

# EnergyWits 智能

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# 「重新校驗」 - 為現有建築物量身定製的節能方案

## Retro-commissioning – Tailor-made for Energy Saving in Existing Buildings

香港每年能源最終使用總量，有超過一半（約54%）是以電力形式消耗，而建築物佔本地約90%的用電量。因此，減少建築物中電量消耗對於應對氣候變化非常重要。

受惠於《建築物能源效益條例》，近年新建成的建築物於設計及安裝上皆已滿足到一定的節能標準。然而，一些新建的建築物即使於落成時已進行第一次校驗，亦可能由於設計和實際操作之間的落差，空間使用的改變或用戶行為的轉變等因素而未能達至如預期般的節能效果。在世界建築密度最高的香港，當中約有60%建築物擁有25年以上樓齡，這些建築物都隱藏巨大的節能潛力。

「重新校驗」是一個具成本效益的系統性測試過程，用作適時檢查現有建築物的效能表現。測試過程會找出運作上需要改進之處，以節省能源及能源開支，例如以能源效益較高的電器取代能源效益較低者（例如製冷機、泵、升降機、照明等）及安裝電錶加以測量運作。測試過程可以單項進行，亦可配合翻新工程進行。

More than half (approximately 54%) of Hong Kong's total annual energy end-use is in the form of electricity consumption and buildings take up about 90% of our total electricity consumption. It is imperative to reduce the use of electricity in buildings to help combat climate change.

Benefitted from the Buildings Energy Efficiency Ordinance (BEEO), buildings built in recent years had already fulfilled various energy saving requirements, both on design and installation. However, even those newly built buildings, which have the first commissioning done during handover, may not perform as expected due to various reasons, including deviation between design and actual operation, change of usage, behavioural change of occupants, etc. All these reasons will cause the building to perform not at its highest efficiency. For Hong Kong, which has the highest building density in the world, around 60% of the buildings are over 25 years old. The saving potential of these buildings would be significant.

Retro-commissioning is a cost-effective and systematic process to periodically check an existing building's performance. The process identifies operational improvements that can save energy and thus lower energy bills, such as replacing less energy-efficient appliances with more efficient ones, including chillers, pumps, lifts, lighting, etc. and fitting meters to measure operation. The process can be performed alone or with a retrofit project.



檢查現有建築物性能及效益

Checking on existing building performance and efficiency

機電工程署正積極推動「重新校驗」這個具成本效益的方案，以進一步鼓勵現有建築物進行節能工作。重新校驗運用數據測試、專業分析及診斷，從而制定具科學基礎的優化方案，作出持續改善。方案既可是修改機電系統的運作設定，亦可配合翻新工程進行。為推廣重新校驗，機電工程署正草擬相關的技術指引，說明重新校驗的流程及重點，為業主及業界提供明確清晰的節能改善建議。同時，機電工程署亦推行先導試驗計劃，以六個不同規模、用途、年齡和能源消耗的現有政府建築物作為試點，進行重新校驗。選定的政府建築物包括辦公室、教育服務中心和市政服務大樓，樓齡在10至30年之間。這些建築物均屬於高能耗，當中有些亦設有建築管理系統。具經驗的本地和海外服務提供商已經參與為這些建築物進行重新校驗。試點研究仍在進行中，目標將於2017年內完成。從諮詢和試點項目中獲得的反饋和經驗將用於修定2017年稍後公布的技术指引。

Electrical and Mechanical Services Department (EMSD) is actively pursuing the cost-effective program of "Retro-commissioning" (RCx) to further encourage energy conservation works in existing buildings. Through the use of data tracing, professional analysis and diagnosis, RCx helps to develop a scientific based optimization scheme and make continuous improvement. The scheme can either modify the operation of the electrical and mechanical systems or be carried out in conjunction with the retrofitting works. To promote RCx, EMSD is drafting the relevant technical guidelines to clarify the RCx process and focus, providing clear energy-saving improvement proposals for building owners and the industry. At the same time, six numbers of existing government buildings of different size, usage, age and energy consumption have been selected to join the Pilot RCx Project. The selected government buildings include government offices, education services centres and municipal services buildings from 10 to 30 years old. These buildings are in high rank of energy consumption and some of them have building management systems. Experienced local and overseas service providers have been engaged to apply RCx in these buildings. The pilot project is still in progress and targeted to be completed by end 2017. The feedback and experience gained from both the consultation and the pilot projects will be used to fine-tune the Technical Guidelines before its official launch later in 2017.

