

能源效益及相關事項通訊

A Newsletter on Energy Efficiency and Related Matters

二〇〇五年八月 AUGUST 2005

第八期 ISSUE NO.

# EnergyWits

智能

# 8

機電工程署  
EMSD



## 強制性能源效益標籤計劃公眾諮詢

### Public Consultation on Mandatory

### Energy Efficiency Labelling Scheme



機電工程署自一九九五年開始推行自願參與的能源效益標籤計劃。雪櫃是第一款納入該計劃的耗能產品。自願參與的標籤計劃現時涵蓋了 17 類耗能產品，包括了電氣及燃氣產品，以及汽油載客車輛。

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自願參與能源效益標籤計劃實施了已有十年，現在是適當時候推行強制性標籤計劃，作為政府持續推廣善用和節約能源的一項措施。為了收集市民、業界和其他相關團體對強制性能源效益標籤計劃的意見，政府於 2005 年 7 月 29 日開始進行公眾諮詢，為期三個月，至 2005 年 10 月 31 日止。

在推廣善用和節約能源及達致可持續發展方面，強制性標籤計劃發揮重要作用，這點在國際上已得到充分確認。超過 40 個國家（包括美國、歐盟、澳洲、新西蘭、加拿大和南韓等）已就多種產品推行強制性標籤計劃，作為長遠善用和節約能源計劃的其中一環。

我們建議分階段把耗用能源的產品納入強制性標籤計劃。首階段把以下三類產品納入計劃：雪櫃、冷氣機、緊湊型熒光燈（即慳電膽）。這三類產品推行強制性標籤後，估計每年全港可節省 1.5 億度電，這相等於約 1.35 億元電費支出，同時每年可減少 105,000 公噸二氧化碳的排放。



諮詢文件可於各區民政事務處及機電工程署索取，或到以下網址下載：  
<http://eels.emsd.gov.hk>

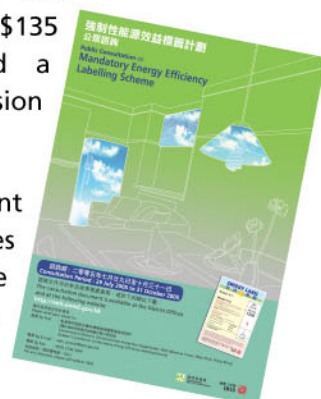
The Voluntary Energy Efficiency Labelling Scheme (EELS) was launched by EMSD in 1995. The first type of energy consuming product included into the scheme is the refrigerator. Now, the scheme covers a total of 17 types of energy consuming products, including electrical and gas products, as well as petrol passenger car.

With the Voluntary EELS in place for a decade, it is considered an opportune moment to introduce a mandatory EELS as part of the Government's ongoing efforts to promote the efficient use and conservation of energy. To collect the views of citizens, businesses, and other stakeholders on the introduction of mandatory EELS, a public consultation was launched on 29 July 2005, which will last for three months until 31 October 2005.

The useful role of a mandatory labelling scheme in promoting energy efficiency and conservation and achieving sustainable development is well established internationally. As part of their long-term energy efficiency and conservation programmes, over 40 countries, including the United States, European Union, Australia, New Zealand, Canada and South Korea, have introduced mandatory EELS for various products.

The inclusion of energy consuming products into the future mandatory EELS of Hong Kong will be implemented in phases. Refrigerators, room coolers and compact fluorescent lamps are proposed to be included in the initial phase of the mandatory EELS. It is estimated that with mandatory energy labelling for these three types of products, an electricity saving of 150 GWh per year can be achieved. This amounts to an annual saving of \$135 million in electricity bill, and a reduction of carbon dioxide emission of 105,000 tonnes per year.

Copies of the consultation document are available at the District Offices and at EMSD. Electronic copy of the consultation document is available at the following website:  
<http://eels.emsd.gov.hk>



# 慳電膽 (緊湊型節能熒光燈)

## Compact Fluorescent Lamps



### 慳電膽時代的來臨

慳電膽（緊湊型節能熒光燈）最先在二十世紀八十年代初出現，其生產技術在九十年代突飛猛進。慳電膽越來越細小，價格也越來越便宜。今時今日，食肆、商店、家居和許多地方都廣泛使用慳電膽。慳電膽有多種形狀和功率可供選擇，大家可以輕易買到功率由數瓦至大約 30 瓦的慳電膽，然而功率較大、達到 200 瓦的產品也有售。

### 慳電膽的工作原理

慳電膽基本上由彎曲成 U 型（或雙 U 型、多 U 型、螺旋型等）的小型熒光管和內置電子鎮流器組成。熒光管內壁塗上三色磷光粉，含有少量水銀（汞），並且充滿甚低壓的惰性氣體。燈絲電極則位於熒光管兩端。

### The Era of the Compact Fluorescent Lamp (CFL)

Compact fluorescent lamps (CFLs) first appeared in the early 1980s. In the last decade, we saw rapid advances in CFL production technology. CFLs are getting smaller and smaller in size, and prices are dropping. Nowadays CFLs are widely used in restaurants, shops, homes, and many other places. CFLs come in a variety of shapes and wattages. We can easily buy CFLs from a few watts to around 30 watts, but larger ones up to 200 watts are also available.

### How does it work?

The CFL is essentially made up of a miniaturized fluorescent tube bent into U-shape (or double-U, multiple-U, spiral) and has a built-in electronic ballast. The tube is coated with tri-colour phosphor powder, containing a small amount of mercury and filled with an inert gas under very low pressure. There are two electrodes, which are small filaments, at the ends of the tube.



新設計的慳電膽外形特別美觀。Some recent CFL designs are aesthetically pleasing.



不同大小、形狀、及顏色的慳電膽  
CFLs come in different sizes and shapes, and colours

鎮流器發出高起動電壓，以產生起動電弧，隨後限制電流大小，以防熒光管受損。熒光管起動後，熒光管中的水銀由液體轉化成氣體，放出紫外光。紫外光令磷光粉發熒光，放出可見光。

慳電膽起動後，亮度最初好像較正常暗，然而會在短時間內逐漸增強。

## 慳電膽既節省大量能源，又可慳錢

慳電膽是白熾燈（如一般燈泡、鎢絲鹵燈等）的良好替代品，耗電量少得多，而且壽命長得多。

慳電膽不但可以替代白熾燈，而且正在取代商店使用的高強度放電燈，甚至開始取代裝飾照明用的鎢絲鹵燈（石英燈）。

## 多種顏色的光可供選擇

慳電膽發出的光的顏色以“色溫”表示。如色溫低於 3500K，則通常稱為“暖”色。如色溫介乎 3500K 和 5000K 之間，則為“涼”色。超過 5000K，則稱為“冷”色。

常見慳電膽的色溫為 2700K 或 6000K，然而市面也有中等色溫（如 3000K、4000K 等）的慳電膽售賣。

人們往往分別用“暖白”、“涼白”和“日光”代表 2700K、4000K 及 6000K。

Often we use the terms “Warmwhite” for 2700K, “Coolwhite” for 4000K, and “Daylight” for 6000K.



