

# ENERGY SAVING PLAN

For Hong Kong's Built Environment  
2015~2025+



**Environment Bureau** in collaboration with  
**Development Bureau**  
**Transport and Housing Bureau**

May 2015

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# MESSAGE FROM THE CHIEF EXECUTIVE

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**S**aving energy should be a matter of course for Hong Kong. This document lays out our energy-saving policy, strategy and targets. The Hong Kong SAR Government has taken stock of past efforts and charted a path that covers buildings and transportation, the two most important areas in which Hong Kong can do to save energy significantly. We have also detailed the gaps and challenges with a view to engaging the community to discuss on best way forward.

In the past decade, we have reduced electricity use in our government buildings alone by nearly 15%. In my 2015 Policy Address, I pledged a new target of reducing an additional 5% electricity consumption in government buildings over the next five years. We have also encouraged all major new government buildings and public housing to achieve a higher green building standard.

In the end, of course, the community plays an indispensable role when it comes to energy conservation. I hope private-sector building owners and managers will too set targets to reduce their energy consumption comparable to or even exceeding Government targets, and to promote green building design and management as well. I also encourage the transportation sector to save energy.

Indeed, everyone can reduce energy consumption by making modest changes to their daily lives. Being 'Energy Aware' and 'Energy Wise' will help Hong Kong become more economically competitive. No less important, it will make Hong Kong an even better city to live, work and raise our families in. I call on everyone to play your part.

A handwritten signature in black ink, appearing to be 'CY Leung', written in a cursive style.

**C Y Leung**  
Chief Executive  
Hong Kong Special Administrative Region

# SPECIAL MESSAGES FROM PRINCIPAL OFFICIALS

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“ I am pleased to witness the publication of this Energy Saving Plan which sets for Hong Kong our own target for reducing energy intensity by 40% by 2025. It shows our commitment to environmental protection, and demonstrates the progressiveness of Hong Kong in tackling the global problem of climate change. I look forward to the concerted efforts of the Government and the community in promoting a healthy, liveable and sustainable environment in Hong Kong. ”

**Carrie Lam** Chief Secretary for Administration

“ Energy saving is one of the best examples of how we can save money, be more competitive economically, as well as improve local air quality and contribute to reducing global carbon emission. I look forward to the outcome of the Government’s dialogue platform with stakeholders on what may be the least-cost-highest-gains energy saving opportunities in Hong Kong. ”

**John C Tsang** Financial Secretary

“ The legal framework has put in place the energy efficiency standards for buildings and appliances. However, there is no reason why we should not try to do even better. It is our shared responsibility to combat the negative effect of climate change. For the sake of ourselves and our future generations, let’s strive to fulfil this duty by (among others) saving energy. ”

**Rimsky Yuen, SC** Secretary for Justice

“ Our commitment to sustainable development is unquestionable as reflected in our vision to position Hong Kong as Asia’s World City and make it a better place to live and work in. I am glad to join hands with the Environment Bureau and the Transport and Housing Bureau to pursue our shared vision to promote energy saving. I also look forward to the active participation of our stakeholders in the construction and buildings sector in achieving and perhaps even exceeding the new energy intensity reduction target of 40% by 2025. ”

**Paul Chan** Secretary for Development

“ The ever-growing demand for goods and services brought about by the increasing population requires us to seriously review our lifestyle to avoid depletion of valuable resources such as fossil fuels and clean air. As housing and transport constitute major sources of energy consumption, we have been striving to integrate energy saving features into public housing developments, as well as to expand and improve public transport. Such efforts can help save energy without compromising the level of comfort and convenience on the part of the users. But energy saving cannot be made possible by infrastructure support alone. It has to be practised. I hope the Energy Saving Plan will help inspire new ideas on how we may embrace energy saving in our daily lives. ”

**Professor Anthony Cheung** Secretary for Transport and Housing

“ The cornerstone of success in achieving the new energy intensity reduction target is community participation, which has been enunciated in the Energy Saving Plan. Our energy saving plan should start right at home, and I appeal to your support for taking action to cut down on unnecessary energy consumption in your family. ”

**Tsang Tak-sing** Secretary for Home Affairs

“ Energy saving should no doubt be our common goal, not just for cost concern but also for our aspiration to make Hong Kong a better place to live. Let’s join hands to promote sustainable use of energy so that we and our future generations will be able to thrive in a clean and green environment. ”

**Raymond Tam** Secretary for Constitutional and Mainland Affairs

# SPECIAL MESSAGES FROM PRINCIPAL OFFICIALS

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“Our economy has been powered by about 230,000 terajoule of energy annually. It is our duty to manage our energy consumption, so that we can reduce energy use and save more resources. We in the Government will continue to be a prudent manager of energy consumption, in the same way as we exercise prudent financial control.”

**Professor KC Chan** Secretary for Financial Services and the Treasury

“I am gratified to see the various initiatives both within and outside the Government to encourage the community to conserve energy. A number of civic-spirited corporations have chosen to channel the savings from their electricity bills to care for the needy. This is a win-win formula as it can motivate all of us not only to care for the environment but also assist the grassroots and underprivileged. I hope that we can build on such heart-warming and commendable efforts.”

**Matthew Cheung Kin-chung** Secretary for Labour and Welfare

“A sustainable future for Hong Kong would require a harmonious balance between economic development and conservation of the environment. It is possible to achieve such balance by pursuing initiatives that can help promote economic development and environmental protection at the same time. I would like to encourage our stakeholders to actively participate in our energy saving efforts by conserving energy, and capitalising on the business opportunities brought about by the need for more energy management services.”

**Gregory So** Secretary for Commerce and Economic Development

“As the premises of our disciplinary forces operate round the clock, it is imperative for us to use energy wisely. We have been striving to minimise energy consumption by undertaking energy saving projects for our police stations, fire stations as well as correctional institutions. Our colleagues will, on the basis of our past experience and achievements, continue to explore new energy saving opportunities.”

**TK Lai** Secretary for Security

“Energy saving is an important concept for our future generations to enjoy a sustainable environment. This is truly a personal responsibility and obligation for all educated individuals in our society. Cultivating this basic value and lifestyle should best start in the formative age of our students. It is therefore advisable to instil energy-saving attitude and habits among primary and secondary school students. I am glad to note that many schools have already taken initiatives in such work. To achieve the goal, the Education Bureau will continue to enhance efforts in collaboration with the Environment Bureau and schools.”

**Eddie Ng** Secretary for Education

“To save energy and combat the negative effects of climate change, the Government has been taking the lead to reduce electricity consumption so as to set a good example for the community. I will call upon all Government colleagues to further enhance their energy saving practices, and to spread this energy saving culture to their families and friends.”

**Paul Tang** Secretary for the Civil Service

“We are committed to building a healthy society, and cutting down on energy consumption will certainly contribute to better air quality, and hence human health and well-being. Our hospitals managed by the Hospital Authority have long been engaged in energy saving efforts, including the adoption of energy saving features and good housekeeping measures. I would encourage all hospitals in Hong Kong to set for themselves ambitious energy saving targets in order to reduce greenhouse gas emissions, improve air quality and promote the health of the population.”

**Dr WM Ko** Secretary for Food and Health

## Be Energy Aware & Energy Wise

**F**rom air-conditioning to a myriad of mobile communication devices, water heating to mobility, modern societies depend on energy in nearly every aspect of life. Energy is essential for us at home, at work, on the road, at sea and in the air. Indeed, technology has made our need for instant energy so common place that we hardly notice it at all.

Fossil fuel still powers much of the world, including Hong Kong, but the combustion process also produces large quantities of waste in the form of air pollutant emissions and greenhouse gases. By conserving energy and using it more efficiently, we will waste less, pollute less and reduce the impact on an already overstressed environment.

Hong Kong has a high-density, high-rise lifestyle. As one of the world's major financial and commercial centres, where much of our activities take place in tall buildings, we use a substantial amount of energy to power our high GDP economy. Thus, energy saving, especially with respect to buildings and transportation, is our key effort in Hong Kong. Our energy-efficient transport system due to our high urban density has been internationally recognised since the 1980s, while Hong Kong's green building movement started in earnest in the 1990s.

In the coming decades, world demand for energy will rise as global population increases. Yet, at the same time there will be increasing constraints on how much fossil fuel the world can safely burn in light of the need to improve air quality, and also what science tells us about the vulnerability of climate disruptions to higher global levels of greenhouse gases. Before the world can switch away from burning ever more fossil fuel, Hong Kong too should play a part in promoting energy saving.

Indeed, each one of us can be more 'Energy Aware', especially saving electricity in buildings, so that being 'Energy Wise' becomes second nature to Hong Kong people. I hope this document will help our residents to understand energy issues better and stimulate all of us to take wiser action.

**K S Wong**

Secretary for the Environment

May 2015

# SUMMARY OF ENERGY SAVING PLAN FOR HONG KONG 2015~2025+

## TARGET

### ENERGY INTENSITY

Hong Kong to achieve energy intensity reduction by 40 % by 2025 using 2005 as the base

Year 2025



Be "Energy Aware" and "Energy Wise"

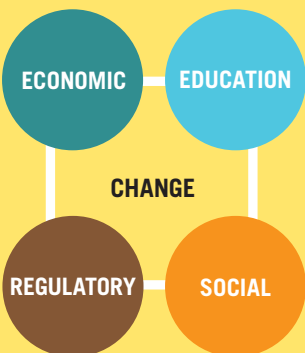


### GOVERNMENT BUILDINGS AND PUBLIC HOUSING

- New government buildings with construction floor area of >5,000 m<sup>2</sup> with central air-conditioning or >10,000m<sup>2</sup> to achieve at least BEAM Plus Gold; and
- New public housing to achieve at least BEAM Plus Gold ready

## POLICY

To drive energy saving through a combination of educational, social, economic and regulatory means, especially for buildings and inhabitants to become highly energy efficient by 2025



## STRATEGY

### PUBLIC SECTOR

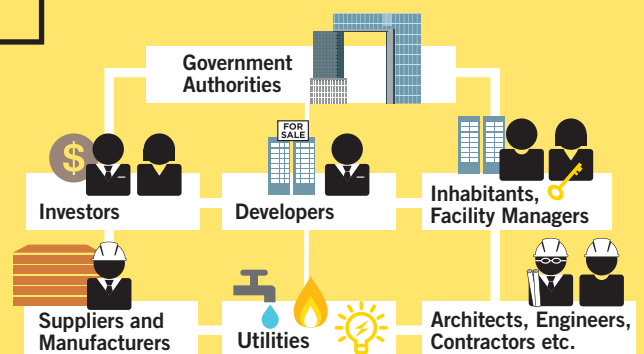
Government and public sector development agencies to lead by example and accelerate conditions for change

### PRIVATE SECTOR

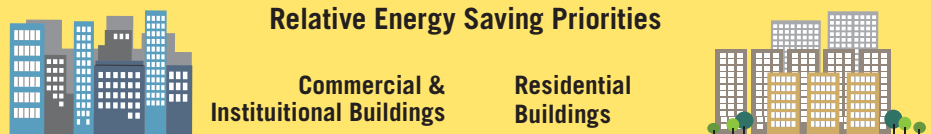
Focus on energy saving in new and existing private sector buildings to capture potential gains

### PARTNERSHIP

Collaborate with energy and built environment stakeholders to enable the 'Energy Wise' transformation



### Relative Energy Saving Priorities



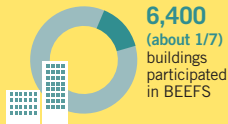
- |                                      |   |                                      |
|--------------------------------------|---|--------------------------------------|
| Building design and structure        | 1 | Appliances inhabitants choose to use |
| Inhabitants' behaviour               | 2 | Inhabitants' behaviour               |
| Appliances inhabitants choose to use | 3 | Building design and structure        |

# SUMMARY OF ENERGY SAVING PLAN FOR HONG KONG 2015~2025+

## KEY ACTIONS

1 Lead the energy saving and green building transformation through government buildings, public housing and public sector development (see targets)

2 Government buildings to achieve 5% electricity reduction target by 2020 (2014 as base); further reduction from 2020-2025 to be determined in 2019-20



**Already in existence**

- 1/7th of buildings in Hong Kong (about 6,400 buildings) participated in the \$450 million Building Energy Efficiency Fund Scheme (BEEFS) programme;
- district cooling at Kai Tak;
- Gross Floor Area (GFA) concessions for private-sector green building projects;
- and approximately \$100 million power companies' Eco Building Fund (CLP Power Hong Kong (CLP)) and Power Smart Fund (The Hongkong Electric Company Limited (HEC)) for energy saving 2014-18



### ECONOMICS



### EDUCATION

6 Update schools and public education programmes

7 Strengthen government departmental energy saving efforts through appointing Green Managers and Energy Wardens; and encourage public sector institutions to save energy

**Already in existence**

- Energy saving in physics curriculum;
- Various secondary school materials;
- Energy Efficiency Centre at Hong Kong Science Museum;
- Energy website

Periodic review, expand and/or tighten relevant energy-related standards:

3 Buildings Energy Efficiency Ordinance (BEEO);

4 Building (Energy Efficiency) Regulation, (B(EE)R); and

5 Energy Efficiency (Labelling of Products) Ordinance (EELPO)

**Already in existence**

BEEO, B(EE)R and EELPO



### REGULATORY



### SOCIAL

8 Support community campaigns via government funding schemes

9 Collaborate with large energy commercial users to develop sector specific campaigns

10 Secretary for the Environment to engage built environment leaders to accelerate green building adoption in the private sector

**Already in existence**

- Thousands of Energy Saving Charter partners since 2005;
- Partnership with stock exchange on carbon footprint repository and Environmental, Social and Governance reporting for listed companies



# EXECUTIVE SUMMARY

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**T**o become 'Energy Aware' and 'Energy Wise', energy saving will need to have a 'centre stage' role not only in government policy but also in how businesses operate and how individuals live. Hong Kong's energy saving policy focuses on driving energy saving through a combination of educational, social, economic and regulatory means, especially for buildings and inhabitants to become highly energy efficient by 2025.

This document provides the background to energy saving in Hong Kong and also where opportunities lie. We will strive to achieve an energy intensity reduction target for Hong Kong as a whole of 40% by 2025 using 2005 as the base. To achieve this, the community must contribute by changing their behaviour, as regulatory action alone is not enough. The proposed dialogue platform with stakeholders seeks to further expedite green building adoption in the private sector, which is critical to achieving this target. Indeed, only if the community can change its behaviour, can Hong Kong look forward to an even more ambitious outcome.

## **Hong Kong's energy saving focus**

Hong Kong has a four-pronged strategy to save energy. They are focussed on government taking the lead; improving building energy efficiency for both new and existing buildings because buildings consume 90% of the city's electricity usage; enabling companies, institutions and residents to make energy efficiency choices when they invest in electrical appliances and vehicles; and promoting energy saving practices and lifestyle for the people of Hong Kong.

## **Chronology of efforts**











The Government has had a two-decade long attempt to build a foundation for Hong Kong to achieve higher energy savings, where government taking the lead has been crucial. The chronology of action since 1993 noted in Chapter 2 is extensive.

Our efforts over the years, when seen together, produced solid results. Since the 1990s, the Government's effort to collaborate with built environment professionals to promote green building has helped start a whole movement in Hong Kong. We are grateful to the Hong Kong Green Building Council (HKGBC) for the part it played.