重新校驗技術指引草稿  
Draft Technical Guidelines on  
Retro-Commissioning



# 香港科技大學中央供冷站轉化為區域供冷系統

## Remodelling the Central Chiller Plant to a District Cooling System at HKUST

繼啟德發展區首個大型區域供冷系統於2013年啟用後，香港科技大學（簡稱：科技大學）也在其校舍新建了一個區域供冷系統。根據科技大學校園設施管理處所提供的資料，現在分享有關項目詳情：

科技大學校園設施管理處發言人表示，香港科技大學於2012年籌建一所樓高八層的獨立實驗室大樓（下稱：新大樓），並於2014年完成（圖1）。它位於學術大樓旁，樓面面積10,000平方米，內有課室、演講廳、辦公室、教學及研究實驗室。

為應付新增冷量需求，科技大學把中央供冷站轉化，改造成一個區域供冷系統，以供應冷凍水給新大樓。此舉節省了建築成本和用電量，獲美國能源工程師學會頒授2016亞洲太平洋區能源項目獎。

### 系統建造

科技大學於2016年之前已逐步將運作逾20年的三台1,000冷噸製冷機更換為三台1,200冷

Subsequent to the first mega District Cooling System (DCS) at Kai Tak Development was commissioned in 2013, the Hong Kong University of Science and Technology (HKUST) has also completed a DCS for its campus. According to the information provided from HKUST Facility Management Office (FMO), the project details are shared below.

"In 2012, HKUST planned to build a new 8-storey detached laboratory building ("the new building") next to the main academic building. It was completed in 2014 and has a floor area of about 10,000 m<sup>2</sup>, comprised of classrooms, a lecture theatre, offices, teaching and research laboratories (Photo 1)," said HKUST FMO spokesperson.

To meet the new cooling demand, HKUST remodelled the central chiller plant to a DCS for supplying chilled water to the new building. This project achieved a substantial saving in construction costs and electricity consumption, and won the 2016 Association of Energy Engineers (AEE) Energy Project of the Year Award for Asia Pacific Region.

### System Construction

HKUST had progressively replaced three 1,000 RT chillers of over 20 years old with three 1,200 RT chillers before 2016. While there is an increase in cooling capacity, the new chillers are 18% more energy efficient, and hence, installation of new transformers was not required (Photo 2).



圖1： 新建的實驗室大樓  
Photo 1: The newly built lab building



圖2： 新1,200冷噸製冷機  
Photo 2: The new 1,200 RT chiller

## 區域供冷 DISTRICT COOLING

噸製冷機。新機能源效益比舊機高18%，既提升了製冷量，卻不需加裝變壓器（圖2）。

接駁新大樓配水管網路的冷凍水管安裝在地下管坑裡，網路接駁點則位於學術大樓的設備隧道內（圖3）。

用戶支站由大樓加壓泵直接接駁，而不採用熱交換器，水泵由變頻器和壓差感應所控制。支站除供應新大樓外，亦會供應另一棟將建成的綜合禮堂（圖4）。

由於新大樓較中央供冷站高，故需要安裝一個新的膨脹水箱在新大樓頂層，以代替中央供冷站內原先的膨脹水箱（圖5）。

The chilled water pipes for the new building's distribution network were installed underground. The interconnection is in the service tunnel of the main academic building (Photo 3).

