removal efficiencies reaching 80%.

At Esquel's factory, an air extraction system is provided in each workshop to collect the fugitive cotton dust or fibres. The collected air is passed through cyclone before being discharged into the atmosphere. Water containing cotton and fibres from the cyclone is sent to Esquel's wastewater treatment plant for treatment and the treated water is reused in the scrubbers.

"The textiles industry employs more people around the world than any other. The companies that make up the industry therefore have much to contribute to social and environmental responsibility," Mr Tsang said.

5. AUDITING AND REPORTING

The EEM Team should conduct energy/emissions audits in accordance with the schedules identified in the action plan. The audits should be designed to track the progress of implementation of the action plan, identify further opportunities for improvement and identify whether overall targets have been met.

Reviewing and Continual Improvement

Suggestions and opinions from staff members could be collected as part of the review to understand where problems have been encountered and to provide an opportunity for members of staff to suggest improvements for the plan. An example audit checklist is presented in *Appendix D*.

Comparing Audit Findings with Reduction Targets

Audit findings should be compared with the action plan and reduction targets to track implementation and performance improvements. An audit report should be prepared to summarise achievements and identify areas for improvement. Effectiveness of each control measures should be evaluated, as far as practicable, to provide information for further improvement and establishing further reduction targets for subsequent periods. Companies should seek continual improvement.

If your operations involve combustion or heating processes, and your action plan includes measures to reduce direct emissions, continuous or regular monitoring of key air pollutants should be considered as a tool to track performance improvements.

Emissions Monitoring

Monitoring of emissions is an effective way to measure the progress of implementation of an EEM Plan, especially for heavy industries that use combustion or heating processes. Different types of air pollutants require different measurement methodologies. Typically, for large industries or industries with significant air emissions such as power plants, continuous emissions monitoring systems (CEMS) are suitable for monitoring emissions. For small to medium sized industries, regular emissions monitoring for each air pollutant is recommended depending on the type of air pollutants emitted from the industry.

Continuous Emissions Monitoring System

Generally, all major combustion facilities are encouraged to use CEMS as it is a useful tool to gather process emissions data for environmental compliance demonstration, process control and optimisation. However, as the investment and maintenance cost of CEMS is high, CEMS is generally more suitable for large industries (e.g. power plants) or those industries which emit high levels of air pollutants or air toxins such as incineration facilities, cement plants, etc.

CEMS generally refers to a packaged system of gas analysers, gas sampling systems, temperature, flow and opacity monitors that are integrated with a data acquisition system to demonstrate environmental regulatory compliance of various industrial sources of

air pollutants. Technical requirements and approved analytical techniques for continuous emissions monitoring systems are available on the U.S. EPA Website: *www.epa.gov/airmarkets/monitoring/polman/polman_oct_28_2003_vol1.pdf*.

The most widely used type of continuous emissions monitoring is an extractive CEMS, in which a sample of gas is continuously drawn from the process point, filtered, transported, conditioned and presented to a gas analysis system. Gas concentrations are measured, recorded and stored as data. The data is used to generate reports, alarms or control some aspect of the industrial process.

Regular Air Emissions Monitoring

Regular air emissions monitoring is helpful to monitor the performance of the plant operation and the air control measures. Typically, different monitoring methodologies are used for monitoring different types of air pollutants. In general, air emissions monitoring follows the U.S. EPA methodology, which is widely used as a guideline for measurement. Further information on detailed monitoring methodologies can be found at *www.epa.gov/ttn/emc/promgate.html*.

In Guangdong Province, stack emissions monitoring should follow measurement standards specified by the State Environmental Protection Agency (SEPA) or Guangdong Environmental Protection Bureau (EPB). The list of measurement methods stipulated by SEPA or Guangdong EPB can be found on their respective Websites, i.e., *www.ep.net.cn/cgi-bin/dbbz/list.cgi*. The measurement method for typical air pollutants are presented in *Appendix E*.

Performance Reporting

The performance audit findings should be summarised annually or bi-annually to report achievements of the energy / emissions reduction programme. Under or over achievement of targets should provide a basis for developing the subsequent year's action plan.

The summary report should include:

- Reduction targets
- Reduction actions
- A comparison of the quantity of emissions made and energy consumed and saved with the previous year's performance
- Details of performance against each reduction target (e.g. performance as a percentage of the target)
- An Action Plan for the following year

A template for the performance report is provided in this section. Endorsers of the Clean Air Charter are encouraged to report their energy/emissions reduction performance, where applicable.