## Successes to date

Our success includes:

-  Laying the legislative foundation to continuously save energy through the B(EE)R; BEEO and EELPO, which together target energy use in buildings;
-  Aiming to achieve BEAM Plus Gold for all major government buildings and committing to achieve BEAM Plus Gold ready or better rating by Hong Kong Housing Authority (HKHA) for new public housing developments;
-  Reducing energy consumption successfully in government buildings from two rounds of effort from 2003-07 and 2009-14 by over 6% and 5% respectively, and setting a new target to reduce yet another 5% from 2015-20 using 2013-14 as the base;
-  Promulgating a green building performance framework for government buildings since 2009;
-  Promoting green building in public sector developments, especially for Hong Kong Housing Society (HKHS) projects and Urban Renewal Authority (URA);
-  Investing in energy saving systems in major public infrastructure, such as district cooling in Kai Tak Development;
-  Providing \$450 million to implement BEEFS, which represents one of the largest government-funded energy saving schemes in the world; 1/7th of the private sector buildings in Hong Kong (about 6,400 buildings) participated in the BEEFS;
-  Enabling the power companies to provide the estimated \$100 million to support energy saving projects from 2014 for 5 years;
-  Raising overall public awareness to save energy; and mobilising a large number of companies, schools and institutions to save energy through a range of continuous campaigns since 2005;
-  Collaborating with built environment professionals through institutional setup and systematic strategies to promote green building, including professional development, awards and research and development (R&D).

## Gaps to be filled

There are gaps that still need to be filled, especially in relation to buildings in the private sector, such as the ones below, but it must be emphasised that the public must also take on the responsibility to act more decisively to save energy in the coming years. On the part of Government, we will do the following:

- 
**1 Capacity Building**  
 Building greater capacity among professionals to provide a wide range of energy saving and green building services as demand for them grows;
- 
**2 Social Mobilisation**  
 Widening and deepening social mobilisation campaigns with targeted sectors, such as commercial building operators to achieve higher energy saving results;
- 
**3 Energy Data**  
 Improving the provision of energy data so that they can be more readily used by the public; collecting and compiling building energy-related data so that the Government and built environment sector can consider further energy saving measures;
- 
**4 Existing Building**  
 Getting building owners of existing buildings in the private sector to adopt energy saving installations and retrofits, and also to adopt energy saving and green building management.

## Going forward

### A. Promoting energy wise buildings

Having laid a foundation for energy wise green building in Hong Kong, the next step is to articulate a clear path on achieving further gains for existing and new buildings.

### B. Mobilising stakeholders

The power suppliers for electricity and town gas are key stakeholders in energy saving. Commercial and residential building owners are a large and diverse group of stakeholders, whose support is critical to promoting energy wise green buildings. Many issues need to be deliberated upon and mobilised by them through concerted effort. Major commercial stakeholders in the transport sector are already focussing on energy efficiency to a great extent because energy cost is their largest expenditure item outside staff cost. However, gains can still be made by the Government collaborating with them on promoting energy saving practices, and at the same time reducing air pollution and greenhouse gas emissions.

### C. Community taking responsibility

For Hong Kong to save energy as a whole, the people must take responsibility. While we will step up collaboration with relevant stakeholders to equip energy consumers in all sectors with better skills and the readiness to do more with less, ultimately, the community needs to take collective actions to change behaviour and be willing to invest in more energy efficient products, technologies and practices.

## Government to lead

### Existing government buildings



We will update the existing commitment for government buildings and internal structure as follows:

- Appoint Green Manager and Energy Warden in bureaux and departments;
- Audit and benchmark; and rationalise existing carbon audits, energy audits and energy-cum-carbon audits;
- Retro-commission to ensure buildings perform to their design standards; and
- Retrofit energy-related systems to reduce energy consumption.

### New government buildings



The Government will continue to use its new buildings to play a leadership role in green building development.

### New buildings



We have tightened and expanded the Overall Thermal Transfer Value (OTTV) standard, which was first introduced in 1995, as well as set the Residential Thermal Transfer Value (RTTV) standard for residential buildings which has taken effect since April 2015; and we will review Building Energy Code (BEC) at least once every 3 year.

## Mobilise stakeholders to act

### Green building

The Secretary for the Environment will create a dialogue platform and invite the power suppliers to discuss energy saving, and built environment stakeholders to discuss expediting green building adoption in the private sector. Energy saving will form a core component of the dialogue as per the various issues raised in Chapter 3. The Secretary for the Environment will also engage stakeholders on how to strengthen a local energy efficiency and green building market, as well as how to strengthen professional capabilities and capacity to provide energy saving and green building services as energy becomes an increasingly important part of the economy.



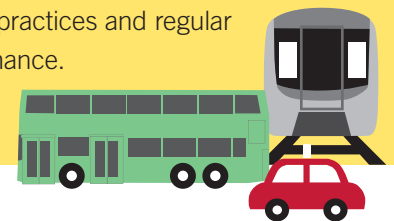
### Mandatory Energy Efficiency Labelling Scheme (MEELS)

The Government has enacted EELPO to implement the MEELS and will continue on-going dialogue with stakeholders to tighten and expand MEELS.



### Transport sector

The Government will encourage transport sector stakeholders to explore how to promote energy saving, such as promoting good driving practices and regular maintenance.



# 1 | INTRODUCTION

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Cities and built environments<sup>1</sup> are like ecosystems – they are complex and dynamic, requiring continual inputs of energy and other resources in order to function. There is a growing concern in Hong Kong about energy issues, as people here tune into the worldwide debate about how cities can offer sustainable energy solutions, an important aspect of which is to use energy more wisely.

Despite the concern, we have yet to acknowledge energy requires a ‘centre stage’ role if we are to make larger strides in energy conservation and efficiency. The challenge is considerable because the transformation for us to become ‘Energy Wise’ will need integrated actions from not only greater government effort but also from business and society. The good news is that Hong Kong has already laid a solid foundation to achieve higher energy savings (see Chapter 2).

However, what is needed is a community consensus on the way forward since implementing regulatory change and agreeing upon specific financial outlays require political support, and businesses and households have to be willing to invest and take action too.



**The good news is that Hong Kong has already laid a solid foundation to achieve higher energy savings**

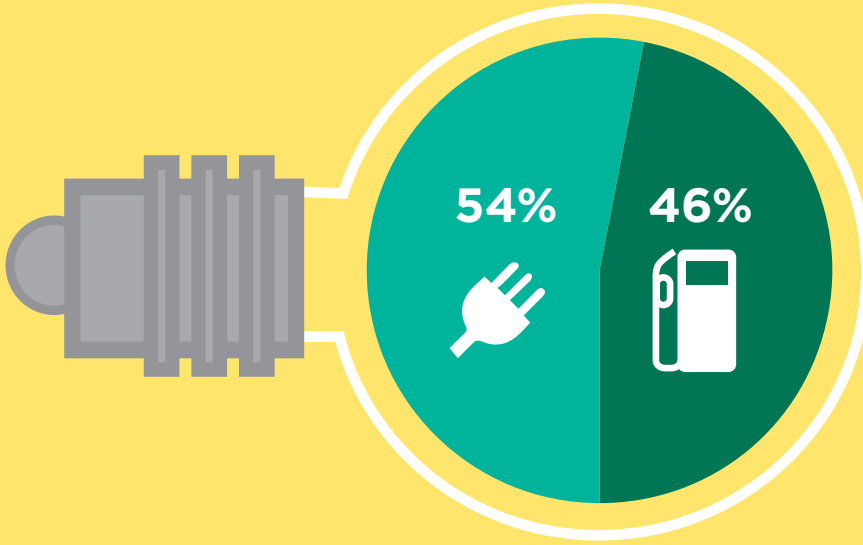
This document focuses on reducing energy consumption by looking at the demand-side of energy in Hong Kong<sup>2</sup> and energy saving opportunities up to 2025, while also pointing the way further ahead to 2035. How energy is used in buildings is obviously very important; while in transportation, where electricity and fuels are both used, there are also opportunities to be more energy efficient. In both sectors, Hong Kong can achieve considerable savings through the efforts of the relevant stakeholders.

This document aims to stimulate and provoke wider community deliberation and debate. We wish to assess the extent to which the relevant stakeholders and the community are ready for the Government to adopt more aggressive policies and measures in energy saving.

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1. Built environment is defined as everything manmade to modify the spaces in which we live and work, including buildings of all types, roads, parks, landscaping etc.  
2. This document does not include energy exported and energy used in international aviation and shipping.

## Characteristics relevant to energy and electricity usage in Hong Kong



More than half (54%) of Hong Kong's total annual energy end-use is in the form of electricity consumption. The rest is used in the form of oil and coal products, town gas and liquefied petroleum gas (LPG), and to a very small extent, biodiesel.

small land mass



sub-tropical climate:  
high temperature and humidity



high population living and working mostly in high-rise buildings



high GDP economy dominated by sophisticated services



# HONG KONG LAND MASS

263 km<sup>2</sup>  
for living/working



Population  
7.2 million

1,104 km<sup>2</sup> with hilly terrain

## POPULATION DENSITY (person/km<sup>2</sup>)

Cooking



Average in Hong Kong  
6,540/km<sup>2</sup>



Densest in Kwun Tong  
55,200/km<sup>2</sup>

Air Conditioning



## SUMMER IN HONG KONG

High humidity  
70-80%



Day 31°C



Night 26°C

Water Pumping



Lighting



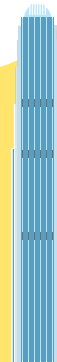
8,000+  
government  
buildings/  
facilities



42,000+  
buildings in  
private sector



50+  
buildings over  
200 m (656 ft)

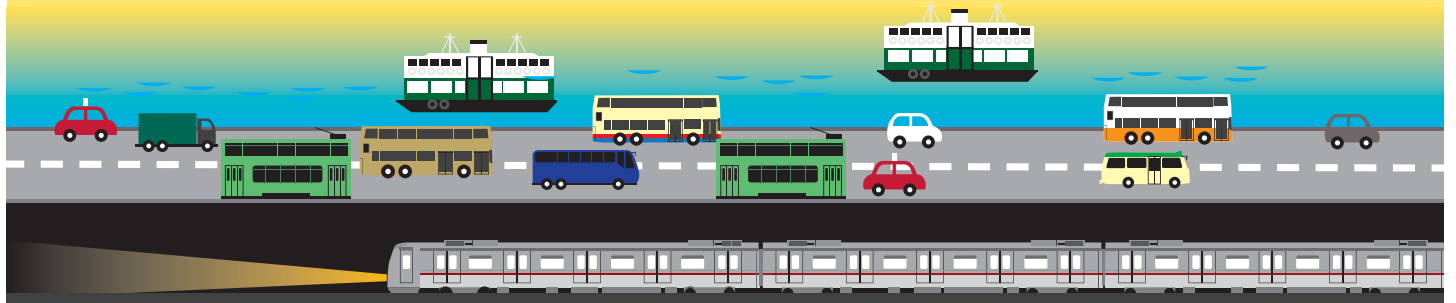


Elevators



lifts  
62,000+  
escalators  
8,700+

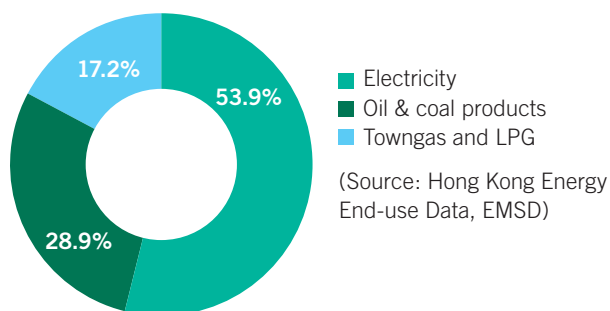
270+  
buildings over  
150 m (492 ft)



## Total energy consumption in Hong Kong

In 2012<sup>3</sup>, Hong Kong consumed 287,970 TJ<sup>4</sup> of energy. Figure 1 shows the distribution of energy end-uses by fuel types. Hong Kong’s energy consumption comprises three fuel types – our largest fuel type use is electricity, followed by oil and coal products,<sup>5</sup> and then town gas and LPG. In recent years, a very small amount of biodiesel is also being used.

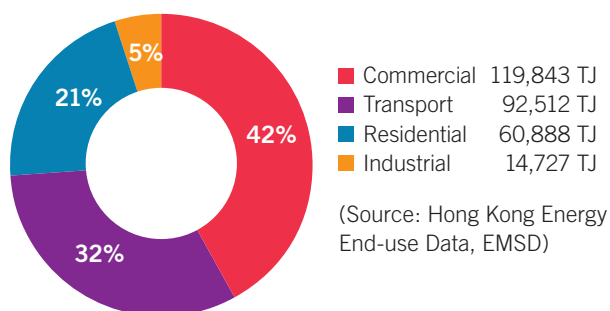
**Figure 1** Hong Kong’s energy end-use distribution by fuel type, 2012



## Energy consumption by sector

Of the energy consumed in 2012, the commercial sector accounted for the largest share (42%), followed by the transport sector (32%), residential sector (21%) and industrial sector (5%).

**Figure 2** Hong Kong’s energy end-use distribution



## Biodiesel

While the quantity used in Hong Kong is still very small, biodiesel as a fuel is worthy of note. Biodiesel is both produced in Hong Kong from used cooking oil and waste fats, as well as imported. Trials have been conducted to test a 5% biodiesel blend (B5) in government vehicles and vessels, as well as in boilers and emergency generators with satisfactory results. Contractors are beginning to use it to power construction equipment, and it has potentials to be a “distributed” renewable energy (RE) source for tri-generation in buildings too, such as at the Zero Carbon Building (ZCB).<sup>6</sup>

3. This report uses 2012 end-use energy data as they are the most comprehensive available. 2013 data will only be available after mid-2015. The energy end-use data covers internal civilian energy end-use. It does not include energy exported, energy used for transportation between Hong Kong and the Mainland and Macao, and also to foreign jurisdictions, as well as energy used for military purposes.

4. The joule is the International System of Units for energy. Electricity consumption is usually expressed in kilowatt-hour (kWh) and one kWh equals to 3.6 mega-joules (MJ). The energy unit commonly used in Hong Kong’s energy end-use database is terajoule (TJ) which equals to  $1 \times 10^{12}$  joules. The average household electricity consumption in Hong Kong is about 400 kWh per month.

5. This category includes petrol, diesel, kerosene, aviation fuel, charcoal, anthracite, coking coal, semi-coking coal and biodiesel. Biodiesel is not shown as the quantities are too small.

6. The ZCB is designed to generate about 70% of its on-site energy from a tri-generation system (cooling, dehumidification and power) that runs on locally-produced biodiesel from used cooking oil. The remaining 30% is generated by solar panels.



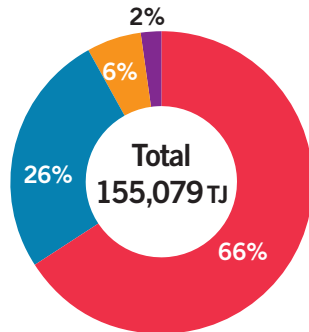
### Energy use in buildings

Buildings account for about 40% of the world’s energy use. In Hong Kong, the main energy used in buildings is electricity and our buildings consume 90% of the city’s electricity. Certain types of electricity use in buildings are particularly significant. Not surprisingly, air-conditioning is the largest electricity end-use in Hong Kong, followed by lighting, office equipment and cooking.

Hong Kong consumed 155,079 TJ (about 43,078 million kWh) of electricity in 2012 (Figure 3).

Air-conditioning accounts for 30%, lighting 13%, office equipment 8% and cooking 8% respectively of the total electricity end-uses. Other major end-uses include the electricity required for refrigeration (6%), industrial processes and equipment (6%) and water heating (3%). The category ‘Others’ (24%) includes the electricity end-uses for lifts and escalators, building plumbing, water supply and sewage treatment, and miscellaneous electrical appliances and equipment (Figure 4).