The user station adopted the design of a direct connection using building pumps and without heat exchangers. The pumps are controlled by variable speed drive (VSD) and system differential pressure sensors. The station was sized to cater for the new building and a future multi-purpose auditorium (Photo 4).

The original expansion tank located in the central plant building was replaced by a new one located on the roof of the new building because the new building is higher than the central plant building (Photo 5).



圖3：設備隧道內的網路接駁點  
Photo 3: System interconnection in tunnel



圖4：用戶支站的大樓加壓泵  
Photo 4: User station pump



圖5：新大樓的膨脹水箱  
Photo 5: The new expansion tank

## 轉化中央供冷站為區域供冷系統的好處 (相較於建造獨立供冷站)

科技大學表示，把中央供冷站轉化為區域供冷系統後有以下好處：

中央供冷站能源效益較高，可減少碳排放。它不會帶來噪音和震動問題，也幫助減少製冷劑及化學品的用量，環保效益佳。新大樓沒有水霧排放，觀感亦較佳。

因沒有變壓器、製冷機和其它設備，大樓可用空間增加。大樓外觀改善之餘，多出的空間亦可撥作其它用途（圖6）。

因無須保養個別供冷站的機械部件，運作和保養人員可減少，也可以集中人手於中央供冷站的運作和保養，使工作更專注（圖7、圖8）。此外，中央供冷站預留了足夠的備用製冷量，令系統的服務更為可靠。

## Benefits of remodelling the central cooling plant to a district cooling system (compared to building an individual cooling plant)

HKUST said that the following benefits were achieved after remodelling the central cooling plant to DCS:

The DCS has higher plant efficiency and therefore reduces carbon emissions. It also eliminates noise and vibration problems, and helps reduce the use of refrigerant and chemicals. Therefore the DCS is more environmental friendly. The new building is aesthetically more pleasing as it does not emit thermal plume.

The DCS increases usable space as the transformer room, chillers and related equipment are no longer required. It gives a pleasant building outlook and enables the designers to convert the space for other uses (Photo 6).

Since there is no individual plant room, operation and maintenance staff can be reduced. Also, they can focus more on the central plant's operation and maintenance works (Photo 7 & 8). Besides, sufficient standby capacity is allowed for the central plant. This leads to higher reliability of the plant's performance.



圖6：騰出的空間可作其它用途

Photo 6: More usable space for other uses





圖7：員工檢查中央製冷機

Photo 7: Staff inspecting central chiller

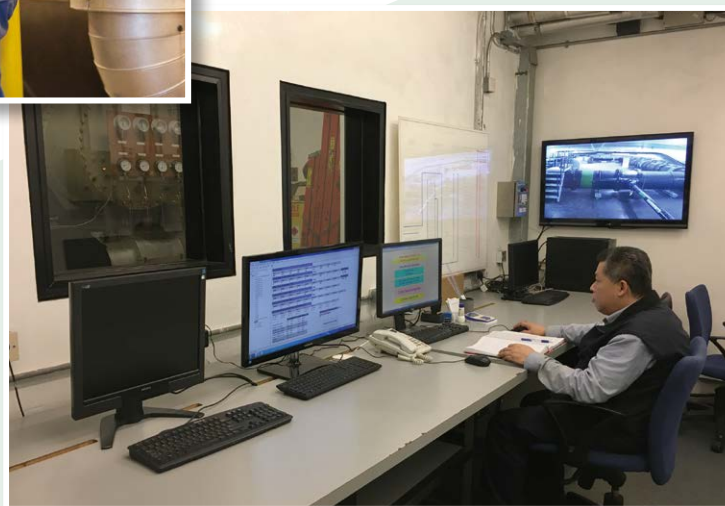


圖8：中央控制室電腦監控系統

Photo 8: Computerized central plant

採用了高效製冷機後，新大樓可望減少20%用電量。中央供冷站自動編配最佳效能的製冷機組去應對不同的冷量負載情況；再者，由於集中製冷，系統較容易調校，方便享用電力公司的電費優惠計劃，也更容易配合蓄冷技術等節能技術。

