The Clean Air Charter

A Business Guidebook

(Final Draft)

Messages

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

Through Project CLEAN AIR, we have successfully engaged the Government, business and the community into a collective clean air effort. The Clean Air Charter has also reflected the growing commitment of the business sector to contribute to cleaner air for all. I encourage all members of the business community to implement clean production and operation, working together to restore a blue sky to Hong Kong and the PRD.

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 practices. 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

The Hong Kong General Chamber of Commerce and the Hong Kong Business Coalition on the Environment acknowledge with thanks the generous sponsorship of the following companies:

We would also like to express gratitude to members of the International Business Committee and the Hong Kong Business Coalition on the Environment for their support to the Clean Air Charter.

American Chamber of Commerce
American Institute of Architects, Hong Kong Charter
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
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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
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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

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!

Project CLEAN AIR Website
www.cleanair.hk

27 November 2006

Taking Action to Save Our Air

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 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.	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

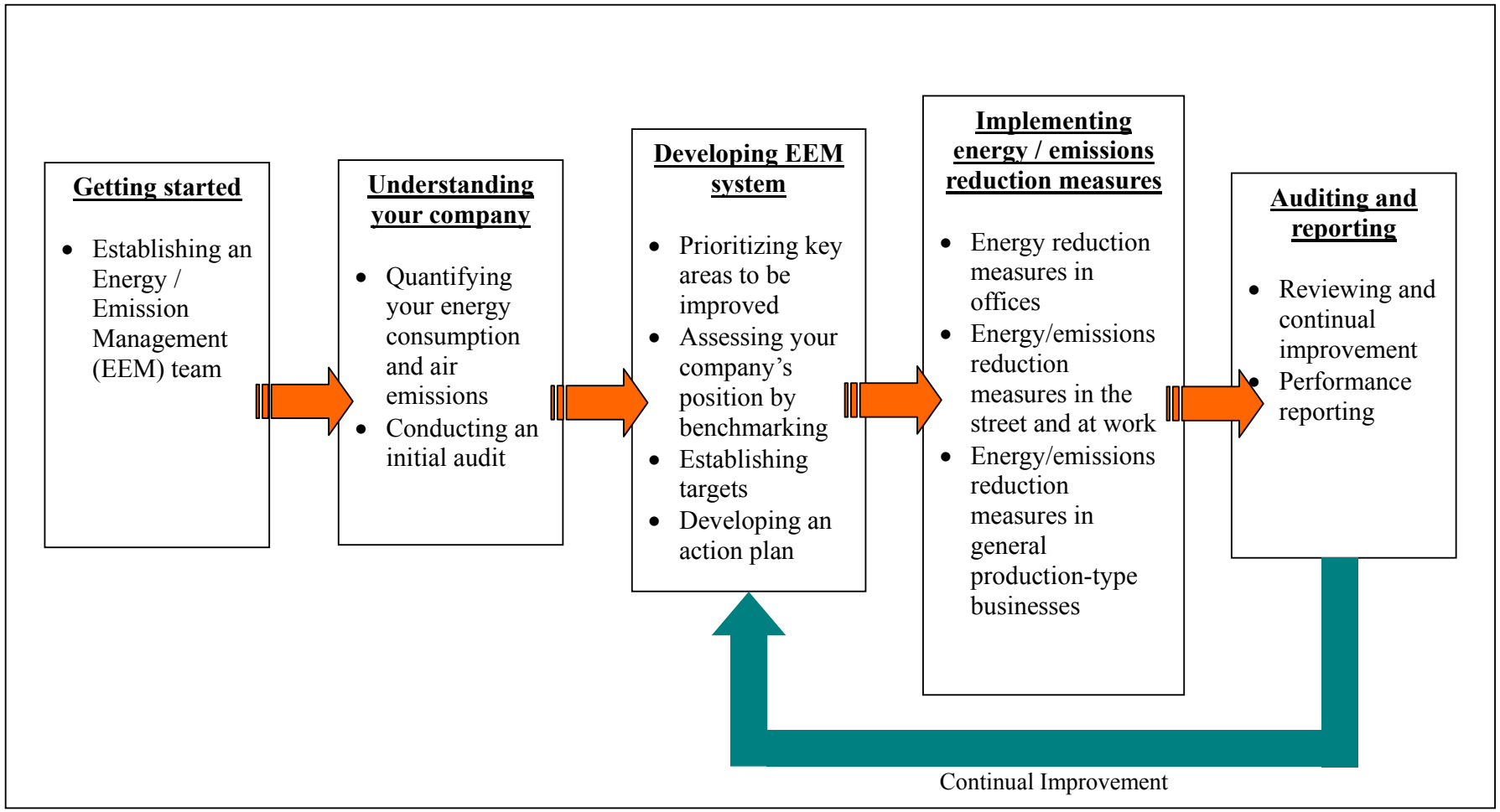
Air emissions reduction and energy conservation measures can be easily implemented and incorporated into daily business operations. To help businesses get started, this Guidebook introduces an Energy/Emissions Management (EEM) System that provides step-by-step guidance on how to reduce air emissions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