REPORT ON ENERGY/EMISSIONS REDUCTION PERFORMANCE

Company Name : _____

Nature of Business : _____

EEM Manager : _____ Date: _____

PART A: REPORT ON PERFORMANCE

A1 - Energy Consumption for All Businesses

	Base Period _____ to _____	Reporting Period _____ to _____	% Change	Notes
Total electricity consumed (✓ if appropriate) ❑ kWh ❑ kWh / area ❑ kWh / employee ❑ kWh / tonne of product				
Total gas consumed (✓ if appropriate) ❑ MJ ❑ MJ / area ❑ MJ / employee ❑ MJ / tonne of product				

A2 - Vehicle Emissions *(if applicable)*

	Base Period _____ to _____	Reporting Period _____ to _____	% Change	Notes
Total kilometer travelled (km)				
NO_x emissions (kg)				
PM emissions (kg)				

Equation:
NO_x emissions = (kilometer travelled of passenger car x 0.9 g/km) + (kilometer travelled of light goods vehicle x 1.6 g/km) + (kilometer travelled of heavy goods vehicles x 8.2 g/km)
PM emissions = (kilometer travelled of light goods vehicle x 0.3 g/km) + (kilometer travelled of heavy goods vehicles x 0.6 g/km)

A3 - Air Emissions from Industrial Operations *(if applicable)*

i] Diesel Backup Generator

	Base Period _____ to _____	Reporting Period _____ to _____	% Change	Notes
Total operating hour (hr)				
NO_x emissions (kg)				

Equation:
NO_x emissions = installed generator capacity (hp) x 0.014 (kg/hp-hr) x operating hour (hr)

ii] Diesel Boiler

	Base Period _____ to _____	Reporting Period _____ to _____	% Change	Notes
Total diesel oil consumption (hr)				
NO_x emissions (kg)				
SO_2 emissions (kg)				

Equation:
NOx : If power rating < 293 kW, NO_x emissions = fuel consumption (litre) x 2.2 g of NO_x/litre
SO2 : If power rating < 293 kW, SO_2 emissions = fuel consumption (litre) x 17 g of SO_2/litre x S content (%)

iii] Indirect Emissions from PRD Power Plants

	Base Period _____ to _____	Reporting Period _____ to _____	% Change	Notes
Total electricity consumed (kWh)				
NO_x emissions (kg)				
SO_2 emissions (kg)				
PM emissions (kg)				

Equation:
NO_x = total electricity consumed (kWh) x 1.4 g/kWh; SO_2 = total electricity consumed (kWh) x 2.1 g/kWh; PM = total electricity consumed (kWh) x 0.2 g/kWh

Other comments/remarks if any:

_____

_____

PART B: REDUCTION TARGET & ACTION PLAN FOR _____ *(next period)*

B1 - Energy Consumption for All Businesses

Reduction Target	Action Plan
1.	
2.	