建造區域供冷用戶支站和配水管網絡比建造獨立供冷站的費用低廉，以2012年的標價計算，估計節省約700萬元建築費用。

區域供冷節省運作和維修保養成本，包括管理廠房的人力資源、備用零件購置和存放、化學品的消耗和合約保養服務。估計每年節省約150萬元。

With the high efficiency chillers, it was estimated that the new building could save 20% of energy. The central cooling plant will select the chillers with highest efficiency in response to different cooling load. In addition, due to the concentration of cooling loads, it can benefit more from the rebate systems offered by the power company and can be more readily adapted to energy-saving technologies, such as thermal storage.

The construction costs of the user station and distribution piping of the DCS were much less than that of an additional chiller plant, with a saving estimated to be about \$7 million at 2012 tender price.

The DCS will save operation and maintenance costs, including manpower required for managing the plant, procurement and storage of spare parts, consumption of chemicals and contracted services for plant maintenance. The saving is estimated to be around \$1.5 million per year.

## 強制性能源效益標籤計劃第三階段

### Third Phase of the Mandatory Energy Efficiency Labelling Scheme (MEELS)

為鼓勵市民使用具能源效益的產品，節省能源，以及減少發電過程中排放的溫室氣體及其他空氣污染物，政府於2008年制定《能源效益（產品標籤）條例》（第598章），推行強制性能源效益標籤計劃（下稱：強制性標籤計劃）規定在本港供應的訂明產品必須貼上能源標籤，讓消費者知悉產品的能源效益表現。

該計劃的第一及第二階段已分別於2009年及2011年全面實施，現時涵蓋五類訂明產品，即空調機、冷凍器具、慳電膽、洗衣機（洗衣量屬7公斤或以下），以及抽濕機。當中空調機、冷凍器具及洗衣機的評級標準已於2015年11月全面提升，鼓勵進口商及供應商引入更多更具能源效益的電器。

為了進一步節約能源，機電工程署檢討了強制性標籤計劃，以期擴大其涵蓋範圍。機電工程署在2015年第二季進行了為期三個月的諮詢，收集消費者委員會、商會、專業及教育機構、電力公司、產品製造商及供應商的意見。此外，機電工程署亦分別於2015年3月及11月諮詢了能源諮詢委員會轄下的能源效益及節約小組委員會。各持份者都普遍支持有關建議。而機電工程署考慮收集到的意見及其他因素，例如海外做法、具備測試標準和測試實驗室、產品的能源消耗量及節能潛力後，建議推行第三階段強制性標籤計劃，以涵蓋下列產品：

To encourage members of the public to use more energy-efficient products so as to save energy and reduce greenhouse gas and other air pollutants emitted during the generation of electricity, the Government introduced in 2008 the Mandatory Energy Efficiency Labelling Scheme (MEELS), through the Energy Efficiency (Labelling of Products) Ordinance (Cap. 598), under which energy labels are required to be shown on the prescribed products for supply in Hong Kong to inform consumers of the products' energy efficiency performance.

The first and second phases of MEELS had been fully implemented in 2009 and 2011 respectively, currently covering five types of prescribed products, namely room air conditioners, refrigerating appliances, compact fluorescent lamps, washing machines with a washing capacity at or under 7kg, and dehumidifiers. Among these prescribed products, room air conditioners, refrigerating appliances and washing machines had their grading standards upgraded in November 2015 so as to encourage importers and suppliers to introduce more energy-efficient products.