兩者都是 5 瓦慳電膽，右手邊新近設計細小得多  
Both are 5W lamps. The more recent design on the right is much smaller in size.

慳電膽耗電量是同等亮度燈泡的三分之一至五分之一。假設某一家庭使用 10 盞 60 瓦燈泡，每盞的壽命為 1000 小時，售價為 6 元，每天亮着 5 小時，則平均成本（包括更換燈泡所需費用和電費）是每年 1200 元左右。不過，如改用壽命達 6000 小時、售價為 30 元的 20 瓦慳電膽，則平均成本（包括更換燈泡所需費用和電費）只是每年 450 元。

CFLs use about 1/3 to 1/5 of the energy of ordinary light bulbs of same brightness. Let's assume a home has 10 numbers of 60W light bulbs, each with life of 1000 hours and costing \$6, and the lights are on 5 hours a day, average cost (including replacement light bulb cost and electricity cost) is about \$1200 per annum. However, if we use 20W CFLs each with life of 6000 hours and costing \$30, average cost (including replacement lamp cost and electricity cost) is only \$450 per annum.

The ballast provides a high initial voltage to create the starting arc, and then limits the current to prevent damage to the lamp. When the lamp is started, the mercury in the tube changes from liquid to gaseous phase, and emits ultraviolet light. This light then causes the phosphor to fluoresce, thus producing visible light.

When switched on, a CFL at first looks dimmer than normal, and its brightness will gradually build up in a short while.

## CFL can save a lot of energy, and dollars as well

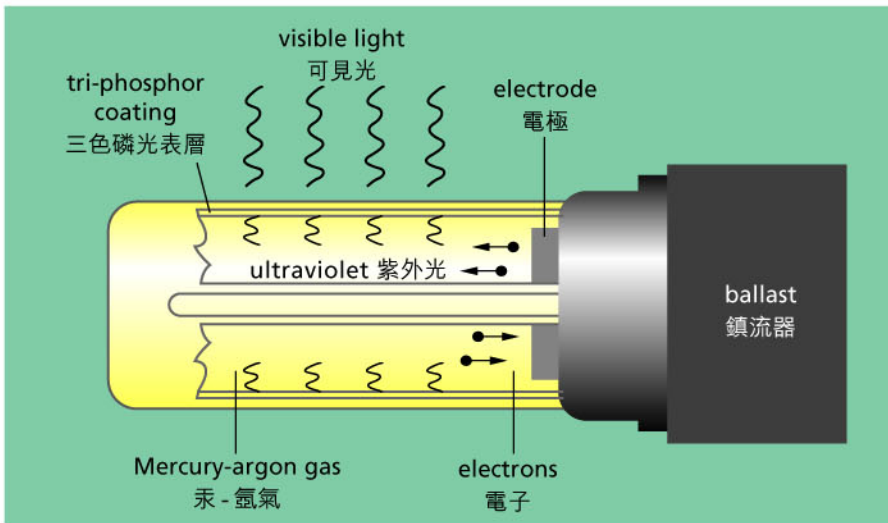
CFLs are good substitutes for incandescent lamps (such as ordinary light bulbs, tungsten halogen lamps). CFLs use a lot less energy, and last much longer.

Not only can CFLs be used to replace incandescent light bulbs, they are now replacing high intensity discharge lamps in shops, and even beginning to replace tungsten halogen lamps for display lighting.

## Different colours of light available

The colour of the light emitted by a CFL is indicated by its “colour temperature”. When the colour temperature of a lamp is less than 3500K, it is usually described as having a “warm” appearance, and “cool” appearance if it is from 3500 to 5000K. For more than 5000K, it is described as having a “cold” appearance.

CFLs with colour temperatures of 2700K and 6000K are commonly available, while lamps of intermediate colour temperatures (e.g. 3000K, 4000K) can also be found.



### 慳電膽可調校光暗嗎？

慳電膽與白熾燈不同，一般並不設計成可調校光暗，不過亦有部分慳電膽可以調校光暗。可調校光暗的慳電膽通常在外殼和包裝盒上有標明。

### 瓦數相同的慳電膽一定同樣光亮嗎？

包裝盒上印上相同“瓦數”的慳電膽不一定具有相同亮度，這與慳電膽的發光效率（即每瓦的耗電換來多少“流明”的光輸出量）有直接關係。

為了令公眾更容易購得能源效益高的慳電膽，機電工程署由1998年起已把慳電膽納入「自願參與能源效益標籤計劃」內。這計劃規定了慳電膽的最低發光效率，因此大家若購買附有能源標籤（屬確認式標籤，沒有分等級）的慳電膽，就得到最低亮度保證。

除了亮度外，能源效益標籤計劃也就慳電膽壽命和流明維持率作出一些規定。如欲為某款慳電膽取得能源標籤，便須對慳電膽樣本進行測試，以確定其平均壽命是否不少於6000小時，使用2000小時後的流明維持率是否不少於78%（即光輸出量不少於開始時的78%）。



慳電膽能源標籤  
Energy label for CFL

### Are CFLs dimmable?

Unlike incandescent light bulbs, CFL is not designed for dimming but some may possess this capability. Dimmable CFLs are often marked as such on the casings and the package boxes.

### Are lamps of same wattage always equally bright?

Lamps of the same “wattage” stamped on the package boxes are not necessarily of the same brightness. This is actually related to the “luminous efficacy” (amount of light output in lumens divided by the electrical power in watts) of a lamp.

To make it easier for the public to choose energy-efficient CFLs, EMSD has included CFLs into the voluntary Energy Efficiency Labelling Scheme (EELS) since 1998. The EELS imposes lower limits of luminous efficacy for CFLs. Therefore, when one buys a CFL with an Energy Label (which is a recognition-type label, with no grading), a minimum brightness is guaranteed.