B2 - Vehicle Emissions *(if applicable)*

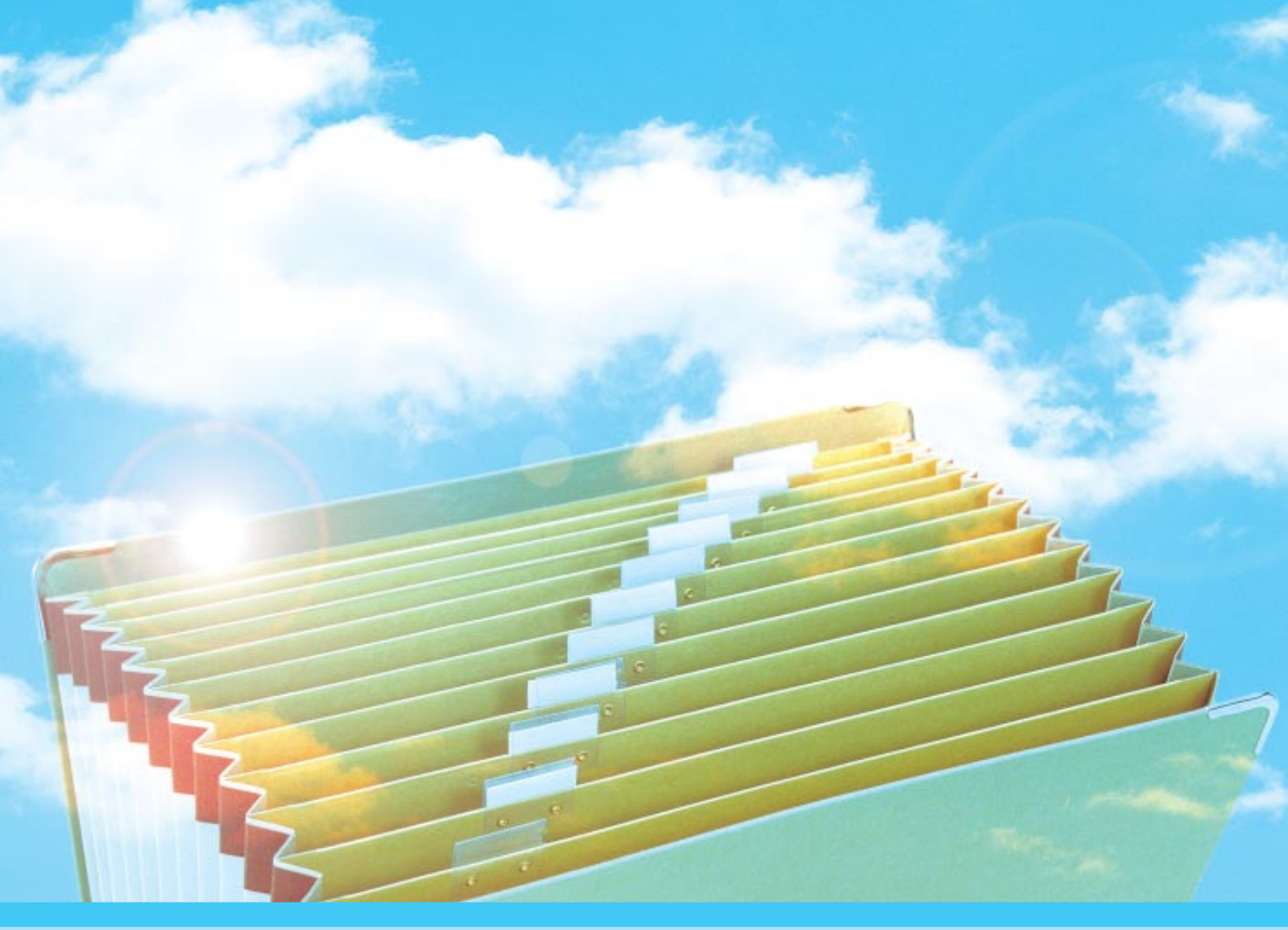
Reduction Target	Action Plan
1.	
2.	

B3 - Air Emissions from Industrial Operations *(if applicable)*

(Diesel Backup Generator / Diesel Boiler / Indirect Emissions from PRD Power Plants)

Reduction Target	Action Plan
1.	
2.	

Notes:This template serves as a general reference to help businesses report on their energy/emissions reduction performance. Companies could revise and modify the content in accordance with the nature of businesses.



Appendix

APPENDIX A

Initial Audit Record Template

General Information

Number of full/part-time staff : _____ (Full-time) _____ (Part-time)

Total number of working hours : _____

Energy Audit

Attach electricity bill or gas bill for the past 12 months for record and plot a graph to show the trend.

	Jan	Feb	Mar	Apr	May	June	Jul	Aug	Sept	Oct	Nov	Dec
Electricity (kWh)												
Gas (MJ)												

List of Office Equipment

	Rating (kW)	Quantity (nos.)
Photocopying machine		
Fax machine		
Personal computer		
Printer		
Water dispenser		
Tea urn		
Refrigerator		
Vending machine		
Other (to be listed)		

Ventilation and Air Conditioning System

Any regular cleaning for filter? Yes / No (If yes, please provide cleaning record log)

Any regular cleaning for ventilation ducts? Yes / No (If yes, please provide cleaning record log)

Any CO_2 sensor provided? Yes / No (If yes, how many and where? _____)

Any complaint from staff? Yes / No (If yes, give details: _____)

	Reception	Staff Workstation	Conference Room A	Conference Room B	Lobby	Pantry	Toilet (Male)	Toilet (Female)	Carpark	Plant Room	Store
Area (m^2)											
Room Temperature (°C)											
Cleaning of filter (yes/no)											
No. of ventilation and A/C systems provided											
No. of Water-cooling system											
No. of Air Handling Unit											

Vehicle Emissions

	Motorcycle	Passenger Car	Van	Light Goods Vehicles	Medium/Heavy Goods Vehicles	Bus
Total number of vehicles						
Total kilometre travelled (km)						
Emissions of NO_x (g/month)						
Emissions of PM (g/month)						

Emissions from Diesel Backup Generators

	Generator 1	Generator 2	Generator 3	Generator 4	Generator 5	Generator 6
Power rating (kW)						
Total operating time (hr/month)						
Emissions of NO_x (kg/month)						