In order to capture further energy saving potential, a review of MEELS has been conducted with a view to expanding the coverage of the scheme. A three-month consultation was conducted in the second quarter of 2015 to gather opinions from the Consumer Council, trade associations, professional and education institutions, power companies, as well as product manufacturers and suppliers. The Energy Efficiency and Conservation Sub-committee under the Energy Advisory Committee was consulted in March and also in November 2015. In general, all stakeholders were supportive of the proposal. Having considered comments received among the consultation and other factors such as overseas practices, availability of test standards and testing laboratories, as well as energy consumption and energy saving potential of the products, it is recommended to include the following products into the third phase of MEELS:

#### 建議的新訂明產品 Proposed new prescribed products



電視機  
Televisions

儲水式電熱水器  
Storage type  
electric water heaters



電磁爐  
Induction cookers





## 建議擴展現有訂明產品的涵蓋範圍 Proposed extension of coverage of existing prescribed products



### 洗衣機

擴展現時涵蓋範圍由洗衣量不多於七公斤增至不多於十公斤

### Washing machines

Extend existing coverage of washing capacity from not exceeding 7kg to not exceeding 10kg)



### 空調機

擴展現時涵蓋範圍至供暖功能

### Room air conditioners

Extend existing coverage to heating performance

以上擬納入第三階段的產品，約佔每年住宅用電量的15%，估計第三段的強制性標籤計劃每年可節省約1.5億度電，並可減少排放10萬5千公噸二氧化碳。

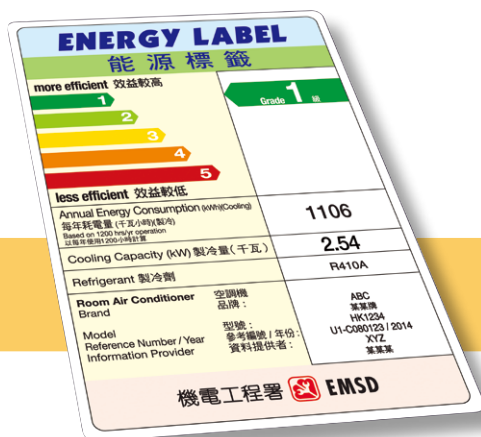
與強制性標籤計劃的現行做法一樣，進口商和本地製造商須先向機電工程署遞交產品資料（包括測試報告）以獲取編配參考編號和記錄，才可在產品貼上指定格式的標籤，向本港市場供應產品。

機電工程署正擬備相關修例文件，並計劃在2016-17立法年度內提交立法會。本署亦與業界合作，商訂建議的推行細節，包括於2017年初進行《實務守則》以及過渡安排的諮詢。有關修訂《實務守則》的詳情，請瀏覽機電工程署能源標籤網，網址為 <http://www.energylabel.emsd.gov.hk>。

The above products proposed for inclusion into the third phase of MEELS are estimated to account for about 15% of the annual electricity consumption in the residential sector. It is estimated that the potential annual energy saving arising from the third phase of MEELS is around 150 million kWh, which will translate into an annual reduction of carbon dioxide emissions of 105,000 tonnes.

Same as the current practice under MEELS, importers and local manufacturers are required to submit the products information, including test reports, to EMSD for assignment of reference number and record; before labelling these products in the prescribed format for supply to the local market.

EMSD is now preparing the relevant legislative amendments for submission to the Legislative Council within the 2016-17 legislative year. EMSD has also worked with the trade on the implementation details of the proposal, including consultation of the Code of Practice and the proposed transitional arrangement in early 2017. For details of revision of the Code of Practice, please visit EMSD's Energy Label Net at <http://www.energylabel.emsd.gov.hk>.



### The 3<sup>rd</sup> Phase of



<http://www.energylabel.emsd.gov.hk>

# 2016年版「淡水冷卻塔計劃小冊子」、「淡水冷卻塔實務守則」及「預防退伍軍人病工作守則」 Fresh Water Cooling Towers Scheme Brochure, Code of Practice for Fresh Water Cooling Towers and Code of Practice for Prevention of Legionnaires' Disease (2016 Edition)