收藏在外殼之中的電子鎮流器  
The integrated electronic ballast is tucked inside the casing

Besides brightness, the EELS also imposes requirements on lamp life and lumen maintenance. Before getting the Energy Label, samples of the lamp have to be tested to check that the average lamp life is not less than 6000 hours, lumen maintenance at 2000 hours is not less than 78% (i.e. light output should not be less than 78% of the initial value), and of course the luminous efficacy can meet the specified requirements.

# 與電網接駁的小型可再生能源發電系統

## Grid Connection of Small-scale Renewable Energy Power Systems

### 為何將可再生能源裝置與電網接駁

在香港，政府和私營機構建造了不少小型可再生能源裝置，主要為發電量數千瓦至數十千瓦不等的光伏裝置，以及太陽能熱水器裝置。在這些光伏裝置之中，大部分為供電給特定負荷的獨立系統，小部分則直接連接上有關場地或建築物內的配電系統。後者被稱為「與電網接駁的可再生能源裝置」，因為這些裝置會與電網並行運作，以應付有關場地或建築物的用電需求。

由於可再生能源資源（例如太陽能或風能）並非恆定或無所間斷，獨立運作的可再生能源裝置的輸出功率會因應可獲得的太陽能或風能而有所變動。然而，與電網接駁的可再生能源裝置一方面補充了電網的電力供應，另一方面，如因天氣關係而令太陽能或風能減少，則這些裝置的電力供應不足之處便會由電網所補充。

### 技術指引的由來

在 2002 年年底，能源效益事務處進行了一項試驗計劃，在灣仔政府大樓安裝了 55 千瓦的「附設於建築物光伏系統」，並使該系統與電網接駁，以便獲得安裝和操作這類系統的經驗。根據推行這項計劃所得到的經驗，我們明白到如欲成功和妥善推行與電網接駁的可再生能源發電裝置計劃，有一些技術方面的事項必須加以留意。

為了與其他專業人士分享推行灣仔政府大樓試驗計劃所得的經驗，能源效益事務處於 2004 年成立了一個工作小組，目的在制訂「**可再生能源裝置與電網接駁技術指引**」。技術指引於 2005 年年初出版。

### 技術指引的要點

技術指引適用於額定功率為 200 千瓦以下並與電網接駁的小型可再生能源發電系統。以下為技術指引中的一些要點：

### Why connect renewable energy installations to grid

In Hong Kong, a number of small-scale renewable (RE) installations have been built by the government and the private sector, mainly photovoltaic (PV) installations with capacities of a few kW to tenths of kW, and solar water heating installations as well.

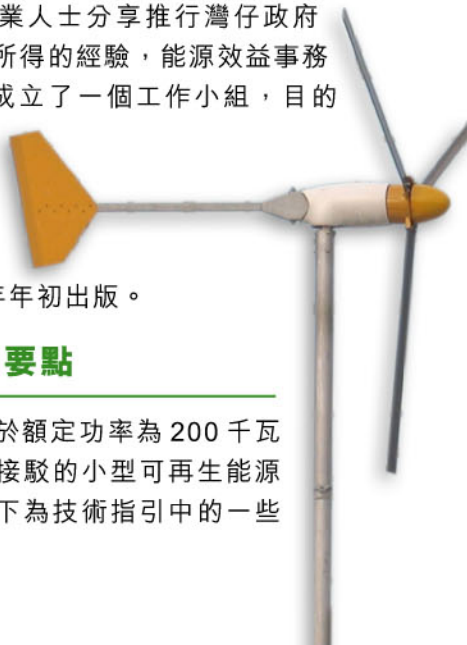
Among the PV installations, most are standalone systems serving dedicated loads, while a few are directly connected to the electrical distribution system within the site or the building. The latter are called "grid-connected" RE installations as they operate in parallel with the electricity grid to serve the electricity needs of the respective sites or buildings.

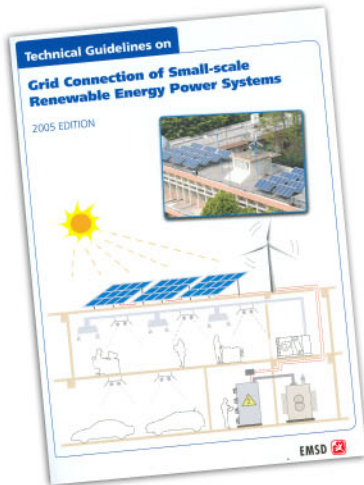
Due to the intermittency of renewable energy resources, the power output from a standalone RE installation fluctuates according to the available solar or wind energy. In contrast to this, a grid-connected RE installation on one hand supplements the grid supply, and on the other hand is supplemented by the grid supply when the solar or wind energy is curtailed by weather.

### How the Technical Guidelines came about

In late 2002, the Energy efficiency Office (EEO) installed a 55kW building-integrated photovoltaic (BIPV) system at Wanchai Tower as a pilot project on grid connection, to gain hands-on experience in the installation and operation of such kind of system. With the experience gained from the project, it became obvious that a number of technical considerations are very important to the successful and proper implementation of a grid-connected RE project.

To share with other professionals the experience from the Wanchai Tower pilot project, a working group was formed in 2004 to develop the **Technical Guidelines on Grid Connection of Small-scale Renewable Energy Power Systems**. The Technical Guidelines was published in early 2005.





技術指引的封面  
Cover of the Technical Guidelines

## Key points of the Technical Guidelines

The Technical Guidelines apply to grid-connected small-scale renewable energy power systems (SREPS) of ratings up to 200 kW. Given below are some key points in the Technical Guidelines:-

### a) Safety considerations

If the SREPS remains connected to the electrical distribution system of a site in the event of an interruption in the electricity supply from the grid, switchboards may continue to remain energized. Therefore, a protection function (“anti-islanding”) should be incorporated into the design of the SREPS, to automatically disconnect it from the electrical distribution system in the event that the grid supply is interrupted for whatever reasons. When the grid supply is restored, the SREPS can either be re-connected to the electrical distribution system under manual control, or it can be automatically re-connected to the system after certain time delay.

### b) Equipment protection considerations

When a SREPS is added to an existing electrical distribution system, the original short-circuit current levels (i.e. fault levels) of the distribution system will be elevated. It is important during the design stage of the SREPS to re-assess the fault levels within the distribution system, and to re-adjust the protection device settings within the distribution system where necessary.