Emissions from Diesel Boilers

	Boiler 1	Boiler 2	Boiler 3	Boiler 4	Boiler 5	Boiler 6
Power rating (kW)						
otal operating time (hr/month)						
Total volume of diesel oil / heavy oil used (litre/month)						
Emissions of SO_2 (kg/month)						
Emissions of NO_x (kg/month)						

Comments

APPENDIX B

EMSD's Energy Indicator & Benchmarking System

Energy Consumption Indicators for Offices, Commercial Uses

	Subgroups	Energy consumed per unit floor area per annum (MJ/m²/annum)
Private Offices	Common services for buildings with central A/C for tenant	848
	Tenant units in buildings with central A/C supply	385
	Common services for building without central A/C supply (but with A/C in common area)	192.3
	Common services for buildings without central A/C supply (but without A/C in common area)	122.3
	Tenant units in buildings without central A/C supply	561
	Private Offices (whole building)	1132
Government Offices	Government Offices (whole building)	826.5
Shopping Centre	Common Services (with A/C in common area)	1301
	Common Services (without A/C in common area)	585.6
	Tenant units - Chinese Restaurants	7179
	Tenant units - non-Chinese Restaurants	5737
	Tenant units - fast food shops, bars and other eating and drinking places	7881
	Tenant units - supermarkets	5077
	Tenant units - general retail (food)	4929
	Tenant units - general retail (non-food)	1663
Standalone Restaurants and shops > 75m²	Chinese restaurants	12022
	Non-chinese restaurants	9839
	Fast-food shops, bars and other eating and drinking places	6598
	Supermarkets	5853
	General retail (food)	4710
	General retail (non-food)	2373
Hotels		1575
Boarding Houses		796

Energy Consumption Indicators for Vehicles

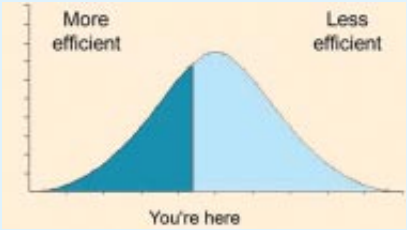
Principal Group	Subgroups	Annual Average Consumption (Litres/100km)		
Private Car	**Engine Type**	**HK**	**KLN**	**NT**
	Engine Size <=1500cc	10.7	10.4	9.6
	Engine Size 1501-2000cc	12.2	12.0	10.8
	Engine Size 2001-2500cc	13.5	13.4	11.9
	Engine Size 2501-3000cc	15.2	15.2	13.3
	Engine Size >3000cc	17.7	17.9	15.3
Petrol Light Goods Vehicle		14.8		
Diesel Light Goods Vehicle	Gross Vehicle Weight < 2.50 Tonnes	10.2		
	Gross Vehicle Weight 2.51 - 4.00 Tonnes	12.2		
	Gross Vehicle Weight 4.01 - 5.50 Tonnes	18.6		
Medium Goods Vehicle (Tractor)	Gross Vehicle Weight 5.51 - 24.00 Tonnes	14.8		
Medium Goods Vehicle (Non-tractor)	Gross Vehicle Weight 5.51 - 10.00 Tonnes	31.9		
	Gross Vehicle Weight 10.01 - 15.00 Tonnes	34.3		
	Gross Vehicle Weight 15.01 - 20.00 Tonnes	44.3		
	Gross Vehicle Weight 20.01 - 24.00 Tonnes	54.1		
Heavy Goods Vehicles	Gross Vehicle Weight 24.01 - 38.00 Tonnes	61.1		
Private Light Buses		24.91		
Non-franchised Buses		36.65		

Source : EMSD Website: www.emsd.gov.hk/emsd/eng/pee/ecib_indicators.shtml

Example

Office "A" is located on the 12/F of a commercial building with a floor area of 2,000 m^2. The office has a centralized air-conditioning system. Total energy consumption in the period between August 2005 and July 2006 was 180,000 kWh. General office hours are from Monday to Friday, 9 am to 7pm. A total of 20 staffs work in the office and a total of 20 computers and 5 photocopiers are used.

Using the EMSD Benchmarking Tools (*www.emsd.gov.hk/emsd/eng/pee/benchmarktool.shtml*), the annual energy consumption per area is estimated to be 310.3 MJ/m^2/annum which is at the 40th percentile of the "Office" subgroup. The tool indicates that the energy consumption performance of Office "A" is good in comparison to the corresponding subgroup.



APPENDIX C

Energy Efficiency Labelling Scheme

EMSD operates a voluntary energy efficiency labelling scheme for appliances and equipment used both at home, office and vehicles. The objective of this scheme is to save energy by informing potential customers of the product's level of energy consumption and efficiency rating, so that buyers can take these factors into consideration when making their purchasing decision. Up to 2006, the scheme covers 18 types of energy consuming products.

