Seminar on Research and Development Work

Mr. W.I. HO
Acting Chief Building Services Engineer
24 May 2010

Building Services

Energy Saving and Carbon Reduction

A1 港聞 教育 · 中國 · 國際 www.mingpao.com

特首談辯論：全民參與看直播

熱捧長洲飄色 遺忘太平清醮

2010·05·22 星期六

庚寅年 四月初九日

港幣六元正 今天出紙 3疊13張

報明

德議會通過援歐基金

A3 A4

報網一體 公信第一

Global Warming Birds Sing Earlier Cause Nuisance

全球暖化 雀鳥早啲擾夢

市民投訴個案增 觀鳥會：應包容

特稿

深夜鳥鳴，就算如出谷黃鶯，也可能擾人清夢。在市區出沒的杜鵑科雀鳥，每逢求偶期就會「無心睡眠」，登上樹頂高聲歌唱。香港觀鳥會今年接獲市民查詢這些雀鳥個案明顯較往年增加，接獲查詢的時間，也從以往的農曆新年之後推前至西曆1月，估計可能與全球暖化有關，令雀鳥提早發放春回大地的信

噪鵑 日夜鳴叫

噪鵑是香港留鳥，一年四季皆可見到，九龍公園是最多噪鵑聚集的市區公園之一。一般在農曆新年後開始日夜不停鳴叫，叫聲爲兩個音節的「ko-el」。

（何志剛攝/香港觀鳥會提供）

半山筲箕灣美孚 清晨鳥鳴嚴重

記者昨日向多區的區議員或居民查詢，發現在中區半山、筲箕灣柏東邨、美孚新邨及將軍澳等區，都有雀鳥在凌晨鳴叫擾人清夢問題。不過，受訪區議員大都認爲雀鳥鳴叫是天性，只要不過於嚴重，建議居民應容忍。

中西區議會副主席陳捷貴表示，近年樓息香港公園的一批小葵花鳳頭鸚鵡，春夏間會於凌晨鳴叫，持續困擾部分中區及半山居民；西貢區議員范國威亦說，曾收到將軍澳居民投訴雀鳥鳴叫，「如果樹木茂

Electricity Consumed by HK

- 147,072 Terajoule (40,853 gWh) in 2007
- Equivalent to 28,597,333 Tonne CO^2 emission
- Residential Sector shares 25%

表 3 Table 3

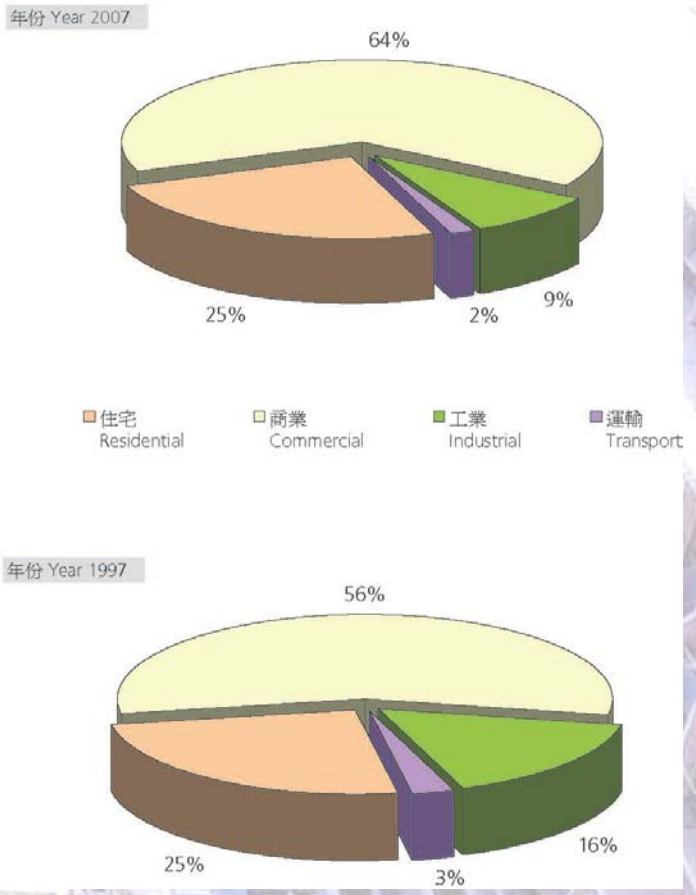
年份 Year	住宅 Residential	商業 Commercial	工業 Industrial	運輸 Transport [2]	總計 Total
1997	28 937	65 036	18 965	3 124	116 061
1998	32 793	70 408	18 489	3 756	125 446
1999	31 400	72 339	17 547	4 002	125 288
2000	32 234	76 689	17 769	3 983	130 675
2001	32 799	80 589	16 759	3 991	134 138
2002	33 394	83 549	16 112	4 057	137 112
2003	34 365	84 921	14 851	4 297	138 434
2004	34 134	86 671	15 430	4 967	141 202
2005	35 811	88 561	14 636	5 163	144 171
2006	35 428	93 317	14 015	2 444	145 204
2007	36 422	95 051	13 104	2 495	147 072

< 單位：太焦耳 Unit : Terajoule >

Data Source: Hong Kong Energy End-user Data 2009 issued by EMSD

Electricity Consumed by Different Sectors

- Commercial Sector increases its share from 56% to 64% in 10 years
- Transport Sector decreases its share from 3% to 2% in 10 years
- Industrial Sector decreases its share from 16% to 9% in 10 years
- Residential Sector keeps its share at 25% in 10 years



Data Source: Hong Kong Energy End-user Data 2009 issued by EMSD

Electricity Consumed by Residential Sector

- 36,422 Terajoule (10,117 gWh) in 2007
- Equivalent to 7,082,056 Tonne CO^2 emission
- 1% reduction would mean 70,821 Tonne CO^2 emission reduction, equivalent to the absorption effect of 3,079,155 nos. of tree