為配合相關規例和國際標準的最新要求，並配合現行使用淡水冷卻塔的良好作業方法，機電工程署為2010年版的「空調系統使用淡水冷卻塔計劃小冊子」及2006年版的「水冷式空調系統實務守則」進行檢討，有關檢討已於2016年12月完成，修訂了計劃小冊子(2010年版)及實務守則(2006年版)第1至3部的一些要求。兩份文件的標題已分別改名為2016年版「淡水冷卻塔計劃」及2016年版「淡水冷卻塔實務守則」。新版的計劃小冊子及實務守則已於2017年1月3日起生效，並有六個月的寬限期。

此外，預防退伍軍人病委員會也更新了「預防退伍軍人病工作守則」。新版的「預防退伍軍人病工作守則」(2016年版)加強了有關冷熱水供應系統的預防措施並加入其他一般的修訂。該工作守則就妥善設計、操作、維修有關設施提供指引，以防止退伍軍人桿菌的傳播。

欲知上述新版刊物的詳情，請瀏覽下列網址：

To cope with the latest requirements of relevant regulations and international standards, and be in line with current good trade practice for using fresh water cooling towers (FWCT), a review of the "FWCT Scheme for Air Conditioning Systems Brochure (2010 Edition)" and the "Code of Practice for Water-cooled Air Conditioning Systems (2006 Edition)" has been conducted by EMSD. The review, which was completed in December 2016, has updated some requirements stipulated in the Scheme Brochure (2010 Edition) and the Code of Practice (2006 Edition) the Parts 1, 2 & 3. The titles of these documents have been renamed as "Fresh Water Cooling Towers Scheme" (2016 Edition) and "Code of Practice for Fresh Water Cooling Towers: Parts 1-3" (2016 Edition) respectively. The new Scheme Brochure and Code of Practice came into effect on 3 January 2017 with a grace period of 6 months.

Moreover, the Prevention of Legionnaires' Disease Committee (PLDC) has also updated the Code of Practice for Prevention of Legionnaires' Disease. The new edition of the Code of Practice for Prevention of Legionnaires' Disease (2016 Edition) has enhanced the general precautions for cold and hot water supply systems together with other general updates. It provides guidelines for proper design, operation and maintenance of related facilities to prevent the spread of legionella.

Information about the above new publications is available on the following websites:

## 2016年版的「淡水冷卻塔實務守則」 2016 Edition of Code of Practice for Fresh Water Cooling Towers

[http://www.emsd.gov.hk/tc/energy\\_efficiency/fwct\\_scheme/publications/index.html](http://www.emsd.gov.hk/tc/energy_efficiency/fwct_scheme/publications/index.html)

[http://www.emsd.gov.hk/en/energy\\_efficiency/fwct\\_scheme/publications/index.html](http://www.emsd.gov.hk/en/energy_efficiency/fwct_scheme/publications/index.html)



## 2016年版的「淡水冷卻塔計劃小冊子」 2016 Edition of FWCT Scheme Brochure

[http://www.emsd.gov.hk/tc/energy\\_efficiency/fwct\\_scheme/publications/index.html](http://www.emsd.gov.hk/tc/energy_efficiency/fwct_scheme/publications/index.html)

[http://www.emsd.gov.hk/en/energy\\_efficiency/fwct\\_scheme/publications/index.html](http://www.emsd.gov.hk/en/energy_efficiency/fwct_scheme/publications/index.html)



## 2016年版的「預防退伍軍人病工作守則」 2016 Edition of Code of Practice for Prevention of Legionnaires' Disease

[http://www.emsd.gov.hk/tc/supporting\\_government\\_initiatives/legionnaires\\_disease/publications/index.html](http://www.emsd.gov.hk/tc/supporting_government_initiatives/legionnaires_disease/publications/index.html)

[http://www.emsd.gov.hk/en/supporting\\_government\\_initiatives/legionnaires\\_disease/publications/index.html](http://www.emsd.gov.hk/en/supporting_government_initiatives/legionnaires_disease/publications/index.html)

# 「慳電熄一熄青年獎」頒獎典禮暨學習團分享會

## “Youth Energy Saving Award” Prize Presentation Ceremony cum Study Mission Sharing Session

「慳電熄一熄青年獎」頒獎典禮暨學習團分享會於2016年11月12日舉行，表揚青年人在推廣節能措施和使用可再生能源方面的創新意念。

The “Youth Energy Saving Award” Prize Presentation Ceremony cum Study Mission Sharing Session was held on 12 November 2016 to commend creative ideas from the youth in promoting energy saving measures and use of renewable energy.