EEM Flowchart Strategy



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 Emissions and Energy 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:

- Liaison with top management on the company's strategy on energy/emissions reduction;
- Development and review of the 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 energy/emissions 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 organization; 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 organization. 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 minimize 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 their company's air emissions and energy consumption and how to conduct an initial audit of operations.

Quantifying Your 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.

Quantifying Your 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 (the 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 sections focuses on quantifying SO_2, NO_x, PM and VOCs emissions.

Selective key air pollutant emissions sources are summarized 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				✓

Emissions Sources	Air Pollutants			
	Sulphur Dioxide (SO_2)	Nitrogen Oxides (NO_x)	Particulate Matter (PM)	Volatile Organic Compounds (VOCs)
Typical Manufacturing Industries (emissions from processes) [(a)]				
Cement	✓	✓	✓	
Chemical				✓
Construction	✓	✓	✓	
Electronics				✓
Plastics			✓	✓
Printing				✓
Textiles	✓	✓	✓	✓
Toys			✓	✓
Indirect Source				
Office	✓ [(c)]	✓ [(c)]	✓ [(c)] [(d)]	✓ [(e)]

Notes:
(a) Many different industries operate in HK and the PRD region, these are just some of the more common industry sectors.
(b) Motor vehicle fuel sold in Hong Kong has a low sulphur content. Much of the diesel sold on the Mainland does not.
(c) NO_x and SO_2 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.

Emissions Estimated from 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.

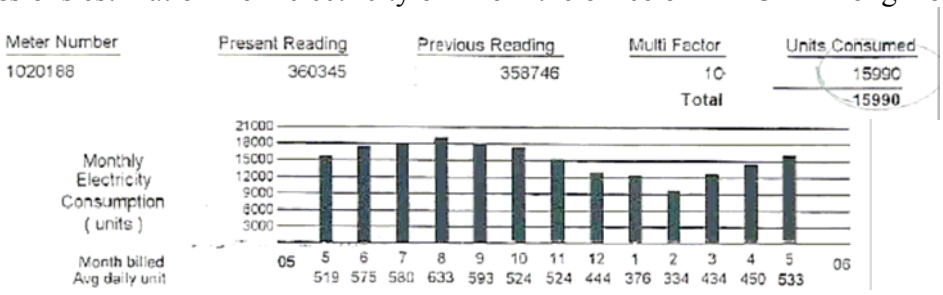
EMISSIONS ESTIMATION FROM USE OF HONG KONG ELECTRICITY

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)

*** 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

EXAMPLE OF EMISSIONS ESTIMATION

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



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

NO_x = no. of unit x 48 (MJ) x 8.92 (kg/10^6 MJ of gas) [Towngas]
NO_x = no. of unit x 46 (MJ) x 8.92 (kg/10^6 MJ of gas) [LPG]