### c) Reliability considerations

The reliability of electricity supply to existing loads should not be adversely affected by the introduction of a grid-connected SREPS. One of the key components affecting the reliability of a SREPS is the inverter. An inverter with long MTBF (mean-time-between-failures) and of proven design should be chosen.

### d) Power quality considerations

Good power quality is important for the proper operation of electrical and electronic equipment. As inverter is often included as part of a SREPS, power conditioning function should be incorporated into the inverter to reduce the injection of harmonic currents into the system.

### a) 安全方面的考慮

如小型可再生能源發電系統在電網的電力供應中斷時仍與有關場地的配電系統接駁，配電板可能會繼續帶電。因此，必須在小型可再生能源發電系統的設計中加入保護功能（「防局部繼續供電」功能），以便當電網因任何緣故而停止供電時，會自動切斷小型可再生能源發電系統與配電系統之間的連繫。當電網恢復電力供應時，小型可再生能源發電系統可以人手與配電系統再次連接，或在延時後自動與配電系統再次連接。

### b) 設施保護方面的考慮

如小型可再生能源發電系統接上現有的配電系統，配電系統原來的短路電流水平（即故障電流水平）將會提高。在小型可再生能源發電系統的設計階段，必須重新評估配電系統內的故障電流水平，並在有需要時重新調較配電系統內的保護裝置設定值。

### c) 可靠性方面的考慮

當引入與電網接駁的小型可再生能源發電系統時，須確保現有負荷能繼續獲得可靠的電力供應。影響小型可再生能源發電系統可靠性的其中一個主要組件是逆變器，因此必須選用具高「平均故障間隔時間值」且具有可靠運作證明的逆變器。

### d) 電源品質方面的考慮

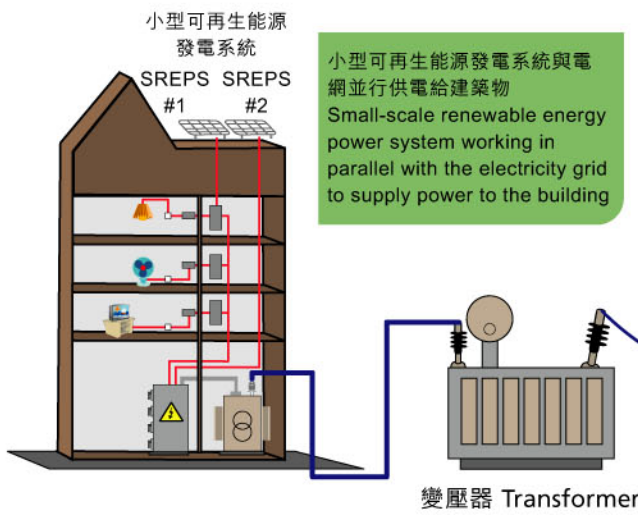
高品質的電源，是確保電力和電子設備妥善運作的重要條件。由於小型可再生能源發電系統通常都裝有逆變器，因此，逆變器應配有電源調節功能，以減少注入系統的電流諧波。

由小型可再生能源發電系統注入配電系統的直流電流如果過多，會引致電壓變形。在逆變器的輸出部分安裝隔離變壓器，可杜絕直流電流注入配電系統。

## 技術指引可供下載

如欲下載技術指引的文本，可瀏覽我們的網頁，網址為：

<http://www.emsd.gov.hk/emsd/chi/sgi/re.shtml>



Injection of excessive amount of direct currents from the SREPS into the electrical distribution system can cause voltage distortions in the latter. An isolation transformer at the output side of the inverter can eliminate the injection of direct currents.

## The Guidelines available for download

Anyone wishing to download a copy of the Technical Guidelines can visit our website at the following address:

<http://www.emsd.gov.hk/emsd/eng/sgi/re.shtml>

## HK's Largest PV Installation 香港最大型光伏裝置

### 機電工程署新總部大樓天台的光伏裝置

## Photovoltaic Installation

### on the Roof of New EMSD Headquarters

#### 350 千瓦光伏裝置

機電工程署九龍灣新總部大樓天台安裝了一套總功率達 350 千瓦的光伏裝置，是全港最大的光伏裝置。裝置包括一組由超過 2300



觀景台的光伏玻璃單元  
The PV glass units on the viewing gallery

#### About the 350kW Installation

A 350 kW photovoltaic (PV) installation has been installed on the roof of the New EMSD Headquarters in Kowloon Bay. This installation, being the largest PV installation in Hong Kong, involves a solar array made up of more than 2,300 PV modules which together has a total area of around 3,180 m<sup>2</sup>, and a smaller system made up of PV glass units.

Each PV module in the solar array is constructed in the form of a rectangular panel and consists of 72 series-connected mono-crystalline silicon PV cells. The panels are mounted on supporting racks in an inclined manner and facing southwards so as to receive maximum solar irradiation in the course of a year.



塊光伏組件組成、總面積約 3180 平方米的光伏板陣列，以及一個由光伏玻璃單元組成的小型光伏系統。

光伏板陣列的每個光伏組件，形狀為長方形平板，並由 72 塊單晶硅光伏電池串聯而成。平板斜放在支架上，面向南方，俾能收集以全年計最多的太陽輻射。

除此之外，天台的觀景台也裝有光伏玻璃單元。共有 20 套這種單元，每套由兩層玻璃夾着 100 塊串聯的單晶硅光伏電池所組成。

裝置輸出的直流電由多台逆變器轉化為交流電，用來補充由電力公司供應的電力，以滿足大樓的電力需求。

我們會持續監察光伏板裝置的表現，而所收集到的表現數據則會用作評估光伏系統在香港的氣候條件下的效能。

## 光伏電池

顧名思義，光伏指把光能直接轉化為電力。光伏電池由半導體物料製成，而這些物料遇光照射會在接連的電路上產生電流。

光伏電池主要分為三種：

- 單晶硅光伏電池 — 轉換效率最高的一種，典型轉換效率為 14 至 16%；
- 多晶硅光伏電池 — 較單晶硅光伏電池便宜，典型轉換效率為 13 至 15%；
- 非晶硅光伏電池 — 最便宜的一種，但轉換效率較低，只有 5 至 7%。

光伏電池有多種尺寸和形狀。單一光伏電池只能產生少量電力，因此為了產生更多電力，電池須連結成模組，模組再連結成陣列，一如機電工程署新總部大樓的光伏板陣列。

In addition to these, PV glass units are installed on the viewing gallery on the roof of the building. There are totally 20 sets of PV glass units, each consisting of 100 series-connected mono-crystalline PV cells sandwiched between two sheets of glass.