「慳電熄一熄青年獎」頒獎典禮暨學習團分享會  
The “Youth Energy Saving Award” Prize Presentation Ceremony cum Study Mission Sharing Session

### 小學組

得獎隊伍代表在典禮致辭時表示，透過參加兩日一夜的「零碳野外樂活體驗營」，他們深刻體會到必需開始注重環保措施，以減少溫室氣體排放，否則環境只會越變越差。

### Primary School Category

Speaking at the ceremony, the representatives of the winning team said that the two-day-one-night “Zero Carbon Environmental Camp” had enabled them to gain indepth understanding of the need to start pursuing green practices so as to reduce greenhouse gas emissions, otherwise the environment will continue to deteriorate.



小學組得獎隊伍代表  
Representatives of the Winning Team of Primary School Category



## 中學組

得獎隊伍的隊員在丹麥參觀轉廢為能焚化爐 / 發電廠後，認為香港可以考慮興建類似設施，以處理大量都市廢物，理由是焚化技術可以把固體廢物體積減少高達90至95%，能大大減輕堆填區的負荷，還能產生電力供社區使用。

此外，得獎隊伍建議可將本地一個地區規劃和構建成為綠色之城，並為該城引入多項的節能環保措施，例如全面採用無火煮食、應用區域供冷系統等，以作為低碳社區的榜樣，以喚起全港市民的環保意識。焚化爐作為綠色之城的設施之一，在設計上可關建垂直綠牆，以改善其外觀。



中學組得獎隊伍代表  
Representatives of the Winning Team of  
Secondary School Category

## Secondary School Category

After visiting the waste-to-energy incineration / power plants in Denmark, the winning team members were of the view that Hong Kong could consider building similar facilities to assist in handling the bulk of municipal waste. It is because incineration could reduce the volume of solid waste by up to 90 to 95%, which would not only greatly relieve the burden of landfills, but also generate electricity for community use.

Besides, to arouse the public's environmental awareness, the winning team suggested to plan and develop a local district into a model low-carbon eco-city by introducing various energy saving and eco-friendly measures, such as full adoption of flameless cooking and application of district cooling system. As one of the city's facilities, incineration plant could be featured with vertical green walls to improve its aesthetical appearance.

## 公開組

得獎隊伍建議可參考哥本哈根市政府的政策，推廣單車文化，以減少使用汽車。該市的市政府高層以身作則，踏單車上班，藉此推動環保。我們可考慮透過以下配套，鼓勵市民以單車代步：

興建更多單車徑，讓單車能到達市區大部分地點；

調整交通燈系統，讓踏單車的人士優先通過；

引入親子單車，方便家庭使用；

擴闊鐵路沿線及港鐵站附近的單車停放設施，並容許乘客攜帶單車乘搭火車及地鐵。



公開組得獎隊伍代表  
Representatives of the Winning Team of  
Open Group Category

## Open Group Category

To reduce the use of motor vehicles, the winning team suggested to consider promoting the culture of cycling by making reference to the policies adopted by the Copenhagen municipal government. The senior government officials there set themselves as role models by riding bicycles to work in order to disseminate the message of environmental protection. We may consider to encourage the public to use bicycles as a means of transport through the following initiatives:

Build more cycle tracks to cover most of the urban areas;

Adjust the traffic light systems to give higher priority to bicycles;

Introduce parent-child bicycles for family use;

Enlarge the bicycle parking areas along railway and around MTR stations and allow passengers to carry their bicycles on board.

## 聯絡資料 Contact

任何人士如欲就本通訊提出意見或詢問，請與我們聯絡，資料如下：

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