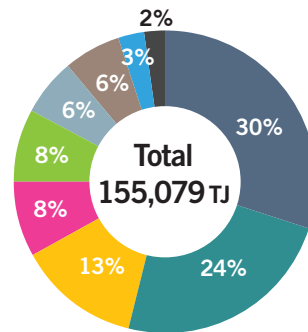
**Figure 3** Electricity consumption by sector, 2012



Commercial	101,813 TJ
Residential	41,189 TJ
Industrial	9,356 TJ
Transport	2,722 TJ

(Source: Hong Kong Energy End-use Data, EMSD)

**Figure 4** End-uses of electricity in Hong Kong, 2012<sup>7</sup>



Space conditioning
Lighting
Cooking
Office equipment
Industrial process/ equipment
Refrigeration
Hot water
Rail and trams
Others

(Source: Hong Kong Energy End-use Data, EMSD)

7. The total electricity consumption in 2012 was 155,079 TJ or 43,078 million kWh; and “Others” includes end-uses not listed, such as lifts and escalators, building plumbing, water supply, sewage treatment and miscellaneous electrical appliances and equipment. “Rail and Trams” include electricity used in the operation of heavy rails, light rail, tramway and peak tramway, but exclude electricity used in buildings and at stations and other premises of the relevant transport operators.

The two power companies, CLP and HEC, have about 3 million customers. Of the total electricity consumed in 2012, the commercial sector took up about 66% and the residential sector 26%. The remaining 8% of electricity consumption was taken up by the industrial and transport sectors.

Hong Kong's total end-use of town gas and LPG was about 49,616 TJ in 2012, or about 17% of total energy use. Town gas is widely used for water heating

and cooking; and LPG is still used for cooking and water heating by a not insignificant number of households. About 40% of the town gas and LPG is used in the residential sector (compared to nearly 27% electricity use), 27% in the commercial sector (compared to nearly 66% electricity use), 2% in the industrial sector (compared to 6% electricity use) and 31% in the transport sector (compared to less than 2% electricity use).

### Town Gas and LPG

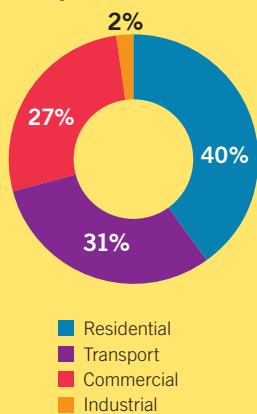
Hong Kong consumed 49,616 TJ of town gas and LPG in 2012. Town gas is produced in Hong Kong mainly from imported naphtha and natural gas. The residential sector accounted for 40% of the consumption, transport 31%, commercial 27% and industrial about 2%.

Town gas is an important supplement to electricity particularly for cooking and water heating with annual sales of about 28,360 TJ.<sup>8</sup> There are nearly 1.8 million households and businesses using town gas for their daily activities. There are also about 250,000 households using small

cylinder LPG and another 230,000 group of users using piped LPG.

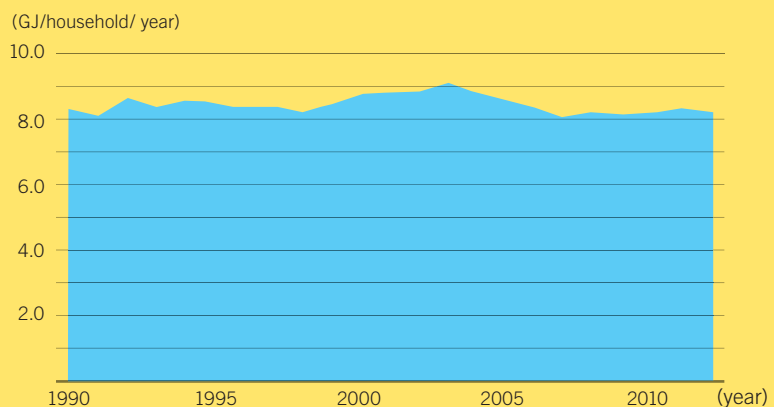
Of the total town gas and LPG consumed in Hong Kong, about 41% is used for cooking, 19% for water heating, 31% for transportation (see Chapter 4) and 9% for other end-uses.

**Figure 5**  
Share of town gas and LPG consumption, 2012



(Source: Hong Kong Energy End-use Data, EMSD)

**Figure 6**  
Household town gas and LPG consumption (GJ/household/year), 1990-2012



(Source: Hong Kong Energy End-use Data, EMSD and C&SD)

8. Based on C&SD's statistics, the number of households in Hong Kong is about 2,389,000 in 2012. Total town gas consumption in 2012 is 28,360TJ. Towngas Sustainability Report 2012 also provides other statistics (page 64, <http://www.towngas.com/sustainabilityRpt/2012/eng/>), such as number of customers (1,776,360).

## Energy use in transportation

Hong Kong consumed 83,275 TJ of oil and coal products in 2012, mainly in the form of oil products for transportation, of which 80% is consumed in vehicular transportation, about 10% in marine transportation and the remaining 10% for industrial and other uses.

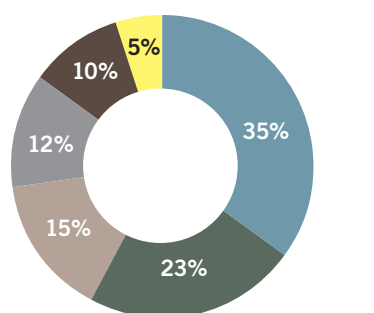
For vehicular transportation, oil products (petrol and diesel) are used in most types of vehicles – LPG is used in taxis and a large portion of public light buses (PLB), while electricity is used for a very small portion of vehicles. In terms of oil product consumption, goods vehicles rank first, followed by private cars and buses. Chapter 4 provides a longer discussion on energy use and transportation.

## Government's electricity consumption

The Government is one of the largest users of electricity in Hong Kong accounting for more than 6% of Hong Kong's electricity consumption, with which it provides a range of essential public services. In 2012-13, its total electricity consumption is about 9,500 TJ (2,639 million kWh), 56% of which (about 5,120 TJ or 1,422 million kWh) was used in government buildings and 44% (about 4,380 TJ or 1,217 million kWh) for public infrastructure. Figure 7 details the breakdown of electricity consumption in government buildings and infrastructures.

Large electricity users in the Government work hard to be more energy efficient since electricity cost is one of their key areas of recurrent expenditure. For example, Water Supplies Department's (WSD) annual electricity consumption was reduced from 697 million kWh in 2007-08 to 677 million kWh in 2012-13. On a per capita basis in water consumers served by WSD, there has been a reduction of 5.8% in electricity consumption over that five year period.

**Figure 7** Government electricity consumption by services, 2012-2013



- Water supply and waste water treatment services
- Municipal services
- Disciplinary forces
- Government offices and quarters
- Street lighting
- Other government services

(Source: EMSD)

### Examples of large electricity users

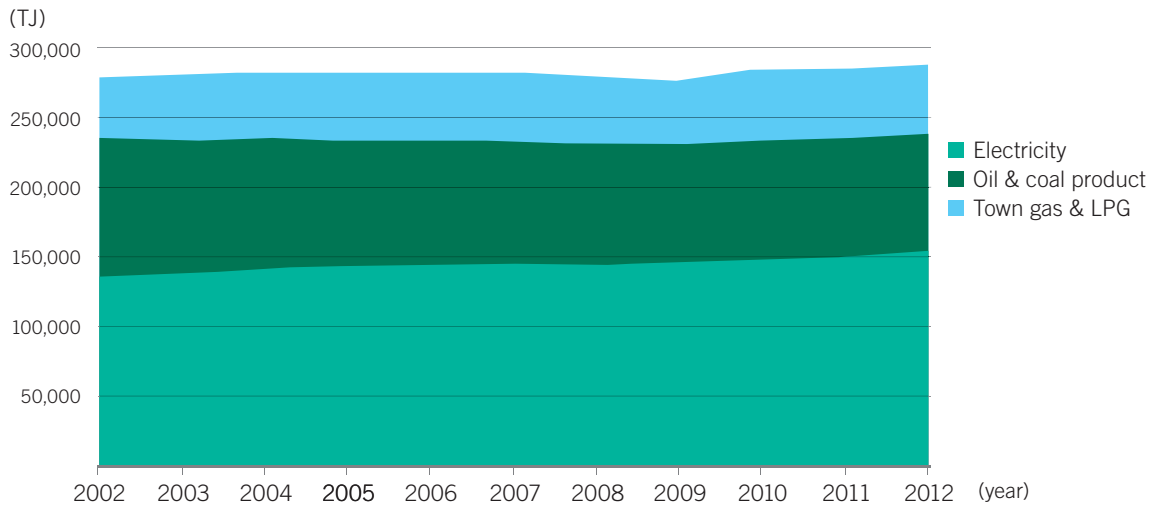
MTR Corporation Limited, which runs Hong Kong’s rail systems, stations and depots, as well as manages significant commercial, office and residential properties is one of the largest users of electricity. The bulk of its electricity consumption is for transport operation (about 76% of its total electricity consumption).<sup>9</sup>

Other major public sector users include the Hospital Authority, which manages all the public hospitals, HKHA, which manages public housing, and Airport Authority which manages the airport.

### End-use change over the years and outlook for the future

Since 2002, the consumption of electricity, town gas and LPG had increased at an average rate of 1.2% per annum, while the consumption of oil and coal products fell at an average of 1.6% per annum (Figure 8). Compared with 2002, the share of electricity had increased by 4.8% and town gas and LPG by 1.5%, while oil and coal products dropped 6.2%.

**Figure 8** Total energy consumption by fuel type, 2002-2012



(Source: Hong Kong Energy End-use Data, EMSD)

9. MTR Corporation Limited’s Sustainability Report 2013, [www.mtr.com.hk/sustainability](http://www.mtr.com.hk/sustainability).

## 1. Population growth

Population growth obviously had an impact on the total amount of energy consumed. Using electricity usage as an indicator, in 2002, the population was about 6.74 million and it increased to just over 7.15 million by 2012 (i.e. about 6%). If we go back to 1990, we can gain even greater insight into the nexus between population growth and per capita electricity consumption (Figure 9).

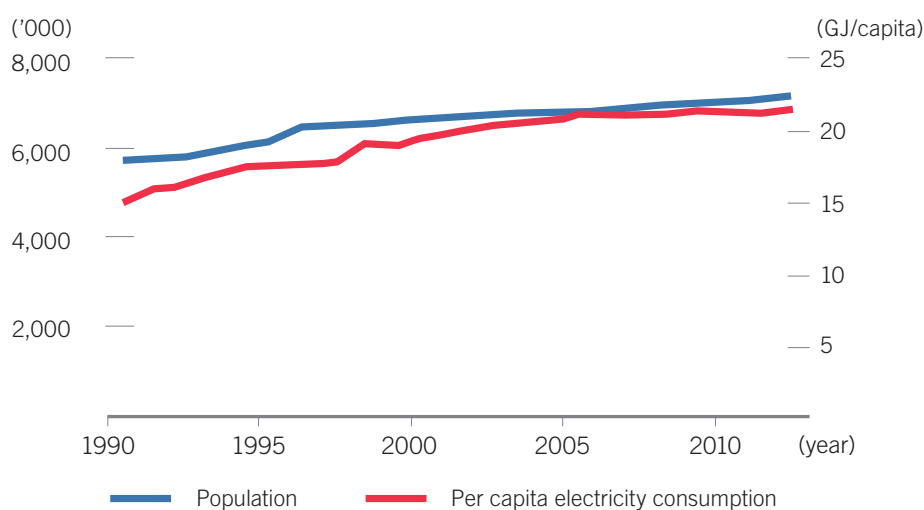
Figure 9 shows a very rapid increase in per capita electricity consumption throughout the 1990s (26.1%). The overall rise in electricity consumption since then was likely due to the increase in living standards achieved over that decade that included wider use of home appliances and electronic products, although the rise slowed in the 2000s (9.2%), which could be due to higher energy efficiency of electrical

appliances, coupled with a growing public awareness of energy saving. This phenomenon of consuming more energy as living standards improve is typical of societies as income rises (Figure 10).

## 2. Energy and electricity consumption and Gross Domestic Product (GDP)

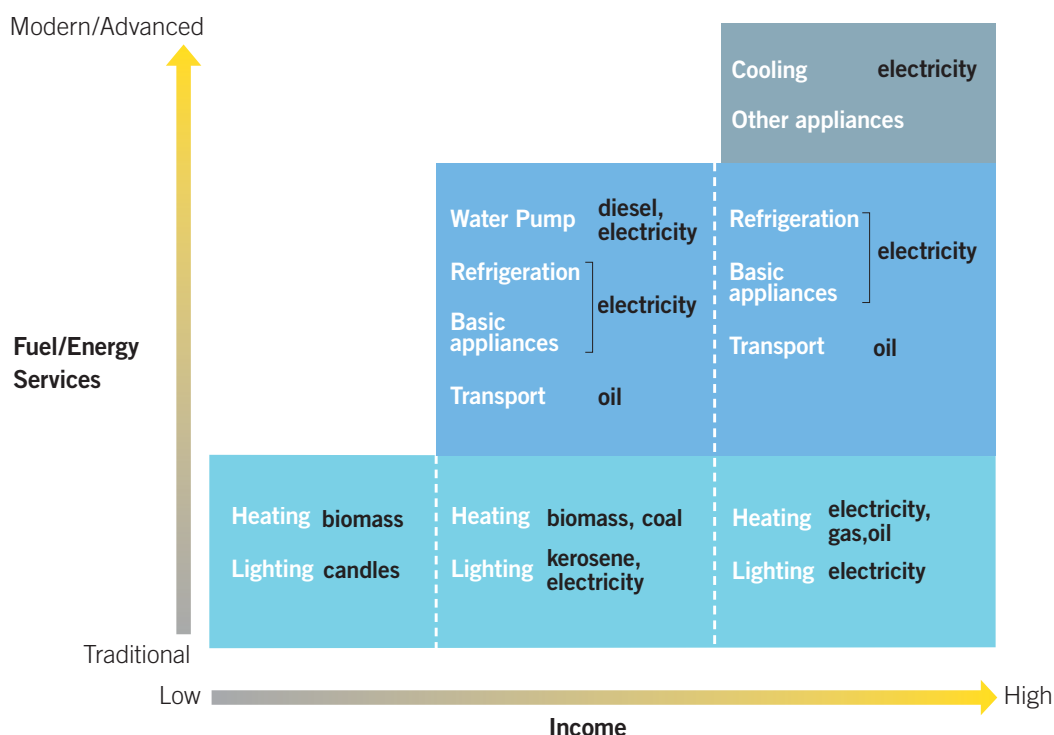
Yet another way to look at Hong Kong's relationship with energy is to link it to our GDP. From 1990 to 2012, Hong Kong's energy consumption and electricity end-use increased, and in the case of electricity, it increased by 81%, equivalent to 2.7% increase per annum. During this period, Hong Kong's GDP increased by 134%, equivalent to an average of 3.9% per annum, while population increased by 25% (1.45 million), equivalent to an average of 1.0% per annum.

**Figure 9** Population increase VS per capita electricity consumption (GJ/capita) in Hong Kong, 1990-2012



(Source: C&SD)

**Figure 10** Typical energy use transition from low to higher income economies



### Mobile Residents and Visitors

A frequently asked question is what impact visitors have on Hong Kong. Visitor numbers have increased from 16.57 million in 2002 by about 230% to 54.3 million in 2013 (28.64 million were same-day visitors).<sup>10</sup> The average length of overnight stay was 3.4 nights. Obviously, visitors consume electricity directly and indirectly while in Hong Kong. They stay at hotels, take public transportation and conduct a range of activities, which mainly require electricity.

Taking the visitor number in 2013, it was equivalent to about 500,000 residents or about 7% of our total population. Their energy consumption would mostly be reflected in the energy use of the commercial and transportation sectors.

When we calculate Hong Kong's electricity consumption on a per capita basis, the number of tourists is disregarded but Hong Kong has a category of 'mobile residents' which is included in our population calculation.