The d.c. output of the installation is converted into a.c. by a number of inverters. The a.c. power generated by the PV installation supplements the electricity supply from the power company to meet the electrical power requirement of the building.

The performance of the PV installation is being continuously monitored. The performance data collected will be used for assessing the effectiveness of PV systems under Hong Kong's climatic conditions.

## About PV cells

Photovoltaic, as the name implies, means direct conversion of light energy into electricity. PV cells are made from semiconducting materials, which can generate a flow of electrons in the electric circuit when light is received by the material.

There are three principal types of PV cells:

- Mono-crystalline silicon PV cells - the most efficient type with typical conversion efficiencies of 14 to 16%.
- Poly-crystalline silicon PV cells – cheaper than mono-crystalline type, with typical conversion efficiencies of 13 to 15%.
- Amorphous silicon PV cells – cheapest of the three types, with typical conversion efficiencies of 5 to 7%.

PV cells come in many sizes and shapes. A single PV cell can produce only a small amount of power. To produce more power, cells are interconnected to form modules, which in turn can be connected to form arrays, just like the solar array at the New EMSD Headquarters.

光伏板陣列鋪滿了整個天台  
The PV array covers the  
whole roof of the building



# 空調系統的 室溫控制

## Room Temperature Control in Air-conditioning Systems

### 節約能源及室溫控制

空調用電佔全港每年用電差不多三分之一。為了推廣節能，政府提倡在夏天把空調室溫提昇至攝氏 25.5 度。

空調系統有不同的種類，例如冷氣機及中央空調系統等，視乎地方的大小及用途而選用。一個空調的室內環境是否令人感到舒適，受很多參數影響，如：溫度、濕度、空氣流速。本文旨在闡釋不同空調系統的室溫控制方式。

### 室溫控制的基本原理

藉着改變空調系統引進室內的冷風（稱為「供風」）的溫度或流量，室內溫度得以加以控制。

引進室內的冷空氣會吸收室內的熱力，因而變得較暖。部份室內空氣會被回送返空調系統（稱為「回風」），經冷卻後再循環流動，引進室內。

### Energy Saving and Room Temperature Control

Air-conditioning accounts for almost one-third of the annual electricity consumption in Hong Kong. In order to promote energy conservation, the Government advocates raising air-conditioned room temperatures in the summer to 25.5°C.

Depending on the sizes and functions of the spaces to be cooled, different types of air-conditioning systems, such as room coolers or central air-conditioning systems, can be installed. Many parameters, such as temperature, relative humidity and air velocity, affect the level of comfort of an air-conditioned indoor environment. This article explains how room temperatures are controlled in different types of air-conditioning systems.

### Basic Principle of Room Temperature Control

Temperature control of a space is achieved by means of either varying the temperature or the flow rate of the cold air introduced by the air-conditioning system into the space (called "supply air").

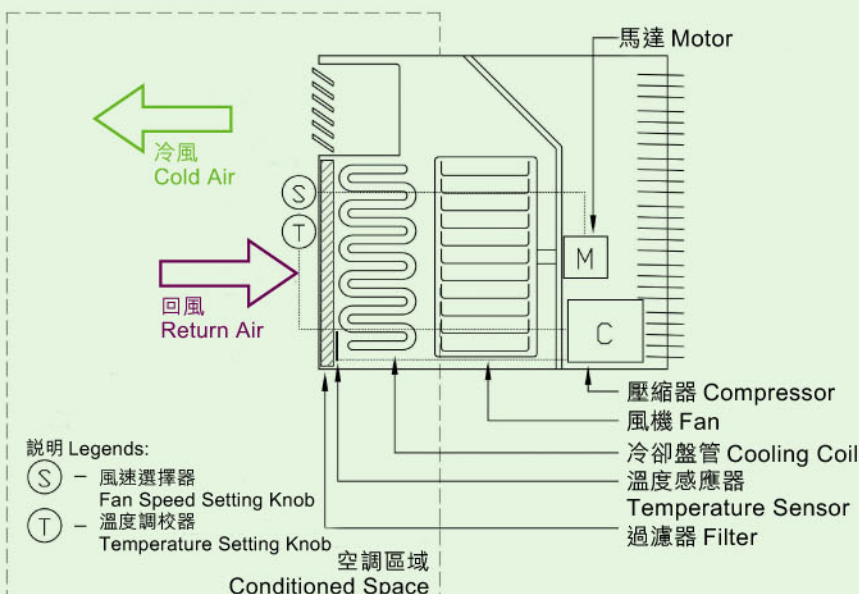
The cold air entering the space absorbs heat from the space and becomes warmer. Some of the room air is returned to the air-conditioning system (called "return air") for chilling before re-circulated back to the space.

A part of the room air is exhausted to outdoors, and is replenished by fresh outdoor air.

### Room Coolers or Split Units

Figure 1 illustrates the major parts of a room cooler. When the room cooler is switched on, the fan will circulate room air through the cooling coil.

圖一：窗口式冷氣機  
Fig.1: Room Cooler



## 窗口式冷氣機或分體式冷氣機

圖一顯示窗口式冷氣機的簡單組成圖。在冷氣機啟動後，風機會運作，把室內空氣抽入，流經冷卻盤管後再送回室內。

室溫憑藉以下方式保持在一個狹窄範圍內：

- 當壓縮器運作時，回風會先被冷卻盤管所冷卻，然後吹進室內。
- 此時室溫會下降。當溫度感應器感應到回風溫度下降至一個下限值時，壓縮器便會停止運作，同時回風不再被冷卻。
- 這時候室溫會上升。當回風溫度上升至一個上限值時，壓縮器便會再次運作。