List of household appliances and office equipment covered in the scheme are highlighted in the table below.

Type	Appliances and Equipment
Household appliances	Refrigerators, room coolers, washing machines, electric clothes dryers, compact fluorescent lamps, electric storage water heaters, electric rice-cookers, dehumidifiers, television sets, electronic ballasts and domestic gas instantaneous water heaters.
Office equipment	Photocopiers, multifunction devices, laser printers, LCD monitors, computers and fax machines.

There are two types of labels under the voluntary scheme for household appliances and office equipment, namely the "Grading Type" and the "Recognition Type" energy labels.

Grading Type		This energy label is divided into 5 grades. Grade 1 is the most energy efficient, which means the model is the most energy saving one. For instance, a washing machine with a Grade 1 energy label may save at least 20% as compared to that with a Grade 3 label.
Recognition Type		This energy label is used to recognise the appliances that have met the minimum energy efficiency & performance requirements.

From 2002, the scheme has also been extended to cover petrol passenger car. Under the scheme, vehicles will carry a "comparison type" energy efficiency label that informs customers of their fuel efficiency under different road conditions.

The HKSAR Government is preparing a legislative proposal for the introduction of a mandatory energy efficiency labelling scheme for 3 specified energy-using products in Hong Kong, namely room air conditioner, refrigerator and compact fluorescent lamp.

Source: EMSD Website: www.emsd.gov.hk/emsd/eng/pee/eels.shtml

APPENDIX D

Quarterly Audit Record Sheet

Audit date : _____

Auditor : _____

Overall Energy Consumption

	Audit Period _____ - _____
Total electricity used (kWh)	
Total gas consumed (MJ)	

Vehicles

	Audit Period _____ - _____
Total kilometre travelled	

Diesel Backup Generators

	Audit Period _____ - _____
Total generating capacity (kW)	
Total operating hour	

Diesel Boiler

	Audit Period _____ - _____
Total power rating (kW)	
Total diesel oil consumption (litre)	

Electricity Consumption in the Manufacturing Process (in PRD region)

	Audit Period _____ - _____
Total electricity used (kWh)	

Progress of Action Plan

Actions	Implemented? (y/n)	Note
1.		
2.		
3.		

Comments:

_____

_____

_____

_____

APPENDIX E

Emissions Monitoring Methodology

US EPA Sampling and Measurement Method

List of CFR Promulgated Test Methods (TM)
www.epa.gov/ttn/emc/promgate.html

Particulates
Method 5: www.epa.gov/ttn/emc/promgate/m-05.pdf

Sulphur dioxide
Method 6: www.epa.gov/ttn/emc/promgate/m-06.pdf

Nitrogen oxides
Method 7: www.epa.gov/ttn/emc/promgate/m-07.pdf

China's Emissions Monitoring Methods (in Chinese)

List of all China's Emissions Monitoring Methods
www.ep.net.cn/cgi-bin/dbbz/list.cgi

Determination of sulphur dioxide from exhausted gas of stationary source
Fixed–potential electrolysis method (HJ/T 57-2000)
www.ep.net.cn/cgi-bin/dbbz/doc.cgi?id=104

Determination of sulphur dioxide from exhausted gas of stationary source
Iodine titration method (HJ/T 56-2000)
www.ep.net.cn/cgi-bin/dbbz/doc.cgi?id=105

Measurement method of smoke and dust emissions from boiler (GB 5468-91)
www.ep.net.cn/ut/bz/pdf/677-1.pdf

Determination of nitrogen oxides (GB/T 13906-92)
www.ep.net.cn/cgi-bin/dbbz/doc.cgi?id=157

APPENDIX F

Understanding Air Pollutants and Air Quality Standards

Types, Sources and Health Effects

The major sources of pollutants and their health effects are summarized in Table A1.1.

Table A1.1 Sources of Emissions, Characteristic and Health Effect of Air Pollutants

Air Pollutant	Sources	Health Effect
Sulphur dioxide (SO_2)	• combustion of sulphur-containing fossil fuels • power plant • marine vessel • motor vehicle	*High level* • impairment of respiratory function • aggravate existing respiratory and cardiac illnesses • increased morbidity and mortality rates *Low level* • chronic respiratory diseases
Nitrogen Oxides (NO_x)	• power plant • motor vehicle • fuel combustion • space heating	*Long term exposure* • lower resistance to respiratory infections • lung development impairment • aggravate existing chronic respiratory diseases
Particulate Matter (PM)	• diesel vehicle exhaust • power plant • crustal derived dust • marine aerosol • diesel fuel	• increased morbidity and mortality rates at high level exposure
Volatile Organic Compounds (VOCs)	• building material • cleaning agent • cosmetics, wax • carpet • furnishing • laser printer / photocopier • printing materials • adhesive, sealant • paint varnish and solvent	• toxicological effects on the central nervous system, liver, kidney and blood • eye irritation: burning, dry, gritty; watery eyes • throat irritation: dry throat • respiratory problems: shortness of breath; bronchial asthma • headaches; poor concentration; dizziness, tiredness, irritability