Mobile residents are Permanent Residents who spend less time in Hong Kong than elsewhere.<sup>11</sup> In 2013, there were 221,900 mobile residents included in Hong Kong's population (about 3% of the total).

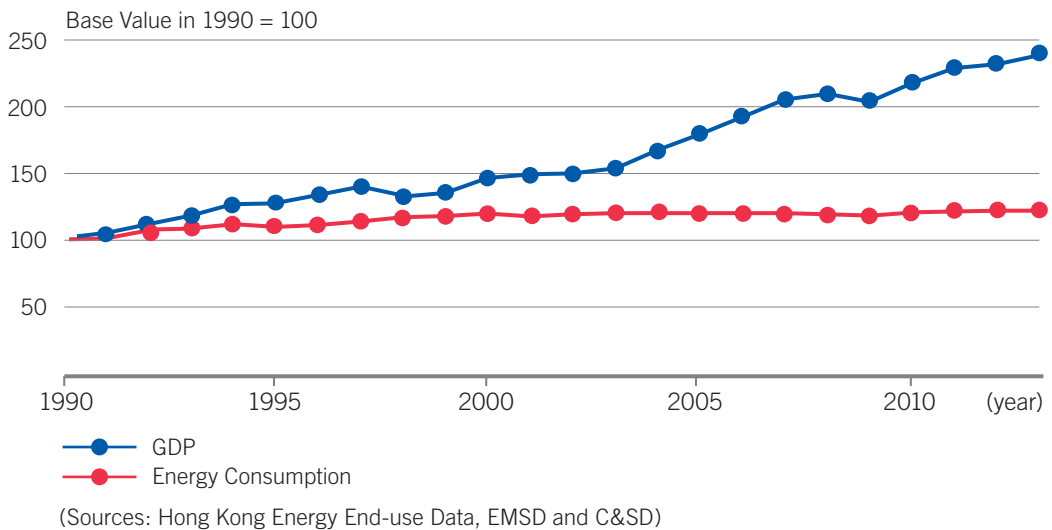
10. See [http://www.tourism.gov.hk/english/statistics/statistics\\_perform.html](http://www.tourism.gov.hk/english/statistics/statistics_perform.html) and [http://www.tourism.gov.hk/resources/english/paperreport\\_doc/fact/2003-09/tourism\\_fact\\_sheet-e\\_sept03.pdf](http://www.tourism.gov.hk/resources/english/paperreport_doc/fact/2003-09/tourism_fact_sheet-e_sept03.pdf).

11. C&SD's definition of 'mobile residents' is Hong Kong Permanent Residents who have stayed in Hong Kong for at least one month but less than 3 months during the 6 months before/after the reference point used to calculate population.

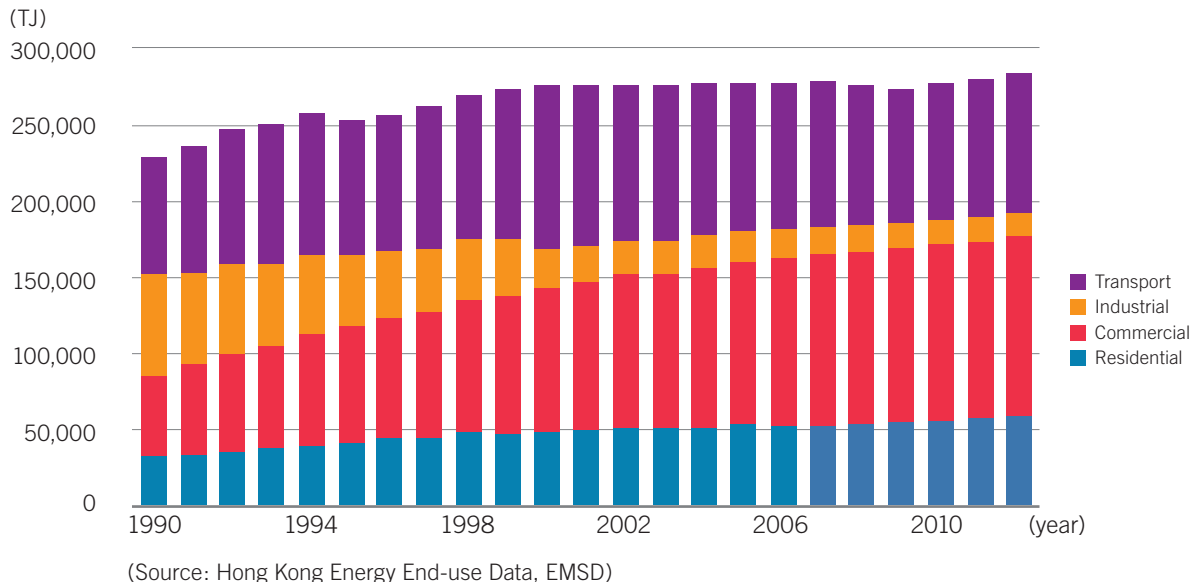
This means the local energy and electricity use-to-GDP ratios have been dropping despite continuing economic growth (Figure 11). This was mainly due to growth in the less energy intensive service sector and decline in the more energy intensive industrial sector although energy conservation and energy efficiency also contributed to the drop.

Figure 12 shows that energy consumption increased by 26% (average 1.1% per annum) in all sectors except the industrial sector. As Hong Kong transitioned towards a service economy, our economy became less energy intensive while our manufacturing industries relocated to the Mainland, starting gradually in the 1980s and accelerating in the 1990s.

**Figure 11** Decoupling of energy use from GDP, 1990-2012



**Figure 12** Energy consumption by sector, 1990-2012



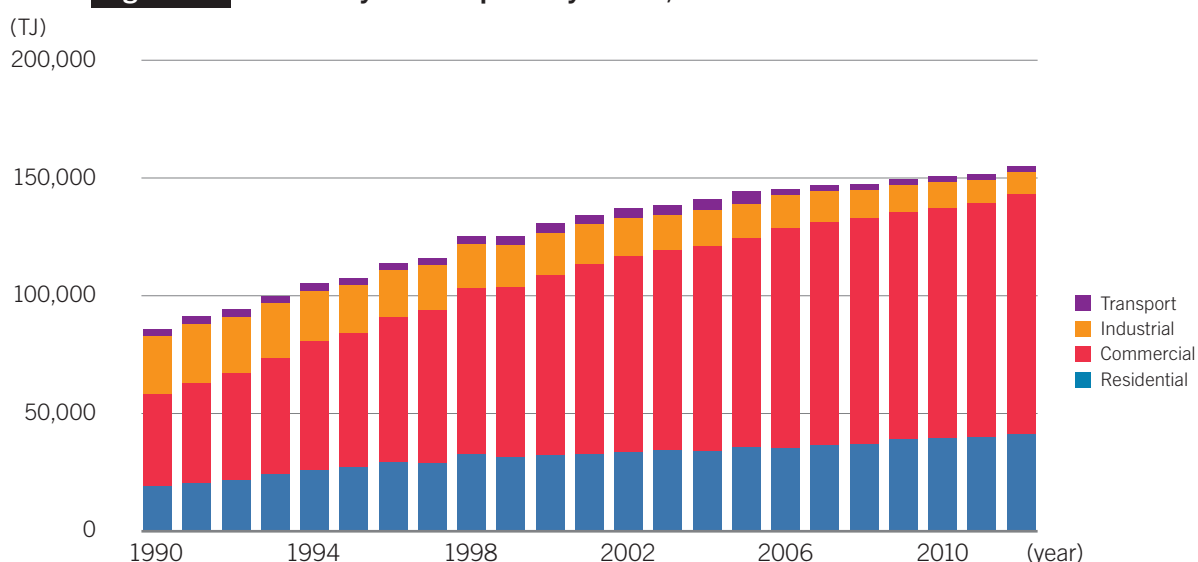
In other words, a very large part of Hong Kong's industrial energy use has been transferred to the Mainland.

Figure 12 reminds us that the commercial sector registered the highest increase in energy consumption (119%), followed by the residential sector (88%). In the same period, electricity consumption increased by 81% (average 2.7% per annum).

Figure 13 shows both the commercial (161%) and residential sectors (116%) registered large increases in electricity consumption. The percentage increase in electricity demand is higher than the increase in total energy demand in the corresponding sector, which means there has been a gradual shift towards using more electricity versus other fuels.

Whether the overall electricity consumption trend will continue in the future will depend on not only government policy but a variety of factors, such as changes in demographics and household size, economic growth and prosperity, changes in the structure of economic activities, technological developments (e.g. energy efficiency of appliances, increasing use of IT to accommodate cloud computing, big data systems, smart meters, battery development for electric vehicles, e-mobility etc.), changes in international fuel prices, electricity tariffs, infrastructure expansion (such as rail and district cooling), and how Hong Kong people choose to use energy, as well as their willingness to moderate their use of energy.

**Figure 13** Electricity consumption by sector, 1990-2012



(Source: Hong Kong Energy End-use Data, EMSD)



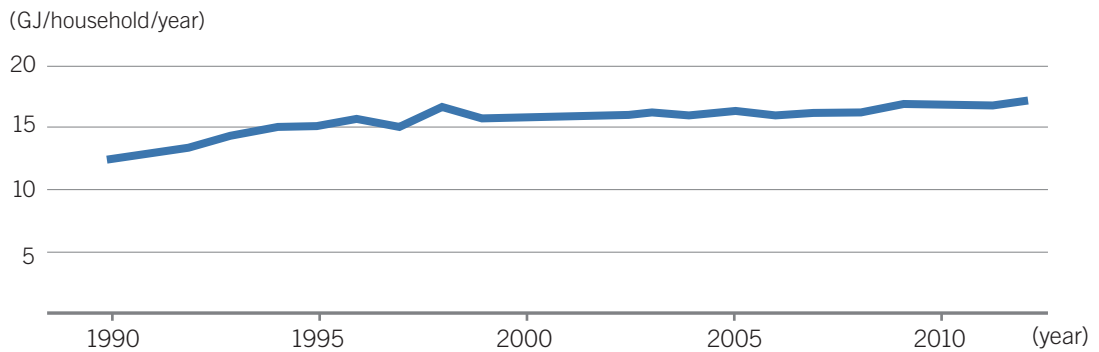
The pattern of the behaviour of people in their energy consumption is most readily reflected by household consumption figures (Figure 14). The average size of each household between 1990 and 2012 had decreased from 3.5 persons per household in 1990 to 2.9 persons per household in 2012.

Overall, Figure 15 shows the 2012 end-use electricity breakdown in the domestic sector, where energy (electricity, town gas and LPG) is mostly used in household appliances.

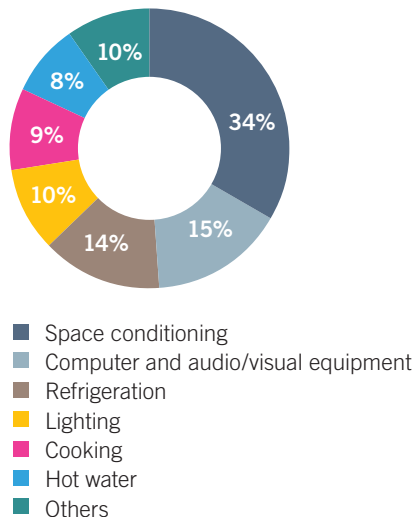
Figure 16 shows electricity use in the commercial sector, where space conditioning is the major end-use of electricity, followed by lighting.

This is why we believe our policy needs to focus on enabling individual householders and stakeholders in the commercial sector to use energy, particularly electricity (as this is the largest portion for both sectors), much more efficiently, as well as to conserve it as far as possible.

**Figure 14 Household electricity consumption (GJ/household/year), 1990-2012**

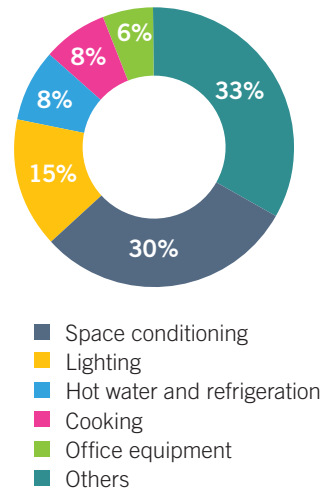


**Figure 15 How the residential sector uses electricity, 2012**



(Sources: Hong Kong Energy End-use Data, EMSD and C&SD)

**Figure 16 How the commercial sector uses electricity, 2012**



(Sources: Hong Kong Energy End-use Data, EMSD and C&SD)

## 2 | FOUNDATION FOR ENERGY SAVING

**P**eople do not want energy per se. We want energy services, such as temperature comfort, light, mechanical motion, and an electric current to power appliances. While people are happy with less energy as long as they can enjoy a high level of energy services, the challenge is that since energy is not valued per se, saving energy has yet to become a widespread social and economic priority. There is still much to be done for Hong Kong people to truly become 'Energy Aware' and 'Energy Wise'.

The concept of energy conservation relates to avoiding or reducing the use of energy in various situations, such as daylighting, improving natural ventilation, cooling a single room rather than the entire flat or maintaining a room at a slightly higher temperature, and choosing clothing materials and dressing to wisely cope with the summer heat, which requires us to play an active part daily to moderate our demand for energy. The concept of energy efficiency relates to the minimisation of energy input in the processes of delivering a particular type of service. To achieve higher energy savings, both energy efficiency and conserving energy are relevant.

### Typical measures

There are many examples from around the world on energy saving policies to achieve specific goals. These include public education campaigns, minimum energy efficiency standards, information labelling aimed at encouraging buyers to look at the purchase of higher efficiency appliances and properties as a financially sound and socially responsible investment, as well as financial incentives and subsidies. Such steps may be further broken down into those targeted at specific sectors, such as buildings, equipment, industry, lighting, electrical appliances, vehicles etc.