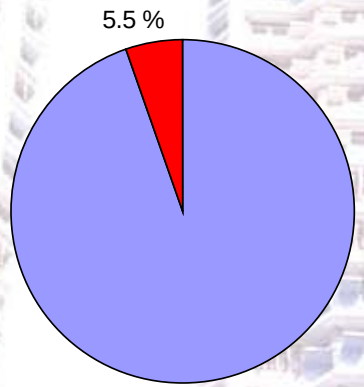
Data Source: Hong Kong Energy End-user Data 2009 issued by EMSD

HA has about 700,000 Domestic Flats in 1,100 plus Domestic Buildings

HA is one of the major electricity consumers due to her communal Building Services Installations

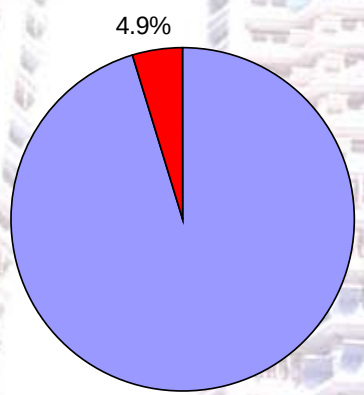
How Are We Doing?

- In 2003/04, 520 gWh electricity was consumed by the BS installations in over 1,100 domestic blocks serving 593K flats
- 878 kWh per flat per annum
- = 5.5% of the 9,546 gWh consumed by the Residential Sector



How Are We Doing?

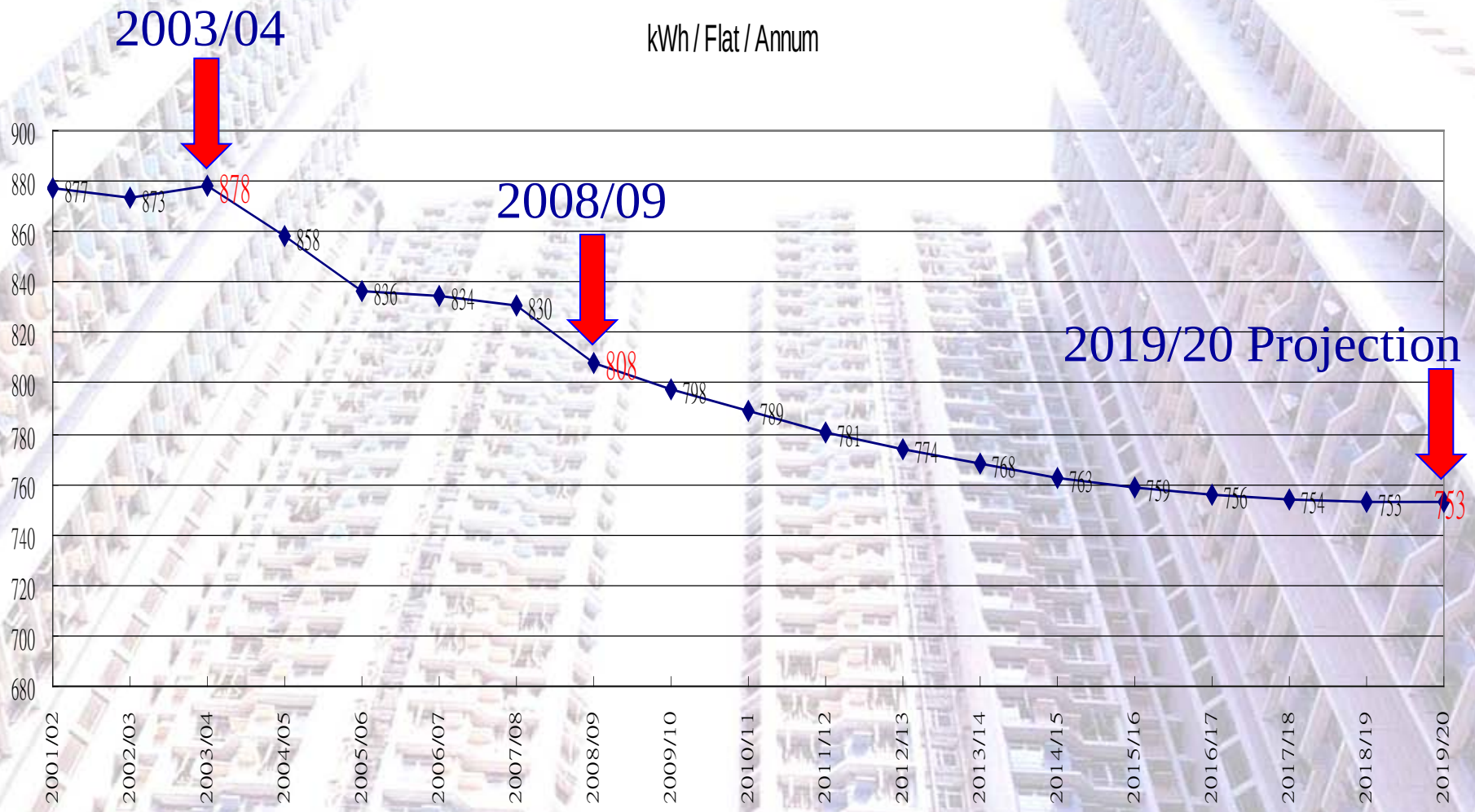
- In 2007/08, 494 gWh electricity was consumed by the BS installations in over 1,100 domestic blocks serving 595K flats
- 830 kWh per flat per annum
- = 4.9% of the 10,117 gWh consumed by the Residential Sector



How Are We Doing?

- In 2008/09, 494 gWh electricity was consumed by the BS installations in over 1,100 domestic blocks serving 611K flats
- 808 kWh per flat per annum
- Decreasing at rate of 1.6% per annum since 2003

How Are We Doing?