採用這種控制方式，室溫會隨着壓縮器的運作而在一特定範圍內上升及下降。我們可利用溫度調校器調校平均室溫。

## 中央空調系統

空調需求量大的樓宇多會採用中央空調系統。

在這種系統中，中央冷卻機組供應冷凍水至每樓層的供風設備，以冷卻該區的空氣。

根據樓層中供風設備的安排，中央空調系統一般可分為盤管式風機系統、固定風量系統及可變風量系統。

### (a) 盤管式風機系統

盤管式風機內有冷卻盤管及風機。冷凍水流經冷卻盤管，風機則把房間空氣引經冷卻盤管，方式與冷氣機相若。

若樓宇內大部分地方均間隔為獨立房間（例如酒店），則通常會採用盤管式風機系統。每間房間裝有一部或以上的盤管式風機。

在控制室溫方面，盤管式風機與窗口式冷氣機相類似，不過，盤管式風機是透過控制冷凍水的流量，而非控制壓縮器的運作，從而改變冷卻盤管的製冷量。

Room temperature is maintained within a narrow range in the following way:

- When the compressor is turned "on", the return air is cooled by the cooling coil. The cold air is blown into the room by the fan.
- Room temperature will fall and when the temperature of the return air as sensed by the temperature sensor reaches a lower limit, the compressor is turned "off" and the return air is no longer cooled.
- Room temperature will then rise and when the temperature of the return air reaches an upper limit, the compressor is turned "on" again.

The room temperature under this type of control will rise and fall depending upon the operation of the compressor. We can adjust the temperature setting knob to move the average room temperature up or down.

## Central Air-conditioning Systems

Buildings with heavy air-conditioning requirements will normally adopt central air-conditioning systems.

In such a system, a central chiller plant supplies chilled water to air-handling equipment located on each floor, where the air is cooled.

Depending on the air-handling arrangement at each floor, central air-conditioning systems can generally be classified into fan-coil unit systems, constant air volume systems and variable air volume systems.

### (a) Fan-coil Unit Systems

A fan-coil unit (FCU) consists of a cooling coil and a blower fan. Chilled water flows through the cooling coil, and the blower fan circulates room air through the coil in a manner similar to a room cooler.

FCUs are suitable for serving building spaces that are partitioned into cellular compartments such as the case of a hotel. Each room is served by one or more FCUs.

Room temperature control for an accommodation served by a FCU is similar to that for a room cooler, except that the cooling effect of the cooling coil is controlled by changing the flow of chilled water, rather than turning on or off a compressor.

## (b) 固定風量系統

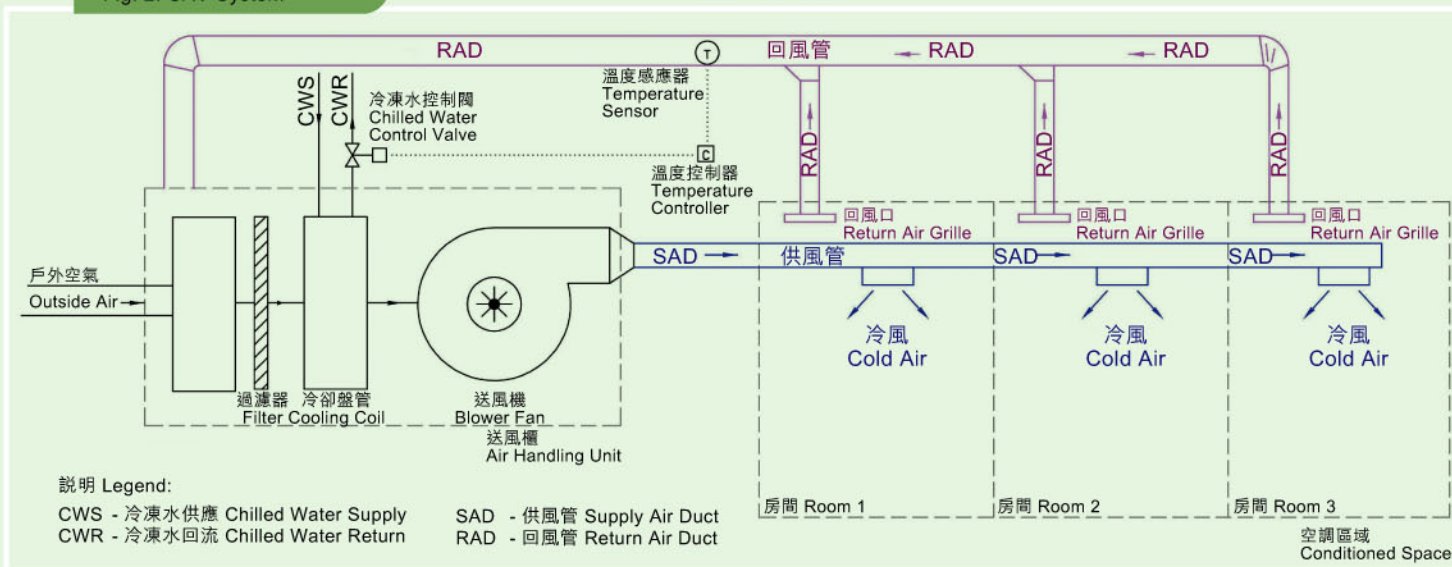
對於固定風量系統，通常做法是在每樓層設置「送風櫃」。

送風櫃裝設有大型的冷卻盤管及送風機。送風機透過「供風管」為各房間提供冷風。「回風管」把各房間的回風帶返送風櫃。

與固定風量系統連接的房間，其供風量會在設計階段定下來，並會保持不變。

圖二為簡單的固定風量系統組成圖。

圖二：固定風量系統  
Fig. 2: CAV System



房間溫度透過以下方式控制：

- 回風溫度藉着裝設在回風管內的溫度感應器而量度。
- 若果所量度到的回風溫度高於設定值，冷卻水控制閥會允許更多冷凍水流經冷卻盤管。
- 房間的供風溫度因而降低，從而降低各房間的室溫。
- 若果所量度到的回風溫度低於設定值，冷凍水流量則會減少。

與同一台送風櫃連接的房間的溫度並非獨立控制，因此，這些房間的冷卻負荷特性應要比較接近（例如所有房間的窗都向同一方向），以減少房間溫度之間的差別。

## (b) Constant Air Volume System

For a constant air volume (CAV) system, usually there is an "air handling unit" (AHU) on each floor for cooling the air.

The AHU has a large cooling coil and a blower fan. The blower fan blows cold air into the rooms through the "supply air duct". The "return air duct" brings the return air from the rooms back to the AHU.

All the rooms connected to the CAV system will have the supply air flow rates fixed during design stage.

Figure 2 illustrates the major parts of a simple CAV system.