### Hong Kong's chronology of action

Hong Kong too has a range of such policies and measures to promote energy saving and green building that have been set in motion over the past two decades, which have laid the foundation we need to go forward. These efforts centre round:



## Chronology - HK Government's energy saving and green building efforts

Year	Public education and social mobilisation	Financial support / incentive to trigger action	Government leadership and setting targets	Legislating on specific requirements
1993			Started Green Manager Scheme – all departments to publish annual environmental reports <sup>12</sup>	
1994			Launched Energy Efficiency Office (EEO) under EMSD	
1995	Launched Voluntary Energy Efficiency Labelling Scheme (VEELS) – covering home and office appliances and equipment, and vehicles			Enacted B(EE)R - requires the external walls and roofs of commercial buildings and hotels to be designed and constructed with a suitable OTTV
1997	Established Hong Kong End-use Data – updated annually			

Year	Public education and social mobilisation	Financial support / incentive to trigger action	Government leadership and setting targets	Legislating on specific requirements
1998	Launched BEC and the voluntary Hong Kong Energy Efficiency Registration Scheme			
2001		Buildings Department (BD), Lands Department (Lands D) and Planning Department (Plan D) issued Joint Practice Note (JPN) No.1 on Green and Innovative Buildings	Launched Fresh Water Cooling Towers Scheme to promote energy-efficient water-cooled air-conditioning system <sup>13</sup>	
2002		JPN No. 2 on Second Package of Incentives to Promote Green and Innovative Buildings		

Year	Public education and social mobilisation	Financial support / incentive to trigger action	Government leadership and setting targets	Legislating on specific requirements
2003			Set target for government buildings – to reduce 6% energy consumption between 2003-04 and 2006-07 using 2002-03 as the base year	
2004	Organised Hong Kong Energy Efficiency Awards – to encourage the private sector and schools to adopt energy conservation best practices			
2005	Promoted No Freezing Summer campaign – to urge the public to adjust room temperature to 25.5°C in the summer			
2006	Promoted Energy Conservation Charter to involve schools, NGOs and companies			
2007			Adopted APEC's Energy Intensity Target – to reduce energy intensity by at least 25% by 2030 (base 2005)	

Year	Public education and social mobilisation	Financial support / incentive to trigger action	Government leadership and setting targets	Legislating on specific requirements
2008	<ul style="list-style-type: none"> <li>Launched Hong Kong Awards for Environmental Excellence (HKAEE) which is a merger and extension of the Hong Kong Eco-Business Awards, the WasteWise Scheme and the Hong Kong Energy Efficiency Awards</li> <li>Fresh Water Cooling Towers Scheme launched in 2001 becomes a standing scheme to promote energy-efficient water-cooled air-conditioning system</li> </ul>		<ul style="list-style-type: none"> <li>Committed to a District Cooling System (DCS) – at the East Kowloon Kai Tak Development</li> <li>New Scheme of Control Agreements – power companies set-up loan funds over 5-years to provide loans to non-government customers to save energy</li> </ul>	Enacted EELPO – to launch the MEELS
2009	<ul style="list-style-type: none"> <li>Committed to energy efficiency demonstration projects – e.g. Sing Yin Secondary School and Trade and Industry Tower</li> <li>Government supported the founding of the HKGBC</li> </ul>	Launched BEEFS – provided \$450 million over three years to promote building energy efficiency by subsidising building owners to conduct energy-cum-carbon audits and energy efficiency projects (Note: Application closed in April 2012)	<ul style="list-style-type: none"> <li>Development Bureau and Environment Bureau issued Circular on Green Government Buildings to promote green government buildings</li> <li>Set target for government buildings – to reduce 5% energy consumption within 5 years using 2007-08 as the base year</li> </ul>	Implemented MEELS Phase I – covering air-conditioners, refrigerators and compact fluorescent lamps
2010	<ul style="list-style-type: none"> <li>HKGBC introduced BEAM Plus</li> <li>HKGBC (together with PGBC) launched biannual Green Building Award</li> </ul>			
2011	<ul style="list-style-type: none"> <li>HKGBC launched BEAM Professional</li> <li>The Council for Sustainable Development (SDC) launched an engagement exercise on maximising building energy efficiency through demand-side management</li> </ul>	Implemented a package of measures to foster a quality and sustainable built environment, including promulgation of the Sustainable Building Design Guidelines, tightening GFA concessions with pre-requisites such as project registration for BEAM Plus, the issuance of revised JPNs No. 1 and 2 and PNAPs APP-151 and 152	Adopted APEC's Energy Intensity Target – to reduce energy intensity by 45% by 2035 (base 2005)	<ul style="list-style-type: none"> <li>Implemented MEELS Phase II – covering washing machines and dehumidifiers</li> <li>Tightening OTTV standard for commercial buildings and hotels</li> </ul>
2012	<ul style="list-style-type: none"> <li>Launched Energy Saving Charter – to promote electricity reduction from air-conditioning</li> <li>The SDC submitted its report on the public engagement on “Combating Climate Change: Energy Saving and Carbon Emission Reduction in Buildings” to the Government.</li> <li>The SDC put forward a number of recommendations, including the promotion of green buildings</li> <li>Completed ZCB – 45% more energy efficient than current standard building design</li> </ul>		Adopted recommendations from the SDC – including to save energy and reduce carbon emissions from buildings, as well as to create a voluntary charter scheme	Gave legal effect to BEEO – a new BEC went into effect in February and the BEEO went into full force in September

12. Examples of such reports are BD's Environmental Report 2013 [http://www.bd.gov.hk/english/documents/COER2013\\_eng.pdf](http://www.bd.gov.hk/english/documents/COER2013_eng.pdf); EMSD's Social and Environmental Report 2012-13 [http://www.emsd.gov.hk/emsd/e\\_download/about/EMSDar/1213ar/pdf/EMSD\\_AR2012&13\\_partD.pdf](http://www.emsd.gov.hk/emsd/e_download/about/EMSDar/1213ar/pdf/EMSD_AR2012&13_partD.pdf); and Environmental Protection Department's Environment Hong Kong 2013 <http://www.epd.gov.hk/epd/misc/ehk13/index/html>.

13. The full name of the pilot scheme was Wider Use of Fresh Water in Evaporative Cooling Towers for Energy-efficient Air Conditioning Systems.

Year	Public education and social mobilisation	Financial support / incentive to trigger action	Government leadership and setting targets	Legislating on specific requirements
2013	<ul style="list-style-type: none"> <li>Launched new campaigns under the Energy Saving Charter on:               <ul style="list-style-type: none"> <li>(i) Indoor Temperature to invite developers and building management companies to maintain an average indoor temperature between 24-26°C between June and September 2013; and</li> <li>(ii) No Incandescent Light Bulbs to promote their early retirement</li> </ul> </li> <li>The Government supported HKGBC to launch the annual Green Building Week</li> <li>HKGBC launched BEAM Plus Interiors</li> </ul>		<ul style="list-style-type: none"> <li>Commissioning of Phase I of DCS – to cover the new Cruise Terminal and Ching Long Shopping Centre</li> <li>Mid-term review of Scheme of Control Agreements – power companies extended loan funds until 2018 for building energy saving.</li> </ul>	The Residential Properties (First-hand Sales) Ordinance took effect. Under the Ordinance, if GFA concession has been granted to a development, the sales brochure for the development must set out the environmental assessment of the building (e.g. BEAM Plus) and information on estimated energy performance or consumption for the common parts of the development
2014	<ul style="list-style-type: none"> <li>Campaign on Energy Saving Charter on Indoor Temperature – Developers, building management companies, offices and housing estates to maintain an average indoor temperature between 24-26 degrees Celsius between June and September 2014</li> <li>HKGBC launched BEAM Affiliate</li> </ul>	The two power companies offered out of their shareholders earnings \$100 million to subsidise building owners on a matching basis to carry out improvement works to enhance the energy efficiency of non-commercial buildings, with priority given to single residential blocks	The Government issued Guidelines on Design and Construction Requirements for Energy Efficiency of Residential Buildings (PNAP APP-156)	The Government tightened the energy efficiency grading standards of room air conditioners, refrigerating appliances and washing machines. The new grading standards will take effect in November 2015
2015	Launched new energy saving for all campaign to encourage all sectors of the community to save energy and adopt a low carbon lifestyle to contribute to the sustainable development of Hong Kong		<ul style="list-style-type: none"> <li>Adopted new target for government buildings to reduce 5% electricity consumption between 2015-20 using 2013-14 as base<sup>14</sup></li> <li>Revised internal circular on Green Government Buildings to enhance the target-based green performance framework for new and existing government buildings</li> <li>Environment Bureau in collaboration with Development Bureau and Transport &amp; Housing Bureau published the first-of-its-kind Energy Saving Plan for Hong Kong's Built Environment 2015~2025+</li> </ul>	



14. Policy Address 2015, paragraph 176

## Summary of government policy

Hong Kong energy saving policy is to drive saving through a combination of educational, social, economic and regulatory means, especially for buildings and inhabitants to become highly energy efficient by 2025.

Government leadership and supporting the public to save energy are important priorities.

The 2013 Policy Address went a step further in supporting low-carbon reforms to include:

“For the well-being of future generations, the Government and the community must commit to improving the environment. ...We will set out clear


objectives and a roadmap to achieve cleaner air, better fuel mix, energy conservation, emission reduction...

These endeavours will turn Hong Kong into a healthy, low-carbon and resource-saving metropolis that is in harmony with nature.”

Working with transport sector stakeholders to save energy is also one of our goals.

## Lessons learnt in Hong Kong

Over the past two decades of efforts, we have learnt many valuable lessons from a variety of steps we have taken to promote energy saving in Hong Kong. The next few pages group our learning for easy reference.



**For the well-being of future generations, the Government and the community must commit to improving the environment. ...We will set out clear objectives and a roadmap to achieve cleaner air, better fuel mix, energy conservation, emission reduction. ...These endeavours will turn Hong Kong into a healthy, low-carbon and resource-saving metropolis that is in harmony with nature.**

The 2013 Policy Address



## Public education and social mobilisation

While it is widely accepted that saving energy helps to lower energy bills and lessen impact on the environment, further progress requires significant behaviour change from a large number of people.

### Schools

Needless to say, working with students is an investment in long-term behaviour change. EMSD runs educational programmes on an on-going basis that include school visits and roving exhibitions to introduce energy issues to students. In 2013-14, over 50 outreach talks were organised. EMSD's Headquarters at Kowloon Bay is popular for students as it hosts two exhibitions and a rooftop viewing



gallery with over 2,000 PV panels. In 2013-14, about 280 visits (~10,300 visitors) were conducted. EMSD also produced the Energy Efficiency Education Kit for Secondary Schools designed for Hong Kong's S4-5 Physics Curriculum and the S1-3 Integrated Science Curriculum. EMSD also launched a Liberal

Studies Education Kit for New Senior Secondary Curriculum that includes three booklets on energy efficiency, energy efficient building and RE.

### Public education

More generally for the public, EMSD initiated the Energy Efficiency Centre at the Hong Kong Science Museum with sponsorship from CLP and HEC; and its interactive Energy Label Net provides information on energy labelling and encourages people to select more energy efficient products.<sup>15</sup>

### Stakeholder groups

From our experience, awareness raising is more successful when efforts:

- Target specific groups with the capability to deliver significant results;
- Show what can be done through best practices; and
- Build capacity and capability among the targeted groups, including among energy services providers.

The HKGBC is one of the most significant stakeholders in promoting green building in Hong Kong. It is a non-profit, member-led organisation established in 2009 to promote the standards and developments of sustainable buildings by engaging the public, the industry and the government, and to develop practical solutions for Hong Kong's unique built environment. HKGBC plays a key role in guiding market transformation. In April 2010, HKGBC introduced BEAM Plus, a comprehensive assessment tool to certify green buildings in Hong Kong. In August 2013, they launched the BEAM Plus Interiors which widens the coverage of the BEAM Plus system to include fit-outs, renovations and refurbishment projects of non-domestic space.

We see stakeholders, such as property owners and managers, as key partners. A good example is adjusting air-conditioning to save energy. Since air-conditioning accounts for about 30% of the

## Greenest school on Earth 2013

Sing Yin Secondary School was recognised by the US Green Building Council as the "Greenest School on Earth 2013". The school was selected by the Government as a demonstration project to showcase the technical viability of various energy efficient technologies, including air-conditioning, lifts, lighting and solar power. The design target was to save 27.3% of the school's annual electricity consumption, which the school achieved. The school's electricity consumption is nearly 30% lower than the average electricity consumption of Hong Kong's secondary schools. The school also has green prefects and energy saving behaviour programmes.

15. See [www.energylabel.emsd.gov.hk](http://www.energylabel.emsd.gov.hk).

total electricity consumption in Hong Kong, moderating indoor temperature has been the focus of public education and social mobilisation campaigns. We worked with 35 developers and property management companies to maintain the average indoor temperature of common areas at over 145 shopping malls, 512 shops, 256 commercial premises, 962 offices, 152 housing estates and 80 residential buildings at 24-26°C from June to September 2014 under the Energy Saving Charter scheme.

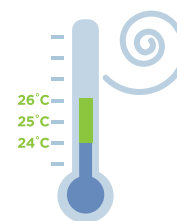
In a particularly successful example of a mall in Kowloon, the management of the mall put in place what may be considered best practices that could be adopted by others:

- Develop implementation plan to encourage active participation of shops and office tenants;
- Brief shops and office tenants at the planning stage and encourage them to participate in the Charter too;
- Roll out publicity by posters, pamphlets and stickers, as well as measure and monitor temperatures and make adjustments where necessary; and
- Review the results of individual tenants; commend achievements.<sup>16</sup>



## Challenge of maintaining indoor temperature

It is a repeated complaint in Hong Kong that indoor temperature of offices, malls, restaurants and cinemas is set too “low”. In other words, many people find it too cold.



According to studies by the American Society of Heating, Refrigerating and Air-conditioning Engineers (ASHRAE), under normal circumstances, more than 90% of people would consider a room temperature of 22.5°C to 25.5°C comfortable. To maximise energy saving without significant reduction in comfort level, we recommend that a room temperature at around 25.5°C should be maintained during summer months. This is in fact a design criterion for air-conditioning systems in summer months for most government buildings. A similar practice has been adopted in the Mainland (26°C), Japan (26°C) and the US (78°F, which is about 25.5°C).

In Hong Kong, we are encouraging people in commercial premises to set their air-conditioning at 24-26°C. The Government promulgates 25.5°C in public facilities in summer and helps facility managers to make adjustments bearing in mind energy saving and acceptance of occupants. Some venues have their temperatures set lower due to special operational need, such as museums, where the range is at 22.5-25.5°C.

As for the No Incandescent Light Bulbs Charter, retail signatories pledged not to replenish their stocks of these energy inefficient light bulbs from 31 December 2013. While this is a voluntary charter, it will help to phase out these bulbs over a few years in the local market, whereas a mandatory scheme would require substantial time for laws to be drafted and legislated.

### Service providers

We expect the energy services market to grow in Hong Kong. EMSD works with relevant service providers to help them better understand energy saving methods, such as organising annual gatherings since 2011 on the control of fresh water

cooling towers in buildings. Since 2012, EMSD has held over 80 presentations to explain the BEEO to various trade bodies. It has also produced various publications to promote energy saving among professionals, including EnergyWits, which reports progress of energy saving and environmental initiatives.

### Recognition / Award

Good efforts need to be recognised. In 2004, EMSD first launched the Hong Kong Energy Efficiency Awards to encourage the private sector to save energy. In 2008, this was merged with other government-initiated environmental schemes into the popular HKAEE led by the Environmental Campaign Committee.

16. For more information, see [http://www.energyland.emsd.gov.hk/indoortemperature/filemanager/doc/experience\\_sharing\\_great\\_eagle.pdf](http://www.energyland.emsd.gov.hk/indoortemperature/filemanager/doc/experience_sharing_great_eagle.pdf)

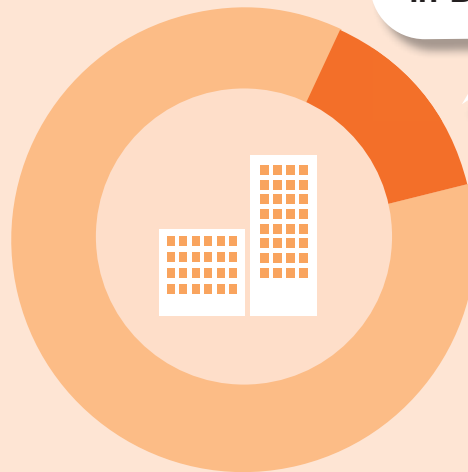


## \$ Financial support/incentive to trigger action

Providing public funds in the right places can help to trigger community adoption of improved energy practices. Retrofitting older existing buildings is a major challenge since owners often do not perceive the expenditure to save energy as a priority. In 2009, the Government provided \$450 million through the Environment and Conservation Fund (ECF) to promote building energy efficiency by subsidising building owners to conduct energy-cum-carbon audits and carry out energy efficiency projects. Applications for BEEFS closed in April 2012 although some projects are still being completed.

Over 6,400 buildings (or about 1/7th of all buildings in Hong Kong) participated in BEEFS, which covered various building services installations. This is a significant effort to engage a large number of building owners. Our observations of the scheme are:

**6,400**  
buildings  
(about 1/7)  
participated  
in BEEFS



## Promotion of energy saving by power companies

The two power companies are also key stakeholder partners for us in promoting energy saving. They are in direct contact with electricity users in Hong Kong, which is why they can be very effective educators and promoters of energy saving.