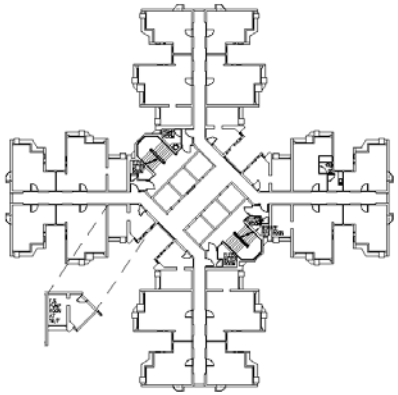
How Much Could be Saved?

- If 808 kWh is further reduced to 753 kWh
- 611K Domestic Flats implies saving of 33,605,000 kWh
- Or $33M Dollar
- Or the effect of 23,523,000 nos. of tree

Energy Reduction Measures

- Trimming down lighting Illumination level at over-illuminated areas
- Replace T8 Fluorescent Tube by high efficiency T5 Fluorescent Tube
- Replace Electromagnetic Ballast by high efficiency Electronic Ballast in lighting system
- Application of Photocell Sensor to control lighting on/off
- Setting timer according to season to control lighting on/off
- Modernize lifts with advanced VVVF control system


494 gWh
808 kWh/Flat



- 40-Storey Domestic Block
- 20 Flats per floor
- Totally 800 Flats
- First Edition in January 2000

- HA produces approx. 15,000 Domestic Flats or 20 Domestic Blocks per annum
- For the purpose of estimating the electricity consumption by BS Installations, New Harmony 1 Standard Block is taken as Reference Building

How Are We Doing?

- January 2000 Edition's design consumes 824,674 kWh per annum
- 1,032 kWh per flat per annum
- 24.9 kWh per GFA(m^2) per annum

How Are We Doing?

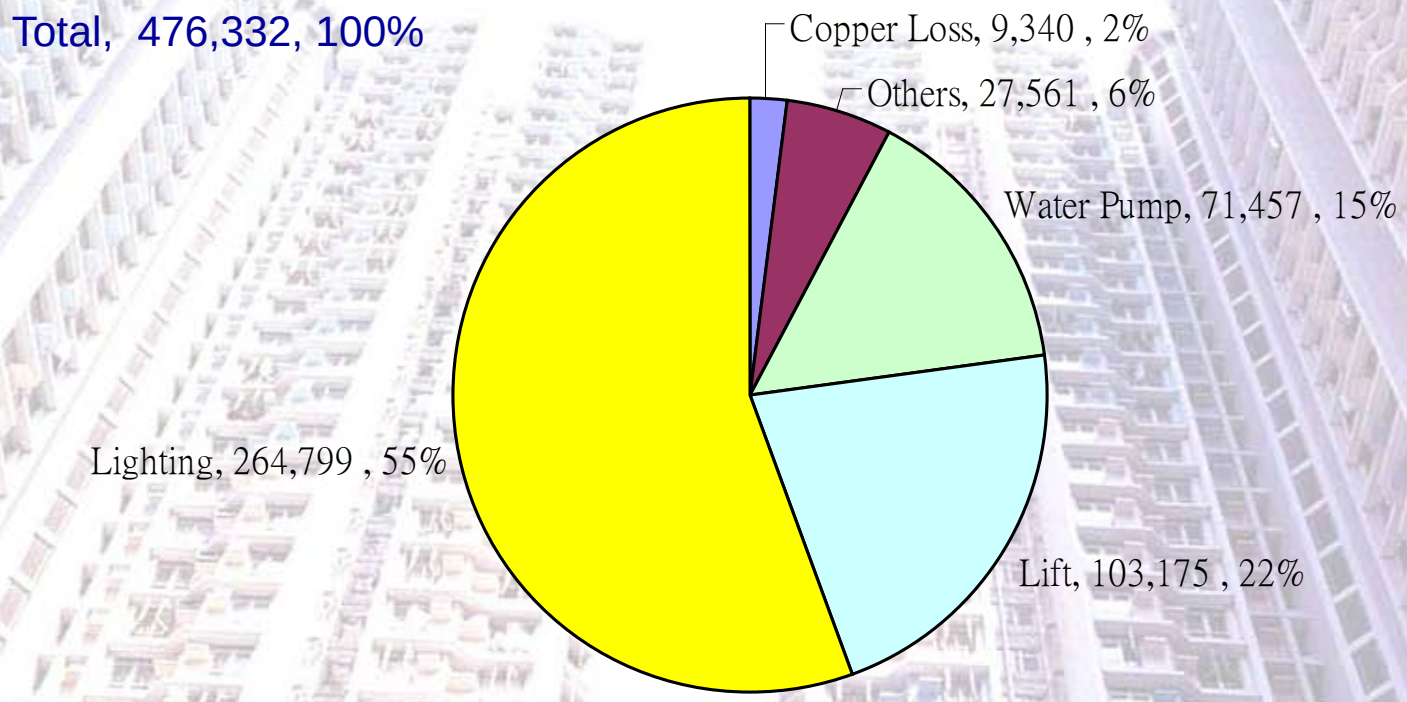
- March 2003 Edition's design consumes 433,176 kWh per annum
- 542 kWh per flat per annum
- 13.1 kWh per GFA(m^2) per annum

How Are We Doing?