The temperatures of all the rooms are controlled together as follows:

- The temperature of the return air is sensed by a temperature sensor located in the return air duct.
- If the sensed temperature is higher than the set-point value, the chilled water control valve will allow more chilled water to flow through the cooling coil.
- In this way, the temperature of the supply air is reduced, and the room temperatures are lowered.
- If the sensed temperature is lower than the set-point value, the chilled water flow rate will be reduced.

Since the temperatures of all the rooms are not independently controlled, the rooms served by the same AHU should have similar cooling load patterns (for example all have windows facing the same direction) so as to minimize the differences in the room temperatures.

在系統初安裝時，會藉着調校房間風管內的裝置，令房間的供風量符合設計的要求，這步驟即所謂「風量平衡」。

### (c) 可變風量系統

可變風量系統與固定風量系統很相似，有送風櫃、供風管、回風管等。不同之處，是房間內都設有「可變風量箱」。

圖三為可變風量系統組成圖。

房間溫度透過以下方式控制：

- 各房間都設有溫度感應器，量度房內溫度。
- 若果所量度到的室溫高於設定值，可變風量箱會允許更多冷風進入房間，從而令室溫下降至設定值。
- 若果所量度到的室溫低於設定值，可變風量箱會減少進入房間的冷風量。

因此，各房間的溫度都能藉着調節各自的供風量而獨立控制，以保持室溫接近設定值。

When the system is first set up, the air flow rate to each room is adjusted by means of a device located inside the air duct for the room, to meet the design conditions. This procedure is called "air-balancing".

### (c) Variable Air Volume System

A variable air volume (VAV) system is quite similar to a CAV system, with AHU, supply air ducts and return air ducts. The major difference is the use of VAV boxes in each room.

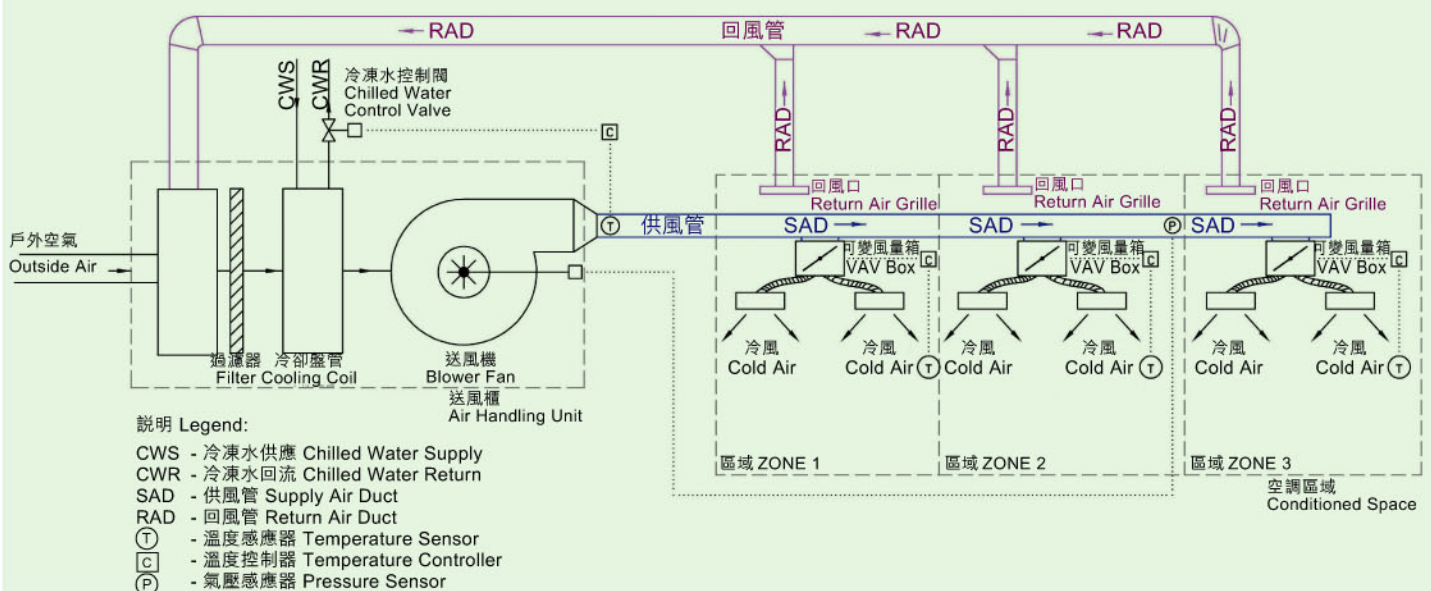
Figure 3 illustrates the major parts of a VAV system.

Room temperatures are controlled in the following manner:

- A temperature sensor located in each room senses the room temperature.
- If the room temperature is higher than the set-point, the VAV box will allow more cold air to flow into the room to lower the room temperature back to the set-point.
- If room temperature is low, the VAV box will reduce the amount of cold air going into the room.

In this way, the room temperatures are independently controlled by varying the air flow rates, to keep them close to the set-point values.

圖三：可變風量系統  
Fig.3: VAV System



# 世界環境日 2005 及攝氏 25.5 度

## World Environment Day 2005 and 25.5°C

何光偉副署長於 2005 年 6 月 5 日出席由環境保護運動委員會主辦的「世界環境日 2005」開展儀式，並擔任主禮嘉賓。今年世界環境日的全球主題為「綠色城市」，而香港的本地主題則為「清新空氣，舒適城市」，藉此鼓勵市民停車熄匙以及在夏天把空調室溫調節至攝氏 25.5 度。當日的開展儀式亦包括啟播三套內容圍繞今年的主題的政府宣傳短片。

本署一直提倡在夏天把空調室溫調節至攝氏 25.5 度。能源效益事務處在「世界環境日 2005」的籌備階段曾向環境保護運動委員會提供有關空調室溫的專業意見。

室內空調溫度過低的情況相當普遍，不少市民在室內須要穿著額外的衣服。美國供暖製冷及空調工程師學會（ASHRAE）的調查發現，把空調室溫調節至攝氏 22.5 至 25.5 度最為舒適。

雖然 25.5 度並非是所有人都喜歡的溫度，但選用這個溫度，我們可以節省可觀的能源而一般情況下不會很影響舒適水平。同時，由於空調系統中的冷卻盤管有除濕作用，室內濕度亦可保持在可接受的水平。

如果我們在夏天把空調室溫全體調高攝氏 1 度，全港電量支出每年便可減少約 10 億元。

Our Deputy Director, Mr K W HO, participated in the kick-off ceremony on 5 June 2005, for the World Environment Day 2005 organized by the Environmental Campaign Committee, as one of the officiating guests.