CLP has an annual \$5 million education fund to support a variety of activities, such as public education and school programmes, seminars, tailor-made energy saving solutions for NGOs and SMEs, and disseminating education materials through their websites, Customer Service Centres, Business Centres, Eco Home and account managers. CLP has also organised the Save Now for a Better Future competition to encourage residential customers to save energy. In 2013, it achieved a total reduction of energy consumption by 2 million kWh with the contribution of over 50,000 customers. CLP's GREEN PLUS Recognition Award acknowledges non-residential customers' contributions to environmental protection and energy saving practices. In April 2015, CLP further launched a territory-wide "CLP Power Your Love Programme" to promote energy saving and community caring by encouraging their

customers to save energy. CLP will subsidise the electricity cost of people in need for each kWh of electricity saved by its customers or for every dollar donated by the general public.

HEC promotes energy saving through its annual Smart Power Campaign. So far, more than 230,000 students and members of the public have participated. Its Smart Power Centre, set up in April 2011, gives advice on the choice of electrical equipment or appliances and general knowledge on the safe and smart use of electricity. Talks have also been organised to promote energy saving at housing estates and elderly centres. HEC launched the "Happy Green Schools" Label Programme to provide school students with innovative learning experiences, such as through the production of videos. HEC has also developed the Low Carbon App to help customers estimate electricity consumption, learn more about carbon footprint, and recommend energy saving plans and tips.



- **Learning is cumulative**

The early applicants went for lighting and air-conditioning retrofits, which had short payback periods, but applicants towards the end of the programme applied for more complex centralised air-conditioning plants and lifts retrofits. Building owners became more willing to explore bigger investment with longer payback periods once the costs and benefits were clear.

- **Savings must be discernable**

As at May 2014, there were 1,115 energy efficiency projects approved under BEEFS and the total estimated energy saving is about 648 TJ or 180 million kWh per annum. About 2/3 of projects are for lighting and air-conditioning retrofits with short payback periods. Upon completion of the projects, the applicants are required to report their before-and-after achievements so that annual energy saving can be estimated.

- **Good potentials exist for further action**

BEEFS raised property owners' awareness of the benefits of energy saving for buildings and mobilised them to take action. It has also encouraged cross-sector cooperation between the property management sector and energy services providers. A good foundation has been laid in Hong Kong for further efforts.

### **Green and innovative buildings in the private sector**

BD, Lands D and Plan D issued JPN No.1 on Green and Innovative Buildings. A package of measures is implemented to foster a quality and sustainable built environment, including promulgation of the Sustainable Building Design Guidelines, tightening GFA concessions with pre-requisites such as project registration for BEAM Plus, including the issuance of revised JPNs No. 1 and 2 and PNAPs APP-151 and 152.





## Government leadership and targets setting

As one of the major electricity consumers in Hong Kong, the Government must take the lead to promote and build professional expertise on energy saving.

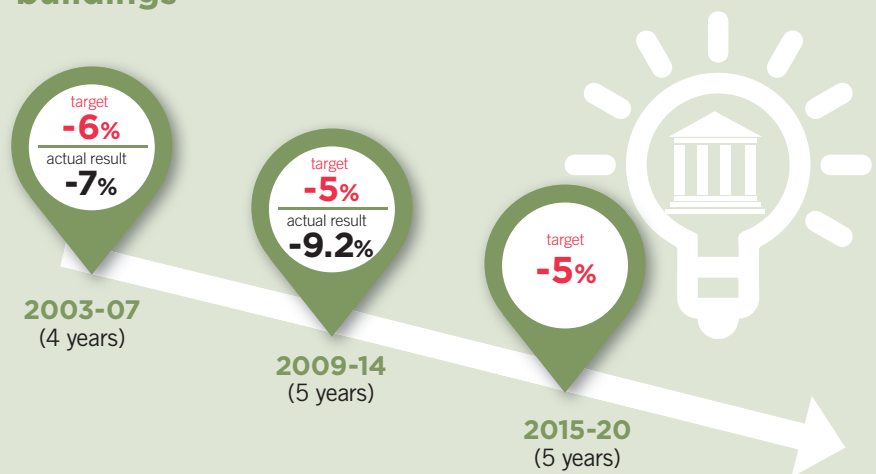
EEO of EMSD set up in 1994 created an expert unit within the Government to focus on achieving energy efficiency. It is responsible for the development, promotion and implementation of energy saving; and provides professional support internally within the Government. The EEO administers EELPO and BEE0. It also develops codes of practice and technical guidelines, implements energy saving programmes, updates the energy end-use database, as well as promotes public awareness, mobilises stakeholders and deals with energy saving measures, equipment and systems, and the use of RE.

Following the creation of the Green Manager Scheme within government departments in 1993, all departments have to publish annual environmental performance reports on their policies and actions, including on energy saving since 2007.<sup>17</sup> We believe there is potential to refresh the scheme so as to deepen knowledge and stimulate greater action.

Hong Kong adopted three electricity reduction targets relating to government buildings and two targets relating to energy intensity across the territory:

- 2003 and 2009 set targets for government buildings – to reduce 6% and 5% energy consumption under comparable operating conditions during two periods (4 years from 2003-04 to 2006-07 and 5 years from 2009-10 to 2013-14) using 2002-03 and 2007-08 as the respective base years
- 2015 adopted a new target of 5% electricity reduction for government buildings for 2015-20 (base 2013-14)
- 2007 and 2011 adopted APEC's Energy Intensity Target – to reduce energy intensity respectively by at least 25% by 2030 (base 2005) and 45% by 2035 (base 2005)
- Apart from target-setting, the Government has since 2009 laid down a target-based green performance framework for government buildings. It provides for specific guidelines on energy efficiency standards, greenhouse gas reduction, use of RE, waste reduction and management, water management and indoor air quality. The Government has revised the framework with a view to further enhancing the environmental performance of government buildings.

### Reduction targets and actual reduction on electricity consumption for government buildings



17. Bureaux and departments have published environmental report since 2007, [http://etwb.host.cco.gov.hk/sarg/controlling\\_officers\\_environmental\\_report.pdf](http://etwb.host.cco.gov.hk/sarg/controlling_officers_environmental_report.pdf)

## Other measures ... where government also took the lead

In order to strengthen an energy saving culture and to spread expertise, the Government must continue to take the lead where appropriate. We will continue to work with stakeholders and the public to expand local expertise in energy-saving services alongside growing demand for them. There is also a need to work with the academic, vocational and professional sectors to build local capacities and capabilities to provide a whole range of such services from energy data collection and analysis to basic electrical and mechanical services to innovations.

- **ZCB**

Hong Kong's first zero carbon building was developed by the Construction Industry Council (CIC) in collaboration with the Government in order to raise community awareness of sustainable living. It showcases state-of-the-art green design and technologies in the construction industry both internationally and locally. It is 45% more energy efficient than current standard buildings. The ZCB is designed to use renewable energy (RE) sources, including biodiesel for tri-generation and solar panels to achieve energy neutrality for its operations. It is designed to achieve carbon neutrality of its operating energy consumption



Zero Carbon Building



Waste-to-energy Plant

and embodied energy of its construction process and major structural materials.

- **Sludge Treatment Facilities**

Hong Kong's new Sludge Treatment Facilities are a waste-to-energy plant scheduled for commissioning in 2015. The facilities have a design capacity of 2,000 tonnes per day to treat sludge from sewage treatment, making it the biggest of its kind ever built. The facility is equipped with boiler furnaces that produce steam, which drives turbines capable of generating more than enough energy to cover the plant's needs. Surplus electricity will be exported to the power grid for external use.

- **Drainage Services Department (DSD) and WSD**

Many government departments are energy innovators. DSD and WSD are particularly noteworthy.

For example, since 2013, DSD has also been making full use of all the biogas generated from its sewage treatment works, and has recorded an increasing trend in the electricity generated in five consecutive years. The amount of electricity generated from biogas in 2012-13 amounted to about 30 million kWh.

The first generator of WSD's hydropower plant at the Tuen Mun Water Treatment Works was opened in 2013 and a second one will be commissioned in 2015. The whole project is expected to generate about 3 million kWh of electricity a year, allowing plant to save about 10% of the electricity bill, while reducing almost 2,000 tonnes of carbon dioxide emissions previously generated as a result of burning fossil fuels.

The first district cooling system in Hong Kong at Kai Tak Development



- **DCS**

As air-conditioning accounts for about 30% of Hong Kong's electricity consumption, the more efficient use of air-conditioning systems can save energy. The Government is building Hong Kong's first DCS at the Kai Tak Development site. A DCS is a large scale centralised air-conditioning system. It produces chilled water at the central chiller plants and distributes the chilled water through a closed loop of underground pipes to air-conditioned buildings within the service area of about 1.73 million square metres of floor space. This system can save up to 35% of the electricity used in a conventional air-cooled air-conditioning system, and is expected to achieve a maximum annual saving in electricity consumption of 85 million kWh, with a corresponding reduction of about 60,000 tonnes of carbon dioxide emissions per year.

- **Guidelines on RTTV**

In September 2014, we took another step forward in promulgating a new RTTV standard for residential buildings. Compliance will be a pre-requisite for the granting of GFA concessions, where the new RTTV standard is applicable to all new residential buildings with first General Building Plan submitted on or after 1 April 2015.

- **New arrangement under Scheme of Control Agreements**

We provide financial incentives for energy audits and saving energy in the Scheme of Control Agreements. The annual energy audit targets for CLP are 150 cases or more and for HEC 50 cases or more. The annual energy saving target for CLP is at least 12GWh and for HEC is at least 3GWh.

In the Mid-term Review of the agreements in 2013, the two power companies agreed to each set up an Energy Efficiency Fund in 2014 out

of shareholders' earnings to provide subsidies (subject to a ceiling) on a matching basis to non-commercial building owners to carry out improvement works to enhance energy efficiency of their buildings, with priority to be given to single residential blocks. Specifically, the two power companies have agreed to pay into their respective funds an amount equal to the financial incentive payments that they will receive under the energy efficiency incentive mechanism for outperforming the energy audits and energy saving targets from 2014 until 2018 when the current agreements expire. As a part of this effort, CLP and HEC launched the Eco Building Fund and Smart Power Fund respectively in June 2014 to enhance the energy efficiency of non-commercial buildings in Hong Kong. It is estimated that about \$100 million would be injected into the two funds to support energy improvement projects.

In addition, the two companies also extended the current interest-free loan fund (\$25 m per annum for CLP and \$12.5m per annum for HEC) for a further 5 years from 2014 to implement energy saving initiatives identified in the energy audits conducted by them.

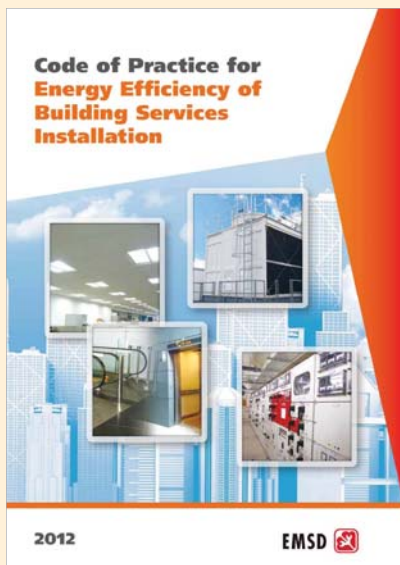


## Legislating on specific requirements

Hong Kong has the regulatory structure in place from which we can consider greater action.

### • B(EE)R

An important first step was taken in 1991 to study how Hong Kong should create a set of energy standards for buildings. Following the enactment of the B(EE)R in 1995, the first code on energy standards was promulgated in the same year to require the external walls and roofs of commercial buildings and hotels to be designed and constructed with a suitable



OTTV to control the amount of heat transferred through the building envelope so as to save electricity consumption in air-conditioning. The OTTV standard was last tightened in April 2011.

### • BEEO

The BEEO has 3 key requirements:

- (i) Developers or building owners of new buildings should ensure that air-conditioning, lighting, electrical as well as lift/escalator installations comply with the design standards of the BEC;
- (ii) Owners or occupiers of existing buildings should ensure those same installations comply with the BEC when major retrofitting works are carried out; and
- (iii) Owners of commercial buildings should carry out energy audits for those same installations in accordance with the Energy Audit Code (EAC) every 10 years.

The BEC and EAC are reviewed every 3 years by making reference to the latest



technological development, international standards and public aspirations. The review of the current 2012 edition of BEC and EAC has commenced and will be completed in 2015, after which further improvements could be considered.

Besides, the BEEO has stimulated growth and jobs in the energy sector of our economy. For example, as building owners have to comply with a range of energy-related activities, and the BEEO opens up a new role of Registered Energy Assessor (REA) who issues certification for building services installations in compliance with the BEC and conducts energy audit according to the EAC.

## The Residential Properties (First-hand Sales)

Ordinance took effect in April 2013. Under the Ordinance, if GFA concession has been granted to a development, the sales brochure for the development must set out the environmental assessment of the building and information on estimated energy performance or consumption for the common parts of the development.

## Energy Efficiency Codes for Buildings

In 1998, EMSD launched five energy-related codes, representing good practices, to deal with installations for air-conditioning, lighting, electrical, and lifts and escalators systems, which together deal with 80% of electricity consumption in a typical building. The five codes were initially promoted for voluntary compliance, coupled with the Hong Kong Energy Efficiency Registration Scheme for Buildings so that a certificate and logo could be displayed for registered buildings that complied with the codes. In a 10-year period, about 2,500 certificates covering about 2,700 installations in

some 1,000 buildings were issued, and about 70% of the buildings were government premises. As the market became better prepared for compliance with the codes, a decision was made to adopt mandatory compliance, which gave birth to the BEEO.

The energy-related codes have since been reviewed, updated, expanded and combined to a single Code of Practice for Building Energy Efficiency of Building Services Installation, which became the BEC in 2012. An EAC was also published in 2012.

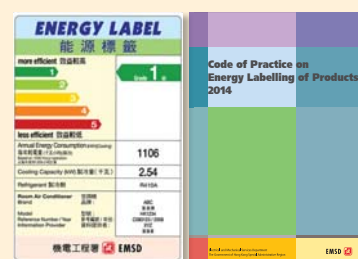
### • EELPO

The EELPO was enacted to launch the MEELS. MEELS Phase I and Phase II have been fully implemented in 2009 and 2011 covering air-conditioners, refrigerators, compact fluorescent lamps, washing machines and dehumidifiers. These five types of appliances account for about 60% of the annual electricity consumption in the residential sector.<sup>18</sup>

Room air conditioners, refrigerating appliances and washing machines together account for approximately half of the domestic electricity consumption in Hong Kong. In light of technology development, the grading standards of the three products have been raised through revision of the Code of Practice on Energy Labelling of Products (CoP). The revised CoP will take full effect in November 2015.

Under the new grading standards, products are required to be more energy efficient in order to obtain Grade 1 energy label. It is estimated that raising the grading standards will bring about an annual energy saving of about 300 million kWh, equivalent to an annual saving of about \$300 million in electricity bill and in environmental terms, an annual reduction of carbon dioxide emission of about 210,000 tonnes.

Over 40 jurisdictions have similar mandatory labelling legislation as MEELS for appliances, the purpose of which is to promote energy saving by informing customers of the energy efficiency performance of the products and encourage product suppliers to make available more energy-efficient products. Going forward, more appliance types would



be added and the energy performance standards would also be re-graded. Re-grading depends primarily on technology development. Due regard needs to be given to other factors, such as grading systems adopted overseas, development of relevant testing standards and public aspirations. While there is no fixed period for the re-grading of energy performance standards as the technological developments vary among different types of appliances, the EEO keeps a close watch on technology development and would propose re-grading when appropriate.