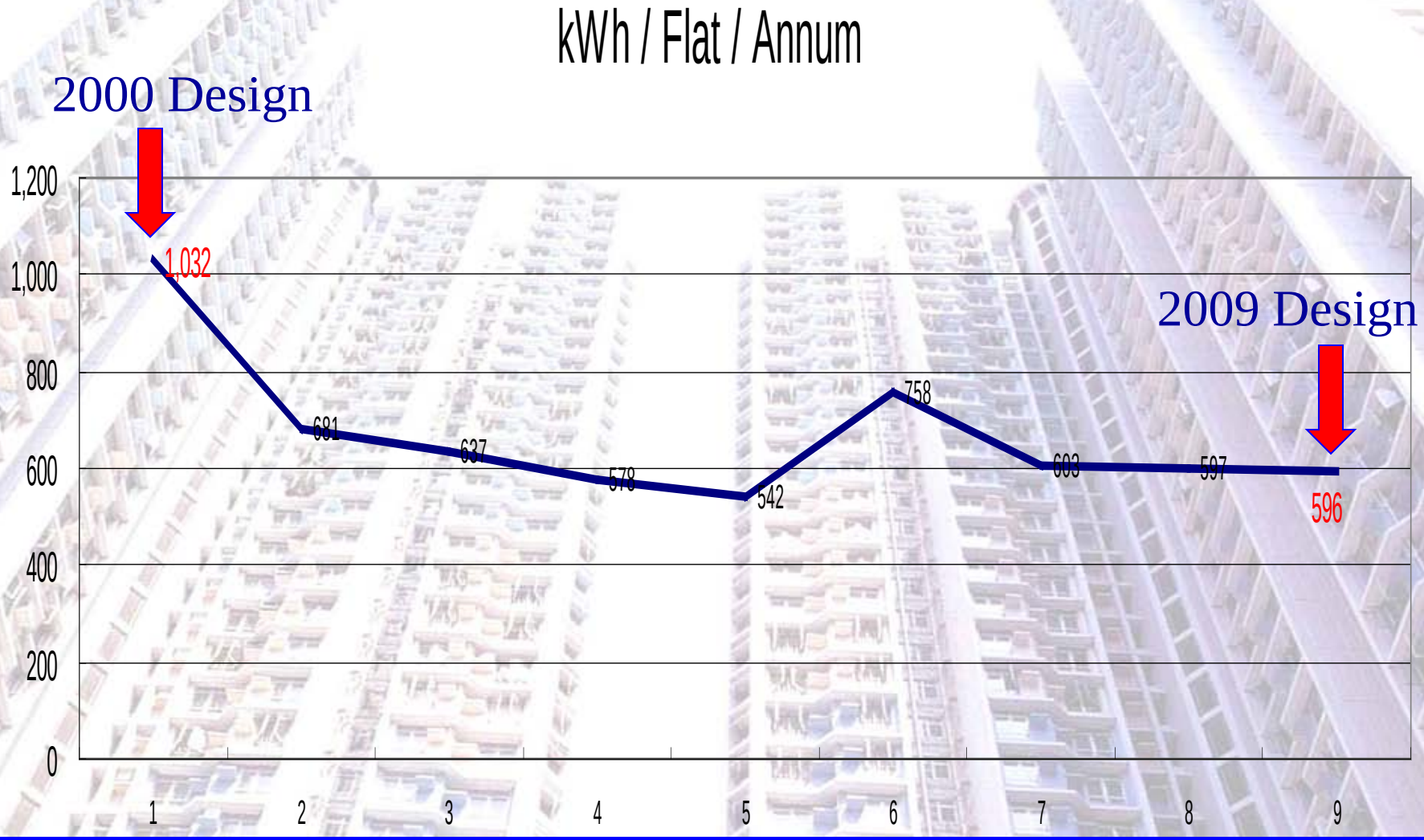
- Latest (2009) design consumes 476,332 kWh per annum
- 596 kWh per flat per annum
- 14.4 kWh per GFA(m^2) per annum
- The rise as compared with 2003 Edition is the result of increase of illumination level at common areas from 40/50 lux to 85 lux in accordance with the Barrier Free Access Design Manual effective from 1 Dec 2008

How Are We Doing?

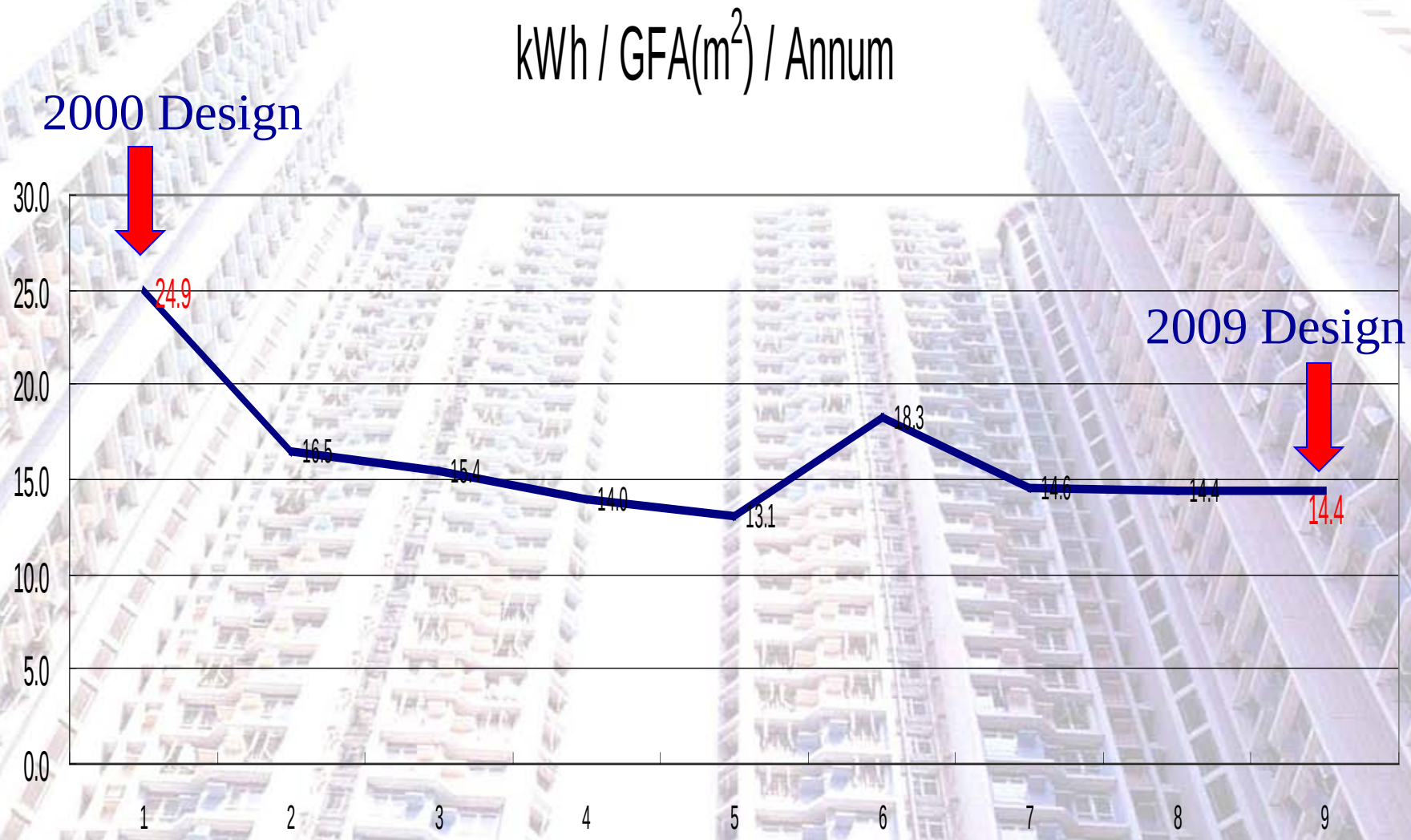
Share of Annual Electricity Consumption (kWh) by Different BS Installations in a NH1 Standard Block with 2009 Design