An extensive discussion of the impact of air pollutants on health is provided in the Air Quality Guidelines for Europe (*www.euro.who.int/document/e71922.pdf*) published by the World Health Organization (WHO).

Standards – Hong Kong, Mainland China, International

Hong Kong

The Air Pollution Control Ordinance (APCO), which is the principal law for managing air quality in the HKSAR, established the Air Quality Objectives (AQOs) and provides the framework for controlling air pollution from stationary sources and motor vehicles. The AQOs are summarized below.

Table A2.1 Hong Kong Air Quality Objectives

Air Pollutant	Concentration ($\mu g\ m^{-3}$) [a]				
	1 hour [b]	8 hour [c]	24 hours [c]	3 months [d]	1 year [d]
Sulphur dioxide (SO_2)	800	-	350	-	80
Total suspended particulates (TSP)	-	-	260	-	80
Respirable suspended particulates (RSP) [e]	-	-	180	-	55
Nitrogen dioxide (NO_2)	300	-	150	-	80
Carbon monoxide (CO)	30,000	10,000	-	-	-
Photochemical oxidants (as Ozone O_3) [f]	240	-	-	-	-
Lead (Pb)	-	-	-	1.5	-

Notes:
(a) Measured at 298K (25°C) and 101.325 kPa (1 atmosphere)
(b) Not to be exceeded more than three times per year
(c) Not to be exceeded more than once per year
(d) Arithmetic means
(e) Respirable suspended particulates means suspended particulates in air with a nominal aerodynamic diameter of 10 micrometers or smaller
(f) Photochemical oxidants are determined by measurement of ozone only

Indoor Air Quality Standards

To improve indoor air quality (IAQ) and promote public awareness, the HKSAR Government has implemented an IAQ Management Program. One of the core tasks of the program is to launch a voluntary IAQ Certification Scheme for offices and public places. Indoor Air Quality Objectives (Table A2.2) have been recommended to minimise the impact on health and to promote the comfort and well-being of all building occupants. A set of 2-level IAQ Objectives has been established to act as the benchmark for evaluating and assessing indoor air quality.

Table A2.2 Hong Kong Indoor Air Quality Objectives

Parameter	Unit	Excellent Class[a]	Good Class[a]
Room Temperature	°C	20 to < 25.5	< 25.5
Relative Humidity	%	40 to < 70	< 70
Air Movement	m/s	< 0.2	< 0.3
Carbon Dioxide (CO_2)	ppmv	< 800	< 1000
Carbon Monoxide (CO)	$\mu g/m^3$	< 2,000	< 10,000
Respirable Suspended Particulates (PM_{10})	$\mu g/m^3$	< 20	< 180
Nitrogen Dioxide (NO_2)	$\mu g/m^3$	< 40	< 150
Ozone (O_3)	$\mu g/m^3$	< 50	< 120
Formaldehyde (HCHO)	$\mu g/m^3$	< 30	< 100
Total Volatile Organic Compounds (TVOC)	$\mu g/m^3$	< 200	< 600
Radon (Rn)	Bq/m^3	< 150	< 200
Airborne Bacteria	cfu/m^3	< 500	< 1000

Note:
(a) 8-hour average

"Excellent" Class represents an excellent IAQ that a modern and comfortable building should have.
"Good" Class represents the IAQ that provides protection to the public at large, including the young and the aged.

More details can be found in the "*Guidance Notes for the Management of Indoor Air Quality*" (*www.iaq.gov.hk/cert/doc/GN-eng.pdf*) published by the *Indoor Air Quality Management Group of the HKSAR Government*. Details of the IAQ Certification Scheme can be found in the "*A Guide on Indoor Air Quality Certification Scheme for Offices and Public Places*" (*www.iaq.gov.hk/cert/doc/CertGuide-eng.pdf*).

Guidelines on Air Pollution Control for Major Polluting Operations

The HKSAR Environmental Protection Department (EPD) published a set of guidance note on Best Practicable Means (BPM) for 27 specified processes to control air emissions
(*www.epd.gov.hk/epd/english/environmentinhk/air/guide_ref/guide_best_pract.html*).