18. More information on energy labels are available at <http://www.energylabel.emsd.gov.hk/en/label/labelflash.html>

### 3 ENERGY WISE GREEN BUILDINGS

For Hong Kong’s buildings to be much more energy efficient, the challenge is how to achieve integrated actions from across the building sector – from policy-makers to property developers to building designers, building managers and other built environment professionals – and also building inhabitants, whether they are owners, tenants or users. A widespread criticism is that advances have been piecemeal and slow even though the knowledge is available. This is not just a challenge for Hong Kong but for other jurisdictions too. To speed up, however, it requires everyone’s willingness to act in a coordinated way.

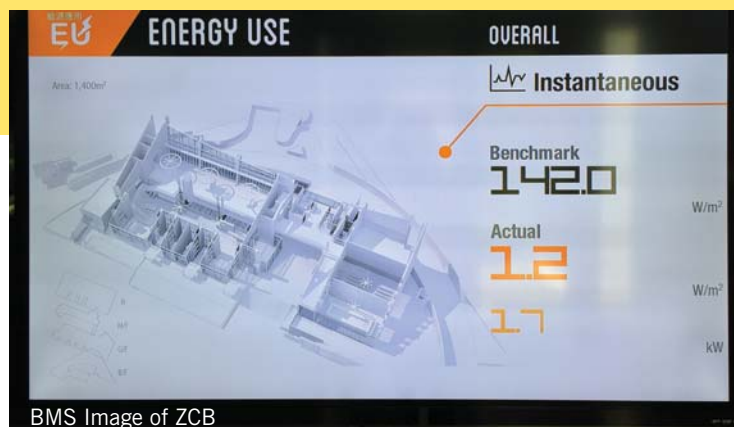
Buildings for commercial, institutional and residential use in Hong Kong offer many opportunities in energy saving although they have very different consumption patterns and intensities. With respect to the commercial sector, office, retail and catering are the core sub-sectors to work with. In Hong Kong, the public sector is a leader in green building in light of the longstanding policy for the Government to play a leadership role in energy saving. The design, construction and management of institutional buildings, public facilities and public housing are among the most energy efficient in Hong Kong. We would like to see the same commitment in the private sector.

#### Buildings coming ‘alive’

With technological advancement, a paradigm shift has taken place in how buildings could and should function. This evolution takes buildings beyond merely providing safety and comfort to being a critical part of the solution to achieving low-carbon, sustainable development.

Buildings can be ‘wise’ because human inhabitants bring physical and technological changes to them. For instance, building design coupled with information technology infrastructure enables a building or parts of a building

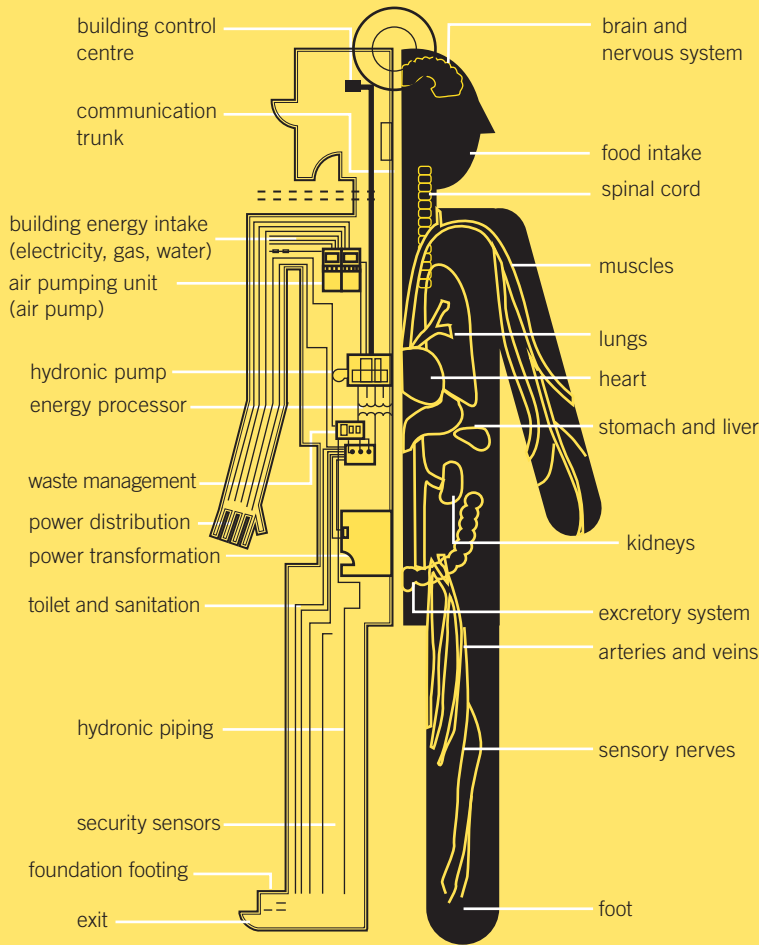
to respond to change according to the needs of the inhabitants, such as automatically turning lights off when there is no one using a part of the space equipped with sensors.



BMS Image of ZCB



**Figure 17 Building system integration**<sup>19</sup>



Today's technology offers building owners and managers the ability to manage their energy consumption through centralised and customised building management systems. Major government and commercial buildings in Hong Kong have these built in; and inhabitants of numerous buildings can also use technology to help them manage their energy consumption. These systems can also provide energy

records for audits and review so that energy saving becomes a continuous process.

In response to the Government's energy efficiency drive, the power companies have worked with their major commercial and industrial customers to save electricity. Old meters are being replaced with new ones to help customers optimise their energy use. Meters send regular 'snapshot' consumption

information to the users' computer network so that businesses can make better energy saving decisions. Schemes have also been launched for smaller commercial users, as well as a selection of households to drive energy saving through empowering users with energy information.

We expect energy saving practices to become increasingly widespread. The Chinese University of Hong Kong provides one of the most innovative recent examples. To educate students about energy saving, the University's Lee Woo Sing College has installed 'smart' meters in their student hostels. The smart meter system captures the electricity usage of air-conditioning, lighting and electric sockets per bedroom. Students can observe their own electricity consumption habit so that they may moderate usage, as well as save money on bills.



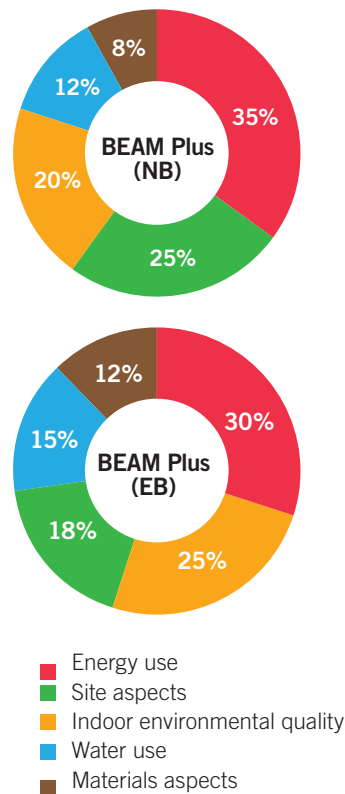
19. Idea drawn from Ahuja, A., Integrated M/E Design: Building Systems Engineering, Chapter & Hall, New York (1997).

## Energy performance and ‘green building’

‘Green building’ has emerged as a market transformer affecting the built environmental sector globally. The mechanism is in place for this transformation to take root on a wider and deeper level in Hong Kong and our goal is to see how to make this happen in the coming years. ‘Green building’ is the practice of creating structures and processes that are more environmentally responsible and resource-efficient throughout a building’s life-cycle.

As to how to assess the environmental performance of buildings, there are various green building assessment methods from around the world. The prevalent method used in Hong Kong is BEAM Plus,<sup>20</sup> which covers assessment for new and existing buildings, and the weighting for energy use is the most important assessment. In other words, a building cannot be considered ‘green’ if it is not sufficiently energy efficient. So far, about 900 building projects have been registered or certified in Hong Kong, most of which used the BEAM Plus or its former system.<sup>21</sup>

**Figure 18** BEAM Plus weighting for new (NB) and existing buildings (EB) (Version 1.2)



This document focuses on energy although green building includes other important attributes.

## Coordinated approach

There are many government bureau and departments with responsibilities related to buildings. Moreover, the Government manages about 8,000 buildings and facilities and is one of the largest building managers in Hong Kong. The challenge to coordinating the policy-making and implementation efforts within the Government towards achieving higher performance buildings cannot be underestimated.

20. The BEAM Plus related method was first established in Hong Kong in 1996 and upgraded over time with the last time being in 2012. “BEAM” stands for “Building Environmental Assessment Method”.

21. As of March 2015, more than 630 building projects have been registered or certified with BEAM Plus and about 280 building projects with BEAM 4/04 or 5/05. In addition, some projects have adopted non-local systems such as the Leadership in Energy & Environmental Design (LEED) building certification system.

## BEAM Plus rating

BEAM Plus has FOUR grades – Platinum, Gold, Silver and Bronze. The HKGBC, an independent, professional body, is the conferring body. To give the private sector a bigger push to pursue green building, BEAM Plus assessment is one of the pre-requisites for the granting of GFA concessions in development projects since 1 April 2011. As of June 2014, 195 new building proposals approved by BD had registered for BEAM Plus assessment. The Government will review the current arrangement after a reasonable number of projects have been completed.

The BEAM Plus assessment scheme includes SIX aspects of a building project, and the HKGBC updates the assessment criteria from time to time in

accordance with local and international best practices:

- Site aspects
- Energy use
- Water use
- Materials aspects
- Indoor environmental quality
- Innovations and additions

BEAM Plus also developed a new assessment tool for interiors in 2013, called BEAM Plus Interiors. This provides a localised benchmark for interiors fit-out, renovation and refurbishment works to help owners, tenants and interior designers. The assessment takes place when the work is completed. Evaluation criteria include whether the building in which the premises is located is rated, the building management, energy use and other attributes

similar to those noted above. BEAM Plus Interiors is applicable to office and retail premises, hotel rooms and function rooms, restaurants, educational facilities and institutional facilities such as hospitals.

Yet another forthcoming assessment tool is BEAM Plus Neighbourhood, which will be especially useful at the inception and planning stages of a project. This tool can take into account the spaces beyond a particular building or project site to bring development components together (such as shared facilities) and put them in a broader site-wide context. There may well be opportunities to develop energy networks that could be managed and operated among buildings.

**Figure 19** BEAM Plus NB and EB Assessment Scope



**Figure 20** BEAM Plus NB and EB Grading (Version 1.2)

	Overall	Site	Energy	IEQ	IA (credit)
<b>Platinum</b>	75%	70%	70%	70%	3
<b>Gold</b>	65%	60%	60%	60%	2
<b>Silver</b>	55%	50%	50%	50%	1
<b>Bronze</b>	40%	40%	40%	40%	–

Remarks: Projects that have met all the pre-requisites in the BEAM Plus rating tool, but have not reached the threshold scores for the lowest Bronze grade, are termed “Unclassified”.

## Solar energy, biodiesel and green buildings

Solar and biofuels are being used in buildings. The BEAM Plus assessment criteria encourage innovations and additions, which include distributed RE installations, as well as the use of biodiesel as an energy source.



### Solar water heating and photovoltaic (PV)

Solar water heating is suitable for site specific uses, such as at hotels, hospitals, sports facilities, where a centralised water heating and storage system is practical. The Government's policy is to deploy solar water heating systems where appropriate. In overall terms, the energy contribution from solar water heating would however not be significant due to Hong Kong's high-rise context. PV can be installed on buildings and public facilities to produce electricity.

The Government has been supporting RE development for public projects as a part of its effort to play a leadership role when RE development is

relatively more expensive. Since 2005, government departments are required to consider the adoption of RE technologies in all new government buildings and major retrofitting projects in existing buildings. A further effort was made in April 2009 to require all new schools and educational buildings without air-conditioning to have at least 0.5% of their electricity consumption to be provided by RE, where technically feasible, and the Government provided funds to help. EMSD has also published a number of guidance notes to provide public information on the applications of RE technologies, such as the Guidance Notes for Household-scale Solar Water Heating System at Village House.

There are many PV installations throughout Hong Kong. These include the ZCB, EMSD's Headquarters, Science Park, Tamar Government Offices, Cruise Terminal, hospitals, correctional facilities, museums, fire stations, police facilities, sports centres, universities and public housing. A large number of schools have installed PV systems on-site.<sup>22</sup>

We are doing more still for government projects with tenders to be issued after 1 October 2015<sup>23</sup>:



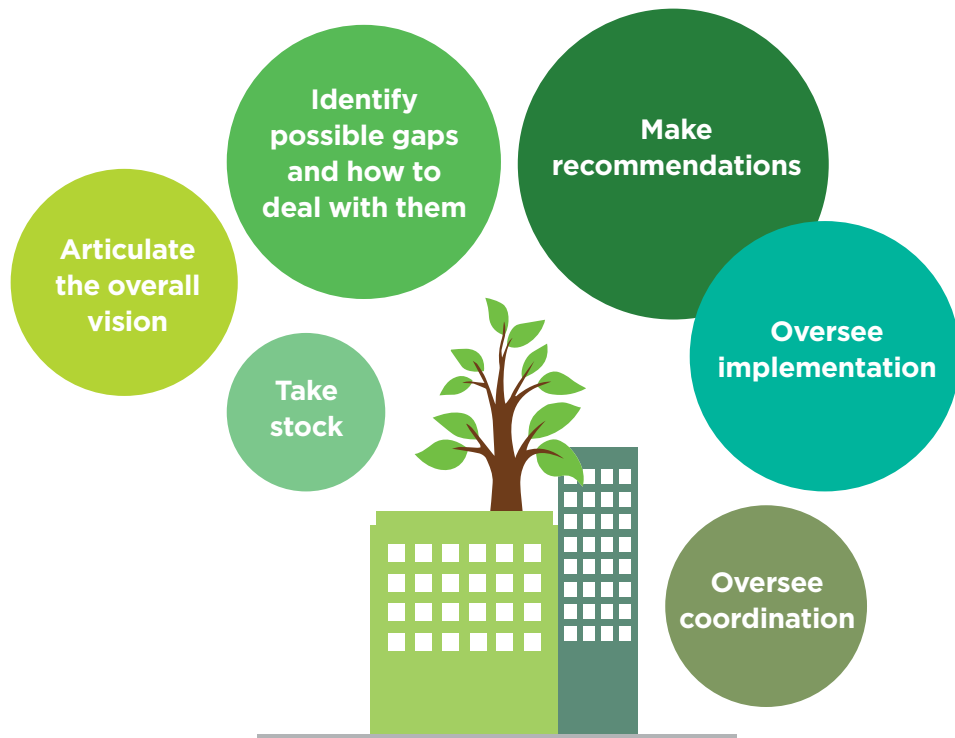
- All new schools and educational buildings irrespective whether air-conditioning is provided or not, should aim to have at least 1% of electricity consumption for their general power and lighting be provided by renewable energy as far as reasonably practicable;
- All new open space and public park products should aim to either have at least 15% of general public lighting or 1% of electricity consumption be provided by RE; and
- All other government buildings should incorporate RE technologies as far as reasonably practicable.

### Biodiesel and green buildings

The ZCB generates about 70% of its on-site energy from a tri-generation system (cooling, dehumidification and power) that runs on locally-produced used cooking oil. There are now examples of biodiesel being used for tri-generation for larger buildings, such as at a 10-storey office building in London.

22. Government and non-government examples are available at [http://re.emsd.gov.hk/english/solar/solar\\_ph/solar\\_ep.html](http://re.emsd.gov.hk/english/solar/solar_ph/solar_ep.html).

23. The revised internal circular on Green Government Buildings took effect in April 2015 to enhance the target-based green performance framework for new and existing government buildings.