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

Emissions Estimated from 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, running pattern, and 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 for different vehicle type (g/km)]

Air Pollutant	NO_x	PM
Average Fleet Vehicle Emissions (g/km travelled)		
Passenger car	0.9	0
Light Goods Vehicles	1.6	0.3
Heavy Goods Vehicle	8.2	0.6

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)

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 for different vehicle type (g/min)]

Air Pollutant	NO_x	PM
Average Emissions (g/min of idling)		
Passenger car	0.2	Negligible
Public Light Bus / Passenger Van /Light Goods Vehicles	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

Emissions Estimation from Industrial Operations

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

Emissions from 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

Emissions from 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 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

Emissions from 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. The emissions of NO_x and SO_2 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 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

Emissions from Industrial Process

Different types of industrial processes will produce different types of air emissions. The US 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 landfill;
- Stationary internal combustion sources such as gas turbine engines;
- Evaporation loss sources;
- Petroleum industry;
- 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) Estimation

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 US 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 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; and • 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 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 said. "You can always find room for improving energy efficiency. Just walk around your office or premises and perform a site survey following the Energy Audit Guidelines, which is available from various sources such as the Government's Website."

Since 1999, CLP 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, a customer installed over 20,000 electronic ballasts, phased out several aging gas or diesel boilers and switched to the highly energy efficient and emissions-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 is as high as 5 GWh a year."

An energy audit is similar to financial accounting. It is a quick way to assess and analyze 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 an 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 energy efficiency by 10% to 30%. Using LCD monitors can save more than 50% off electricity usage compared to CRT monitors. Regular cleaning of condenser tubes, cooling coils and air filters can help maintain cooling efficiency. Purchasing energy efficient equipment can reduce the level of energy consumption, etc.

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

3. DEVELOPING ENERGY/EMISSIONS MANAGEMENT SYSTEM

Prioritizing Key Areas to be Improved

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 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 organizations 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 summarized 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.

No idea where to start? A benchmark can help

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

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

Managing Energy Efficiency by Objectives and Targets

"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, 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 at area A	AB Cheung	31/3/07
1.		
2.		
3.		

Sustain Energy Saving Programme by Adopting Knowledge-based Approach

"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 analyzing 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 analyze 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 optimization 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. Minimize 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

Every Member of Staff Needs to Contribute

"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.

Energy Reduction Measures in Offices

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.

Tips:

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

Source: Health, Safety and Environmental Report 2004, Towngas Website:

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 high level of energy consumption from air-conditioning, workplace temperature should be adjusted at 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 25.5^0C 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^{o}C 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

Action 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 efficiency equipment

Office equipment, such as photocopiers and laser printers, emit ozone. Therefore, they should be placed in an 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 document if possible.

If you are looking for photocopiers or printers, look for ones that are recognized 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 minimizing 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.

Tips:

- 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% 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% 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%.

Source: EMSD

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.

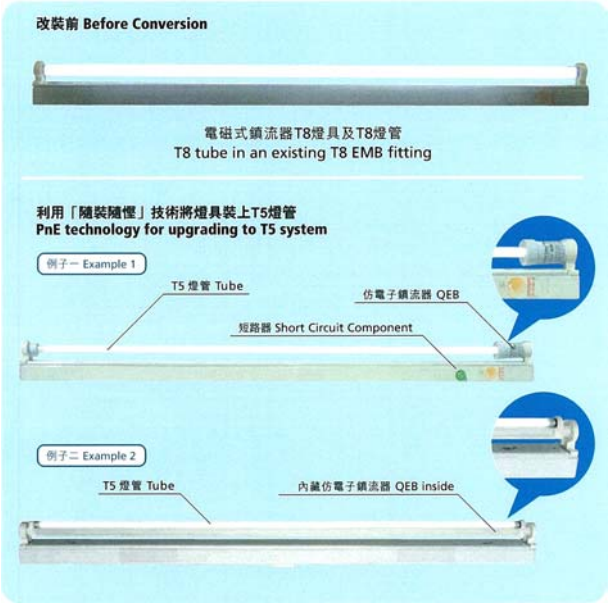
The company does not make any significant direct emissions into the air from this site, however, as with all offices, the consumption of energy will contribute indirectly towards emissions to air from power stations, through the use of energy. Wing's Trading Co. Ltd has a good understanding of the importance 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 authorized 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 minimize the energy usage.
7. Air-conditioners and the light are switched off in meeting rooms when these are not in use.