Mainland China

Ambient Air Quality Standards and Emissions Standards

China's State Environment Protection Agency (SEPA) promulgated an Ambient Air Quality Standard (GB 3095- 1996) and established three levels of standards based on three types of land usage. The concentrations of air pollutants should comply with the ambient air quality standards at the boundary of the site.
www.ep.net.cn/cgi-bin/dbbz/doc.cgi?id=12
www.ep.net.cn/cgi-bin/dbbz/doc.cgi?id=12
www.ep.net.cn/cgi-bin/dbbz/doc.cgi?id=70

In addition, SEPA established an *Integrated Emissions Standard of Air Pollutants (GB 16297-1996)* to control the air emissions from stacks. Industries with stack emissions are required to meet this integrated emissions standard. Three levels of emissions limits and allowable concentrations of 33 types of air pollutants have been established based on the age of the industrial facility and the location of the emissions sources.
www.ep.net.cn/cgi-bin/dbbz/doc.cgi?id=30

Separate emissions standards for thermal power plants, boilers and industrial kilns and furnaces have also been stipulated by SEPA.

Thermal Power Plants (GB 13223-2003)
www.ep.net.cn/ut/bz/pdf/hdc.pdf

Boilers (Coal-fired, oil-fired & gas-fired) (GB 13271-2001)
www.ep.net.cn/ut/bz/pdf/381-1.pdf

Industrial Kilns and Furnaces
www.ep.net.cn/cgi-bin/dbbz/doc.cgi?id=102

Indoor Air Quality Standards

SEPA developed a set of indoor air quality standards (*www.ep.net.cn/ut/bz/pdf/735-1.pdf*) for residential developments and offices, which include:

- Four physical parameters including temperature, relative humidity, air flow and fresh air intake volume;
- 13 chemical parameters including sulphur dioxide, nitrogen dioxide, carbon monoxide, carbon dioxide, ammonia, ozone, formaldehyde, benzene, ethylbenzene, benzyl [a] pyrene, particulates and total volatile organic compounds;
- Biological parameter including bacteria; and
- Radioactive parameter including Radon.

International Air Quality Standards

Tables A2.3 to A2.5 provide the commonly used international ambient air quality standards, including the Air Quality Standards developed by the *U.S. EPA, World Health Organization (WHO), World Bank and European Union (EU).*

Table A2.3 Sulphur Dioxide (SO_2)

Averaging Time	US ppm	WHO µg m^{-3}	World Bank[(a)] µg m^{-3}	EU µg m^{-3}
10 min	-	500	-	-
15 min	-	-	-	-
1 hr	-	-	500	350
24 hr	0.14	20	-	125
1 yr	0.03	-	100	20

Note:
(a) Total SO_x

Table A2.4 Nitrogen Dioxide (NO_2)

Averaging Time	US ppm	WHO µg m^{-3}	World Bank µg m^{-3}	EU µg m^{-3}
1 hr	-	200	-	200
24 hr	-	-	500	-
1 yr	100	40	100	40

Table A2.5 Respirable Suspended Particulates (RSP or PM10)

Averaging Time	US ppm	WHO µg m^{-3}	World Bank µg m^{-3}	EU µg m^{-3}
24 hr	150	50	-	50
1 yr	50	20	-	40

Notes:
- *Only those pollutants for which HKAQOs have been established are listed in the tables.*
- *The EU standards are derived from the so-called "AQFD Daughter Directives". The national standards for some EU countries may be slightly different and/or more stringent than those shown.*

Useful Websites

Project CLEAN AIR

Project CLEAN AIR
www.cleanair.hk

Clean Air Charter and List of Endorsers
www.cleanair.hk/eng/charter.htm

"7-7-7 Care-for-Air" Guideline
www.cleanair.hk/eng/public_guideline.htm

Others

Action Blue Sky
www.epd.gov.hk/epd/english/action_blue_sky/action_blue_sky.html

What is Air Pollution Index (API)?
www.epd-asg.gov.hk/english/api_you/api_you.php

Hong Kong SAR Environmental Protection Department
www.epd.gov.hk

Guidance Notes for the Management of Indoor Air Quality in Offices and Public Places
www.iaq.gov.hk/second.asp?page=new&sub=pub

Energyland
www.energyland.emsd.gov.hk

EMSD Energy Conservation Charter
www.energyland.emsd.gov.hk/blue_sky/eng/index.htm

Guideline on Energy Audit by EMSD
www.emsd.gov.hk/emsd/e_download/pee/guidelines_on_energy_audit_2004.pdf