How Are We Doing?

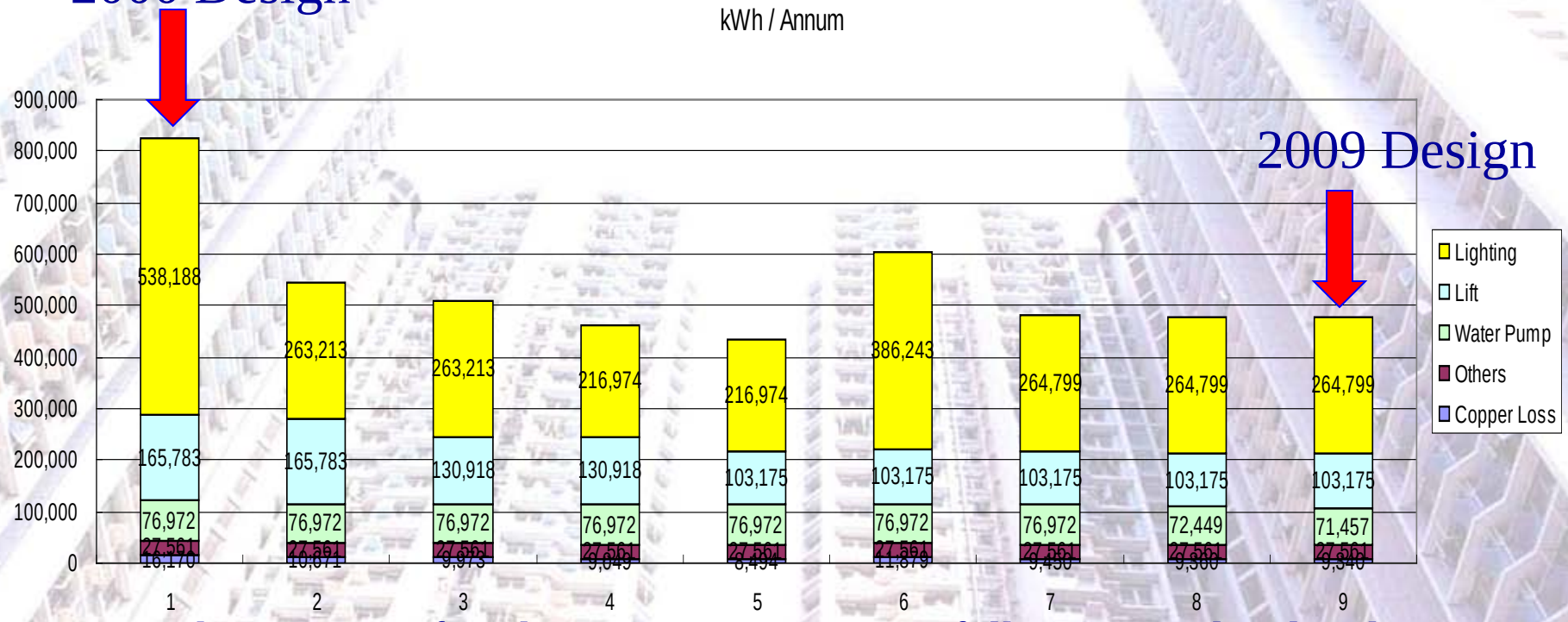


How Are We Doing?



How Are We Doing?