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

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

Energy / Emissions Reduction Measures in the Street and at Work

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 engines off 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.

Tips:

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. They estimate 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 KMB.

As one of the largest public transport companies in Hong Kong, KMB makes around 2.8 million passenger trips daily. Among the 4,053 buses in the KMB bus fleet, 3,450 buses achieve Euro II or above emissions standards, with 448 and 567 buses achieving Euro III and close to Euro IV emissions 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 emissions levels of sulphur oxides, nitrogen oxides and particulates. Catalytic converters have been installed 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 matters and reduce smoke levels to virtually zero. Euro III-engined buses equipped with CRTs plus an exhaust gas recirculation device are able to meet emissions 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 emissions standards for all its buses and screens the database for all bus routes requiring emissions 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, and 90% of KMB buses operating on Hennessy Road, Queensway, Des Voeux Road Central and Nathan Road, are at Euro II or above standard.

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.

Reducing Energy 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. Aging lifts can be upgraded through a modernization plan to install a state-of-art Variable Voltage Variable Frequency (VVVF) system, so that lifts are driven by microcomputer rather than traditional mechanical controls. The smoother acceleration and deceleration that the AC machines produce, and a slower speed for short distance also reduce energy consumption. In addition, lighting and ventilation systems can be automatically turned off through refit when the lifts are not in use.

For escalators, a sensor can be fitted, so that they can automatically stop when not in use to conserve energy.

Source：Chevalier International Holdings Ltd

VOC Control

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 minimize 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;

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

The US Environmental Protection Agency (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.

Energy/Emissions Reduction Measures in 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 increase 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 are removed is kept at the designated level; and
- Installing suitable emissions control measures as described as below.

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 summarized below.

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

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.

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.

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.

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 (S.Z.) Co. Ltd 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 °C.

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

"Every year we produce 600 million shirts, made from pure cotton. Raw materials are provided by our cotton farm in Xinjiang." Mr Calvin Tsang of 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 emission monitoring system (CEMS). 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.

Apart from power generation emission, 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 with removal efficiencies reaching 80%.

"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.

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.

5. AUDITING AND REPORTING

Reviewing and Continual Improvement

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.

Suggestions and opinions from staff members could also 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 summarize 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 monitor 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 optimization. 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 analyzers, 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. Environmental Protection Agency (US 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 US 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 summarized 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. 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 traveled (km)				
NO_x emissions (kg)				
PM emissions (kg)				

Equation:
NO_x emissions = (kilometer traveled of passenger car x 0.9 g/km) + (kilometer traveled of light goods vehicle x 1.6 g/km) + (kilometer traveled of heavy goods vehicles x 8.2 g/km)
PM emissions = (kilometer traveled of light goods vehicle x 0.3 g/km) + (kilometer traveled 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 Year _____ to _____	Reporting Period _____ to _____	% Change	Notes
Total diesel oil consumption (hr)				
NO_x emissions (kg)				
SO_2 emissions (kg)				

Equation:
NO_x : If power rating < 293 kW, NO_x emissions = fuel consumption (litre) x 2.2 g of NO_x/litre
SO_2 : 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 Year _____ 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.	
3.	
4.	

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.

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