The global theme selected for 2005 was "Green Cities". In Hong Kong, the local theme of "Fresh Air, Cool City" was adopted to encourage the public to turn off idling vehicle engines and set air-conditioned room temperature in the summer to 25.5°C. Three TV APIs on the local theme were also launched in the ceremony.

EMSD has been advocating to the public to set the air-conditioned room temperature in the summer to 25.5°C. The Energy Efficiency Office provided expert advice on this aspect to the Environmental Campaign Committee during the preparation for the World Environment Day.

It is not uncommon to see people wearing extra clothing inside air-conditioned premises because the temperature is too low. According to a survey done by the American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE), most people will feel comfortable when room temperature is between 22.5°C to 25.5°C.

25.5°C may not be everyone's most preferred temperature, but it is a temperature that can save a substantial amount of energy without significantly affecting the comfort level under normal circumstances. At the same time, relative humidity is kept at an

acceptable level in air-conditioned spaces, since the cooling coils in air-conditioning systems have dehumidifying effects.

If everyone adjusts the air-conditioned room temperatures up by 1 degree Celsius in the summer, we can save about \$1 billion in electricity expenditure annually.



## 機電工程署 5 個風力監測站

### EMSD's Five Wind Monitoring Stations



繼政府物料營運中心天台、伙頭墳洲（即晨曦島）及砵甸乍山的風力監測站落成後，東龍洲和廟仔墩的風力監測站也於 2005 年 3 月建成。

我們會在 2006 年年中之前，蒐集這 5 座風力監測站各自在一整年內的風力數據。這些數據可用作評估香港東面的地方的風力發電潛力。

Following the wind monitoring stations at Government Logistics Centre, Town Island and Pottinger Peak, two more wind monitoring stations at Tung Lung Chau and Miu Tsai Tun respectively were erected in March 2005.

By mid-2006 we will have gathered year-round data from all five wind monitoring stations, which can be used for assessing the wind energy potential in the eastern region of Hong Kong.

## 慳電膽燈飾設計比賽

### The "Design Competition of Lighting Fittings for Compact Fluorescent Lamps"

「慳電膽燈飾設計比賽」頒獎典禮於 2005 年 3 月 16 日在香港理工大學蔣震劇院舉行。

是次比賽由機電工程署、香港照明學會、香港理工大學設計學院和屋宇設備工程學系聯合舉辦。

比賽在 2004 年 9 月展開，共收到 56 份由多間大專院校的全日制和兼讀制學生的作品。所有入圍的作品都甚具創意及實用性，設計水平亦十分高，盡展同學們的才能及製作技巧。



機電署署長黎仕海太平紳士與奪得金獎的同學合照  
Our Director, Mr Roger LAI, and the Gold Award winners

The award presentation ceremony for the "Design Competition of Lighting Fittings for Compact Fluorescent Lamps" was successfully held on 16 March 2005 in the Chiang Chen Studio Theatre of the Hong Kong Polytechnic University.

The competition was jointly organized by the Electrical and Mechanical Services Department, CIE (Hong Kong), and the School of Design and Department of Building Services Engineering of the Hong Kong Polytechnic University.

The competition started in September of 2004. A total of 56 entries were received from full-time and part-time students of post-secondary educational institutions. All the finalist entries had the qualities of originality and practicality, with a high standard of design achievement which reflected the students' talents and practical skills.

## 訪問 國家發展和改革委員會

### Visit to National Development and Reform Commission

機電工程署和國家質量監督檢驗檢疫總局已於2005年4月19至20日在北京舉行《機電產品安全合作安排》年度會議。機電工程署代表團由何光偉副署長帶領。

能源效益事務處的同事也藉此機會加入機電工程署代表團，並訪問了國家發展和改革委員會和有關的部廳（包括環境和資源綜合利用司及其節能處、能源局、能源研究所等），以便就推廣能源效益和節約能源、能源標籤以及新能源和可再生能源等事宜與有關官員交換意見。



機電署代表與發改委代表合照  
EMSD officers and NDRC officers

The annual meetings under the "E&M Products Safety Co-operation Arrangement" between EMSD and the General Administration for Quality Supervision and Inspection and Quarantine were held in Beijing from 19-20 April 2005. The EMSD delegation was led by our Deputy Director, Mr K W HO.

Taking this opportunity, colleagues from Energy Efficiency Office joined the EMSD delegation and visited National Development and Reform Commission (NDRC) and related ministries and departments (including Department of Environment and Resources Conservation and its Energy Efficiency Division, Energy Bureau, Energy Research Institute, and others), to exchange views on matters relating to the promotion of energy efficiency and conservation, energy labelling, and new & renewable energy.

國家發展和改革委員會在2004年11月公佈了「節能中長期專項規劃」，文件中訂下了至2020年的一系列目標，包括每萬元GDP能耗的目標、主要產品單位能耗指標的目標、主要耗能設備能效指標的目標、以及重點領域和重點工程的特定目標。如對此有興趣，請參閱以下網站：<http://www.ndrc.gov.cn/a/news/200411252.htm>

The NDRC announced the Medium and Long Term Energy Conservation Project Plan in November 2004. The Plan sets out the targets up to 2020, including target energy consumption per yuan GDP, target energy consumption intensities of major products, target energy efficiency levels of major energy-consuming equipment, and specific targets for key areas and key projects. Anyone interested can visit the following link to get more information (in Chinese): <http://www.ndrc.gov.cn/a/news/200411252.htm>

## 廣泛使用淡水於節能空調系統的 蒸發式冷卻塔先行性計劃

### Pilot Scheme for Wider Use of Fresh Water in Evaporative Cooling Towers for Energy-efficient Air Conditioning Systems

由2005年4月1日起，先行性計劃涵蓋的指定地區數目由57個增至71個。先行性計劃小冊子和指定地區的位置圖可從機電工程署的網頁下載，網址為：<http://www.emsd.gov.hk/emsd/chi/pee/wacs.shtml>

With effect from 1 April 2005, the number of designated areas covered by the Scheme has increased from 57 to 71. The Pilot Scheme brochure and the location plans for these designated areas can be downloaded from EMSD's website at: <http://www.emsd.gov.hk/emsd/eng/pee/wacs.shtml>