2000 Design

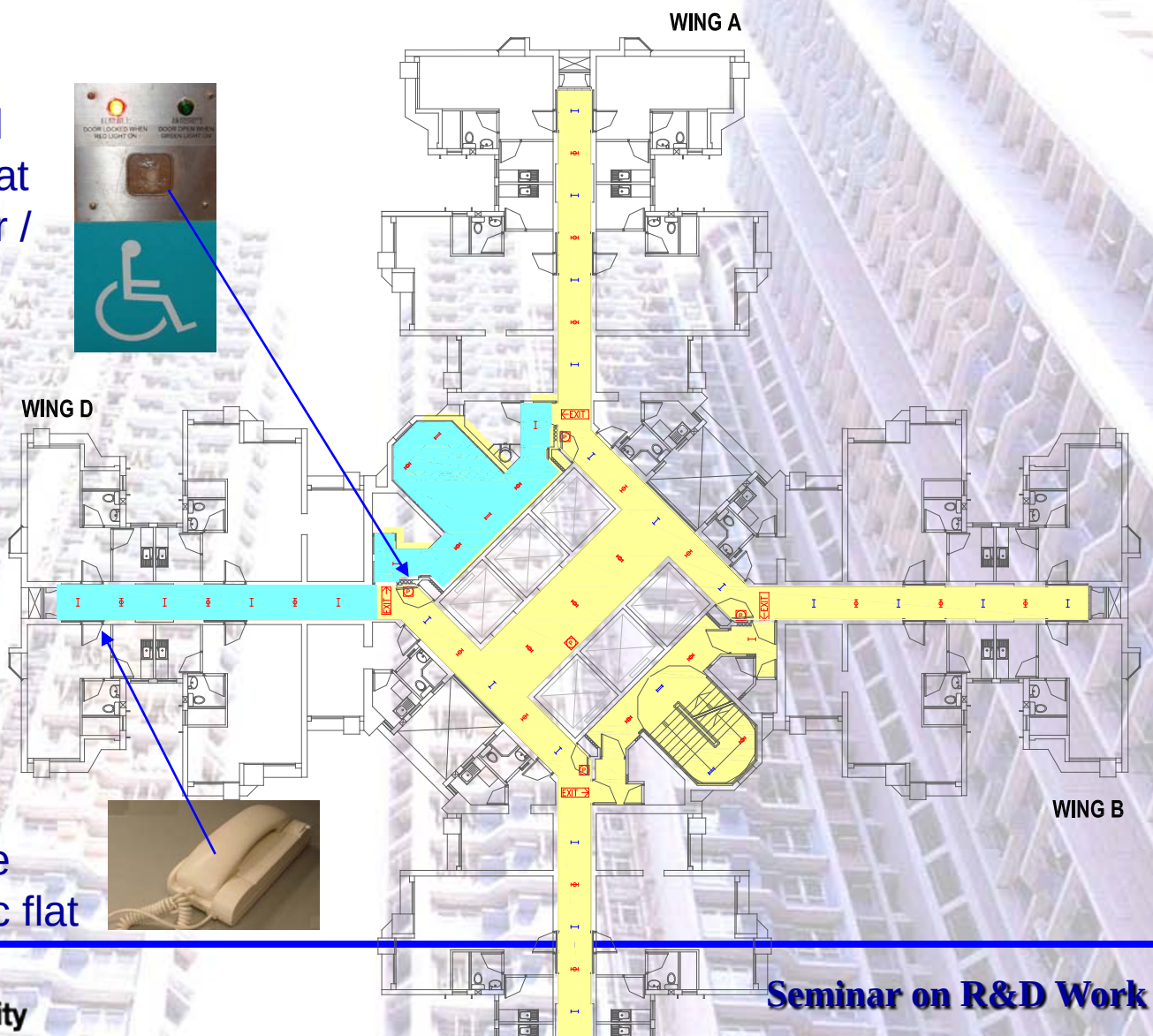


2009 Design

- Enhancement of Lighting Design in terms of illumination level and control
- Optimization of Lifts involving number, capacity and lift car decoration
- Improvement of Fresh Water Supply System with Variable Speed Drive System and High Efficiency Motor

New Lighting Design

Manual switch at corridor / lobby



Doorphone handset inside each domestic flat

New Lighting Design

Location	Control Method	Normal Illumination Level	Elevated Illumination Level*
Lift lobby	▪ Switching at lift landing	50 lux	85 lux
Corridor	▪ Switching at corridor entrance ▪ Switching at exit door ▪ Switching inside each domestic flat	30 lux	85 lux
Staircase	▪ Motion sensor with integrated photo cell	30 lux	85 lux

* The elevated illumination level will be automatically resumed to normal illumination level after an adjustable time delay.

On Average

596 kWh/Flat

14.4 kWh/GFA(m^2)

Photovoltaic Panel

- First system at Lam Tin Estate Phase 7 & 8
- 248 sq.m Mono-crystalline silicon PV panels on the roof of 3 blocks and part of the covered walkway
- Capital investment $3M
- Total capacity 33 kW, grid connected
- Would generate 43,000 kWh per annum
- On average 14,333 kWh per block per annum
- Approx. 3% of the total demand of the BS Installations
- 70 Years payback

Photovoltaic Panel

- Another one with smaller scale at East Harbour Crossing Phase 5 to be completed next year
- Multi-crystalline silicon PV panels for one block
- Thin-film Amorphous PV panels for another block (subject to final decision)