Water-cooled Air Conditioning System
www.emsd.gov.hk/emsd/eng/pee/wacs.shtml

China Environmental Regulations and Standards
www.ep.net.cn/cgi-bin/dbbz/list.cgi

US Ambient Air Quality Standards
epa.gov/air/criteria.html

World Health Organization - Air Quality Guidelines (2nd Edition) 2000
www.euro.who.int/air/activities/20050223_4

Compilation of Air Pollutant Emissions Factors, Volume 1: Stationary Point and Area Sources, AP-42, 5th Edition
www.epa.gov/ttn/chief/ap42

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Australian Chamber of Commerce
Austrian Chamber of Commerce and Association
Belgium-Luxembourg Chamber of Commerce
British Chamber of Commerce in Hong Kong
Business Environment Council
Canadian Chamber of Commerce in Hong Kong
Chinese General Chamber of Commerce
Chinese Manufacturers' Association of Hong Kong
Danish Chamber of Commerce Hong Kong
Dutch Business Association in Hong Kong
European Chamber of Commerce
Federation of Hong Kong Industries
Finnish Business Council
French Chamber of Commerce & Industry in Hong Kong
German Chamber of Industry & Commerce
Hong Kong Bahrain Business Association
Hong Kong Japanese Chamber of Commerce & Industry
Hong Kong Trade Development Council
Hong Kong-Thailand Business Council
Indian Chamber of Commerce
International Chamber of Commerce – Hong Kong, China
Irish Business Forum
Israeli Chamber of Commerce
Italian Chamber of Commerce in Hong Kong
Korean Chamber of Commerce
New Zealand Chamber of Commerce in Hong Kong
Norwegian Chamber of Commerce
Singapore Chamber of Commerce (Hong Kong)
Spanish Chamber of Commerce
Swedish Chamber of Commerce in Hong Kong
Swiss Business Council in Hong Kong

In preparing this Guidebook, we have benefited from the advice of an Expert Group, comprising the following members:

Mr Pang Sik-wing	Environmental Protection Department, HKSAR
Mr Donald William Johnston	Anderson Asia (Holdings) Limited
Mr Stanley Fong	Chevalier International Holdings Ltd
Dr Jeanne Ng	CLP Holdings Ltd
Dr Chan Sai Chung	EnvironmentalCare Ltd
Mr Peter Rawlings	Gammon Construction Ltd
Dr Glenn Frommer	MTR Corporation

Editorial Team:
Dr W K Chan, Mr Malcolm Ainsworth, Mr Thinex Shek, Ms Dannie Lo
Hong Kong General Chamber of Commerce

Consultant:
Environmental Resources Management

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Hong Kong General Chamber of Commerce
香港總商會 1861

The Hong Kong General Chamber of Commerce is the oldest -- founded in 1861 -- and largest -- around 4,000 corporate members -- business organisation in Hong Kong. We are international in character, with membership comprising of multi-national companies, Chinese mainland companies, and Hong Kong companies. We are a self-funding, nonprofit organisation, and as such, we are a truly independent body representing the entire scope of trade, service and industry in the Hong Kong Special Administrative Region.

Our loyalties lie first and foremost with our members, acting as their voice in advising the SAR Government on matters affecting businesses and the economy, providing members with business information and opportunities, and facilitating networking through a variety of Chamber activities.

We also take an initiative to promote Hong Kong as an international business center in the heart of Asia, and pledge our confidence in Hong Kong now and into the future.

HKGCC Website: *www.chamber.org.hk*
22/F United Centre, 95 Queensway, Hong Kong
Tel : (852) 2529 9229
Fax : (852) 2527 9843
Email: chamber@chamber.org.hk

The Hong Kong Business Coalition on the Environment (BCE) is a partnership of various business and private sector organisations formed to create a coherent voice addressing environmental matters. It aims to promote greater environmental awareness, responsibility and performance in the business community and to act as a catalyst for Government actions and policy changes toward an improved environment for Hong Kong. It also seeks to promote environmental cooperation and awareness in the Pearl River Delta.

The founding members of the BCE are the Hong Kong General Chamber of Commerce, American Chamber of Commerce in Hong Kong, Canadian Chamber of Commerce and the Business Environment Council. The BCE is led by a Convenor. The Hong Kong General Chamber of Commerce serves as the Secretariat. Membership has now expanded to 32 business associations and professional bodies, including foreign chambers of commerce resident in Hong Kong.

BCE Website: *www.chamber.org.hk/bce*

BCE Secretariat / HKGCC
22/F United Centre, 95 Queensway, Hong Kong
Tel : (852) 2823 1228
Fax : (852) 2527 9843
Email: bce@chamber.org.hk