Photovoltaic Panel

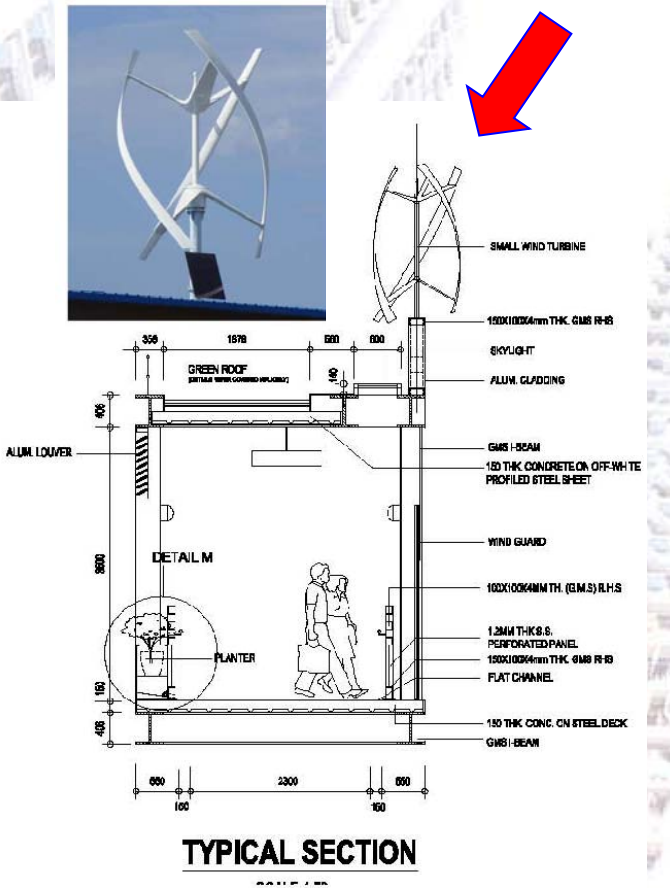
- A system 6 times larger at Kai Tak Development (200 kW) to be completed in 2013
- Probably the second largest in HK after EMSD (350 kW), will exceed the Science Park (198 kW) and Penny Bay Fire/Police Station (85 kW)
- 4 types of PV Panel will be installed for comparison:
  - Mono-crystalline
  - Multi-crystalline
  - Thin-film Amorphous
  - Thin-film CIGS

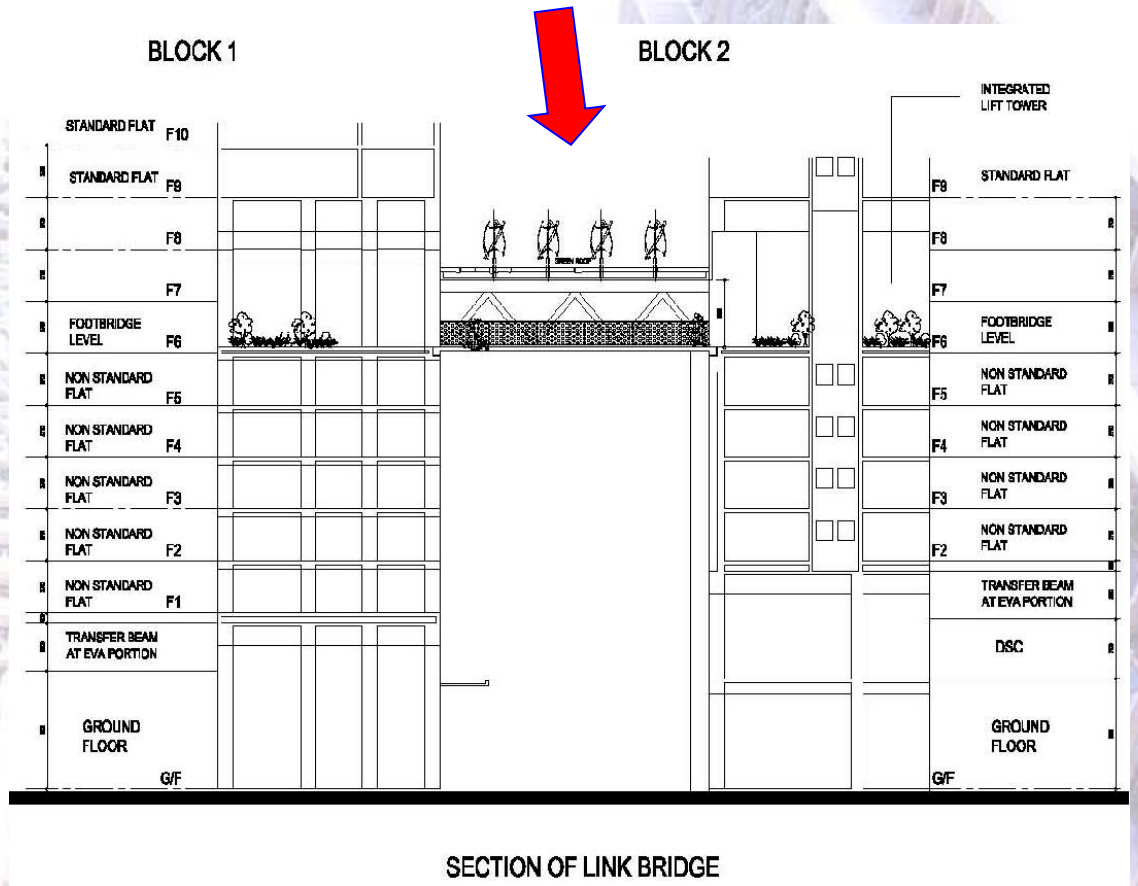
Wind Turbine

- First one at Sau Mau Ping South Estate with high wind speed revealed by Micro Climate Study
  - Vertical axis wind turbine
  - Wind Rotor Diameter 1.05 m
  - Wind Rotor Height 2 m
  - Working Wind Speed 3-10 m/s
  - Startup Wind Speed 2 m/s
  - Tower height including the turbine 9 m
- Together with 6 Wind-solar Hybrid Lamp Poles serve 850 m^2 external area by LED light

Wind Turbine

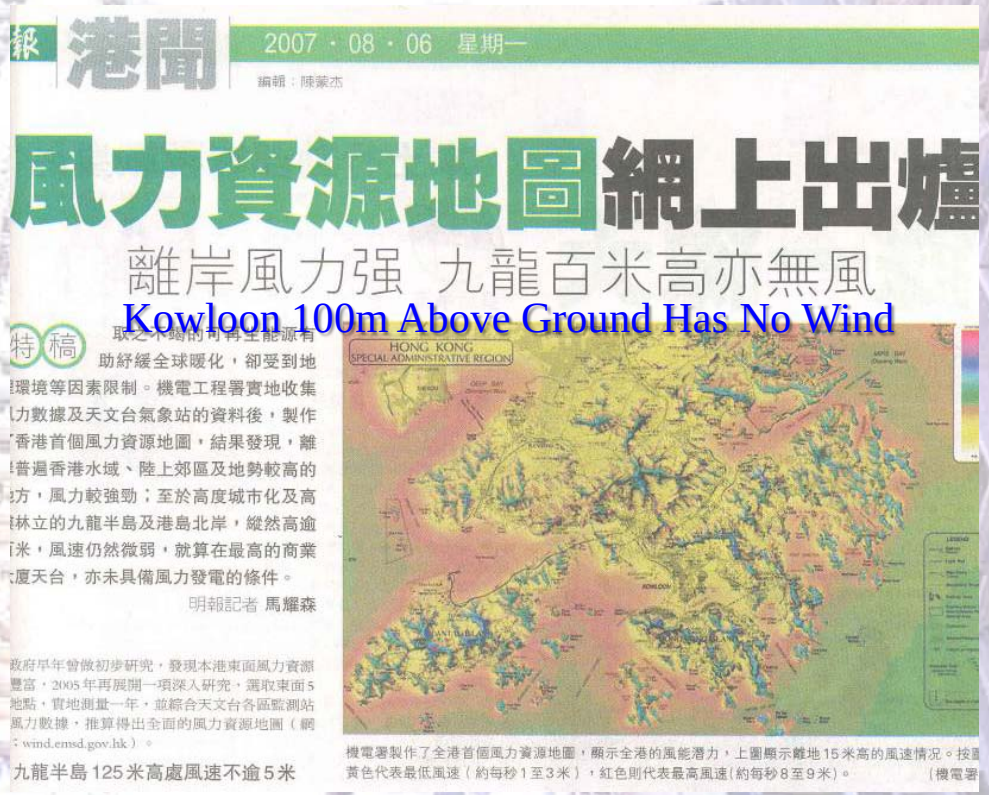
- Second one at Kwai Shing Circuit PRH Development (under consideration)





Wind Turbine

- The power of the wind flowing through a certain area is the kinetic energy captured and can be estimated by the following equation
- Power = ½ x Air Density x Area x Velocity^3
- With low wind speed in urban area, Wind Turbine will not pay back
- MingPao Presscut



港聞 2007 · 08 · 06 星期一

編輯：陳蒙杰

風力資源地圖網上出爐

離岸風力强 九龍百米高亦無風

Kowloon 100m Above Ground Has No Wind

特稿

助紓緩全球暖化，卻受到地
環境等因素限制。機電工程署實地收集
力數據及天文台氣象站的資料後，製作
香港首個風力資源地圖，結果發現，離
普遍香港水域、陸上郊區及地勢較高的
方，風力較強勁；至於高度城市化及高
林立的九龍半島及港島北岸，縱然高逾
米，風速仍然微弱，就算在最高的商業
廈天台，亦未具備風力發電的條件。

明報記者 馬耀森

政府早年曾做初步研究，發現本港東面風力資源
豐富，2005年再展開一項深入研究，選取東面5
地點，實地測量一年，並綜合天文台各區監測站
風力數據，推算得出全面的風力資源地圖（網
：wind.emsd.gov.hk）。

九龍半島125米高處風速不逾5米

HONG KONG SPECIAL ADMINISTRATIVE REGION

機電署製作了全港首個風力資源地圖，顯示全港的風能潛力，上圖顯示離地15米高的風速情況。按
黃色代表最低風速（約每秒1至3米），紅色則代表最高風速（約每秒8至9米）。（機電署

Renewable Energy Lighting











(I) 14.4 kWh "Compressor"

- For New Buildings, HA has been successful in "compressing" the average electricity consumption by BS installations from 24.9 to 14.4 kWh per GFA(m^2) per annum
- HA wishes to be a role model in energy saving
- Objectives of research study are to help HA to find new means to further "compress" 14.4 to a smaller figure
- All systems including lighting, lift and pump etc. shall be considered holistically
- It has a huge implication, every means of energy reduction could be applied to both new buildings and existing buildings

(II) Photovoltaic Panel

- HA has a Mono-crystalline PV panel system at Lam Tin Estate
- HA will have a Multi-crystalline (or with Thin-film Amorphous) PV panel system at EHC Phase 5 next year
- HA will have a multi-type (Mono-crystalline, Multi-crystalline, Thin-film Amorphous & Thin-film CIGS) PV panel system at Kai Tak Estate in 2013
- Objectives of research study are to help HA formulating a strategy in respect of the provision of similar systems in public housing estates or contributing to the wider application of PV technologies in Hong Kong.

(III) Carbon Emission Estimation

- HA has established a methodology to estimate the CO^2 emission from a building throughout its construction period and service life (100 years)
- Five Aspects are included:
  - Materials Consumed During Construction (Steel Form Work, Timber Form Work)
  - Materials for Structure (Steel Form Work, Timber Form Work)
  - Communal BS Installations (Lighting, Lifts, Pumps etc.)
  - Renewable Energy
  - Planting
- Take NH1 Standard Block as a reference block, the estimated total CO^2 emission is 49,187 tonnes, or 61.56 Tonnes/Flat, 1.49 Tonnes/GFA(m^2), 1.34Tonnes/CFA(m^2)
- With the methodology and the bench marking figures, the project teams can enhance their design to achieve carbon reduction
- Objectives of research study are to help HA to determine if Life Cycle Costing/Life Cycle Analysis should be included

Way Forwards

- Further enhance our design
- Employ newer technology
- Apply advanced products
- Collaborate with academia, government departments, institutions and industry pioneers to further reduce our energy consumption and carbon emission
- With our joint effort, our children will be able to see beautiful snowy mountains and our little blue planet will be a better place to live


Thank You