**Figure 21** Role of Steering Committee on the Promotion of Green Building

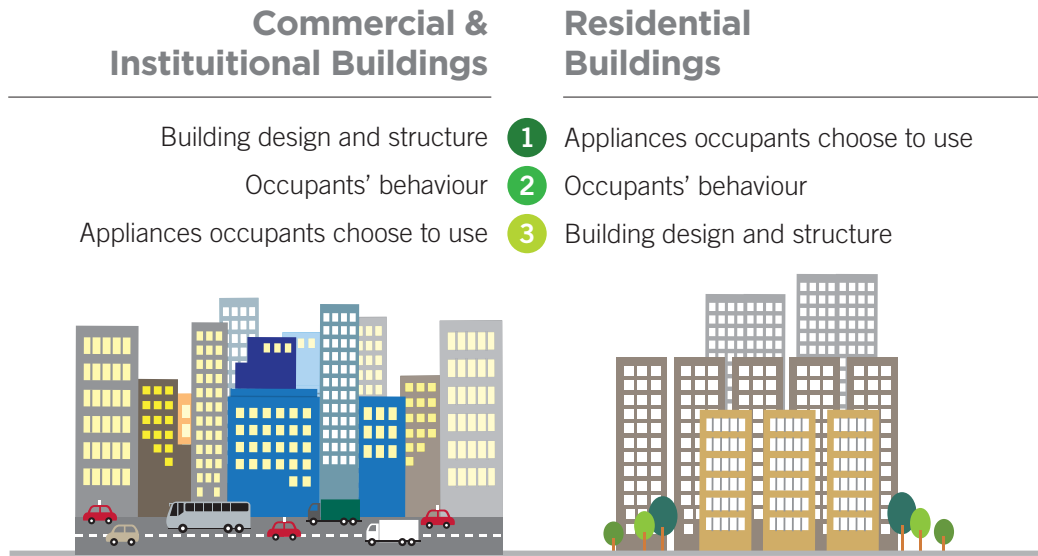
In recognition of this, an internal high-level Steering Committee on the Promotion of Green Building led by the Secretary for the Environment was formed in 2013.

The Steering Committee has considered the required strength-of-action that could bring about substantial energy saving gains in buildings. Figure 22 shows in the simplest possible form its assessment for commercial and institutional buildings versus residential buildings. The conclusion is that building design

dictates the future energy performance of a building to a very large extent although total energy consumption is also highly affected by the behaviour of the inhabitants. Thus, we must focus on both aspects.

This means capturing the energy saving potentials in new buildings is critical but managing consumption of existing buildings and enabling inhabitants to wisely choose and operate their appliances and moderate their energy usage are equally important.

**Figure 22** Relative energy saving priorities for different types of buildings



**Promoting energy saving buildings – going forward**

The Government’s view is that Hong Kong has laid a good foundation on achieving better energy saving in buildings. Chapter 2 provides a chronology and assessment of past actions in public education and social mobilisation, government leadership and collaboration with built environment professionals, incentivising action in the private sector, and laying down the necessary legislation.<sup>24</sup>

The next step is to define a roadmap and timetable to achieve higher energy saving gains in green building developments and to do it in a more coordinated way with the wide participation of the private sector. In embarking on this next step,

stakeholders need to define an agreed plan with two broad goals in mind – firstly, triggering private sector action with respect to private sector buildings; and secondly, triggering a local energy efficiency market that would also strengthen Hong Kong’s environmental industry related to buildings. The plan should take into account a timetable for change between 2015 and 2025, and then towards 2025 and 2035.

Several expert and professional bodies have provided the Government with specific ideas on how to achieve an energy saving and green building transformation, such as the HKGBC, whom we regard as a key stakeholder and close partner. We generally agree with their broad direction, as well as the areas where improvements may be made.

24. According to a study conducted by McGraw Hill Construction, World Green Building Trends SmartMarket Report, published in 2013, there are four drivers for green building developments – regulation (laws such as BEEO and EELPO); environment (government leadership, and assessment tools such as BEAM Plus); economic (such as providing GFA concessions and BEEFS); and social (public education, reporting, transparency, professional training etc). The chronology in Chapter 2 shows Hong Kong’s efforts cover all these areas.

In summary, the HKGBC sees the transformation taking place in two stages: firstly, to establish a system for reporting on energy-related information through reporting, benchmarking and assessment of buildings in the next decade; and secondly, to retro-commission and retrofit existing buildings to improve their performance, where the majority of the energy saving would occur.<sup>25</sup> We also agree with them that the first stage requires only modest investment; although we wish to point out that it requires considerable attention from both the Government and private sector with everyone being a willing player; and that the second stage will involve significant investment from the private sector because the bulk of the reduction will

come from existing buildings, especially commercial buildings, which is why it is necessary to work on an agreed plan with the major building owners and stakeholders.

It is the Government's responsibility to consider the many details involved; and the practicalities and cost of implementation cannot be brushed aside. This document can address only the general direction of the potential transformation in energy saving. To go forward, we will need to deliberate on the many technical details with stakeholders and experts. All those who wish to see a green building transformation in Hong Kong should help to build community and political support for it.

## Retro-commissioning and retrofitting of buildings

Most of the existing buildings were designed and built at a time when energy saving was not a foremost consideration. Nevertheless, many of the commercial and institutional buildings built in the past two decades were designed to meet various standards and had equipment built-in. When they were first built, there should have been a commissioning process to test performance. Retro-commissioning is a cost-

effective systematic process to periodically check an existing building's performance. The process identifies operational improvements that can save energy and thus lower energy bills. The process can be performed alone or with a retrofit project, such as replacing less energy efficient appliances with more efficient ones (e.g. chillers, pumps, elevators, lights etc) and fitting meters to measure operations.

Global experience shows that even buildings that are just a few years old can benefit from retro-commissioning because it can still help to identify unnecessary energy losses, such as leakage in the building envelope, where energy management systems need to be reprogrammed, controls that are out of calibration or fault in equipment.

25. Details can be found from HKGBC's "HK3030 – A Vision for A Low Carbon Sustainable Built Environment in Hong Kong by 2030, December 2012, and Market Drivers for Transformation of Green Buildings in Hong Kong – A Roadmap to Deep Energy Reductions, October 2014. Each piece of equipment consuming 50 kW or more will be monitored, as well as each floor or major area with sub-main distribution exceeding 100A (3-phase 380V) current capacity.

## Opportunities for New Buildings

It is clear that we must do more to capture the opportunities presented by new buildings to make them more energy efficient.

### 1. Building envelope

The OTTV standard is an effective way to reduce energy demand because it helps to reduce heat transfer through building envelopes hence saving energy consumption for air-conditioning. The standard when it was first introduced in 1995 covers commercial buildings and hotels, and the standard was last tightened by 20% in April 2011. The Government also applies this standard and has sought to exceed it for its new buildings. The OTTV standard was extended to residents' club-houses in residential developments in April 2015. Compliance will be a pre-requisite for the granting of GFA concessions.

In 2014, we took another step forward in promulgating a new RTTV standard for residential buildings, which took effect in April 2015. Compliance will be a pre-requisite for GFA concessions, where the new RTTV standard will apply to all new residential buildings with first General Building Plan submitted on or after 1 April 2015.

In addition, we will outperform the B(EE)R by at least 10% for all new office-type government buildings with CFA of >5,000 m<sup>2</sup> for projects with tenders to be issued after 1 October 2015.

### 2. BEC review

As for tightening the requirements of the BEC under the BEEO, it will be reviewed at 3-yearly intervals as a matter of policy with the first review to start in 2015 by making reference to the latest technological development, international standards and public aspirations. The code for lighting power density had already been reviewed and the new standard was gazetted in February 2014. This new standard represents a 10-15% improvement over the 2012 standards. Going forward:

- Through reviewing the BEC every three years between 2015 and 2025 (i.e. there will be potentially four reviews during the next 10 years) and beyond, we will optimise opportunities to tighten standards.

### 3. Government leadership

The Government has used its own buildings to lead the way in energy efficiency. Since 2009, the Government stipulates that all new government buildings with CFA of >10,000 m<sup>2</sup>, should aim to outperform the BEC by certain specified percentages, as well as achieve at least BEAM Plus Gold rating.

Going forward, we have put in place new energy saving requirements for new buildings and facilities with tenders to be issued after 1 October 2015:



- Outperform the BEC where the CFA is >5,000 m<sup>2</sup> by:
  - Office, recreational and community >10%
  - Cultural schools, educational hospital and health facilities >5%
  - All others >3%
- Outperform the BEC where the CFA is <5,000 m<sup>2</sup> by at least 3%;
- Incorporate other energy efficiency features where appropriate (e.g. air-conditioners, lights, lifts/escalators, motors, building energy management systems etc.);
- Install energy consumption monitoring systems;<sup>26</sup> and
- Audit and re-commission after 5 years in use.

In the residential sector, in light of the fact that the Government is a major developer of affordable housing through the HKHA, we will continue to lead here too, as will the other public sector development agencies, the HKHS and URA.

### **Opportunities for Existing Buildings**

The bulk of Hong Kong's 42,000 building stock is made up of existing buildings with a large number of them built before 1995 when the B(EE)R came into force for OTTV, and bearing in mind that the BEEO only came into

force in full in 2012.<sup>27</sup> In other words, existing buildings are constrained by their building designs and they may not be able to achieve similar energy performance compared to new buildings. However, there are still many opportunities to save energy.

#### **1. Government to show best practice**

Our aim is to achieve an energy performance for existing government buildings in line with the requirement for new government buildings (as noted above) whenever there are major renovation works for building service installations. We believe the steps the Government takes represent best practice and the private sector could consider making similar efforts too.

In order to achieve good results, the following cycle of steps should be taken and this is the way we would move towards:

- Set building energy reduction target;
- Give specific energy saving responsibility to a senior level official;
- Audit and benchmark;
- Re-commission to ensure buildings perform to their design standards; and
- Retrofit energy-related systems to reduce energy consumption.

26. Each piece of equipment consuming 50 kW or more will be monitored, as well as each floor or major area with sub-main distribution exceeding 100A (3-phase 380V) current capacity.

27. A large number of buildings were built before 1995. For example, as of January 2013, 75.8% of commercial buildings (2,143 buildings) and 90% of composite buildings (11,030 buildings) received occupation permits before 1995.

## Public housing and green building

There are currently over 200 public housing estates/courts with about 30% of Hong Kong’s population living in public rental flats and another 17% in subsidised sale flats. The Government’s plan is to build 200,000 public rental housing units and 90,000 subsidised sale flats between 2015-16 and 2024-25<sup>28</sup>.

The HKHA is the developer of public housing, and a major developer in Hong Kong. While it specialises in affordable housing, it is an innovator in green development. HKHA has been incorporating green concepts into its projects for many years. It adopts a policy to get its new projects ‘BEAM Plus Gold Ready’

so that all new public housing production from 2015-16 would target to achieve the performance equivalent to at least BEAM Plus Gold. This represents a tremendous public sector commitment in adopting green building. There

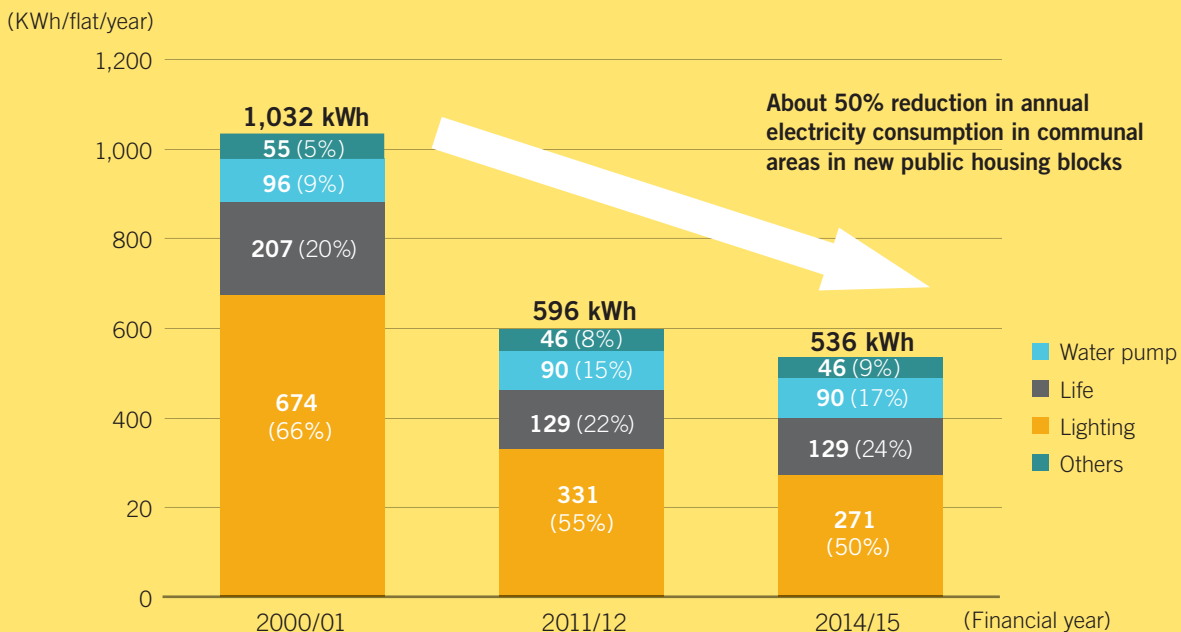
are currently the Ex-Yuen Long, Ex-Au Tau, Tung Chung, San Po Kong, and Anderson Road Sites A and B Phases 1 & 2 projects which have achieved Provisional BEAM Plus Platinum rating.

Currently, public housing accounts for 45% of total energy consumption in residential buildings. Since 2000, HKHA has implemented a number



of initiatives to achieve better energy performance in new public housing developments. Through these, HKHA has achieved a substantial reduction in communal electricity consumption within public housing blocks by 42% over the past 13 years from 2000-01 to 2013-14. A further 10% reduction in the current communal electricity consumption is

**Figure 23** Annual electricity consumption in communal areas of a typical public housing domestic block (41-storey, 799 flats)



28. Long Term Housing Strategy, December 2014, Transport and Housing Bureau, <http://www.thb.gov.hk/eng/policy/housing/policy/lths/LTHS201412.pdf>.

anticipated after implementing more energy saving initiatives from 2014-15 onwards.

HKHA adopts a holistic approach in reducing building energy reduction. The initiatives implemented include provision of energy saving systems, setting up energy management tools and promoting energy saving awareness:

### 1. Energy saving systems

As lighting, lifts and water pumps account for around 55%, 21% and 16% respectively of the communal energy consumption of a residential public housing block, much effort has been made to reduce the energy use of these systems, including:

- Optimising the illumination levels in public areas by adopting energy efficient lighting, maximising daylight by using photo sensor and timer control, and implementing two-level lighting control systems to fulfill barrier free access without unduly increasing lighting power demand;
- Using various means to save energy with respect to lifts and water pump systems; and
- Implementing grid-connected PV systems in new public housing developments under planning and design since May 2011 to meet at least 1.5% of the communal electricity demand of each block.

### 2. Energy management tools

Since 2000 and before the full operation of the BEEO in 2012, HKHA had already adopted the

then non-statutory BEC under the Energy Efficiency Regulation Scheme for Buildings in new developments.

Moreover, HKHA also developed and rolled-out an Energy Management System in December 2011 for new developments using the ISO 50001 best practice energy framework, and was awarded the first ISO 50001 certificate on residential building design in Hong Kong in June 2012. This framework is based on continual improvement for organisations to integrate energy management into their overall quality management system. ISO 50001 certification is scheduled for all existing public housing estates by phases by April 2015.

### 3. Energy awareness raising

To raise public housing tenants' awareness, HKHA has installed small meters and display panels at ground level lobbies of new housing blocks so that



Energy awareness display panel

tenants can see the per flat average electricity, gas and water consumption of their own block, with a view to encouraging them to save energy. In addition, one or two solar-powered lamp poles have been placed at each new development since 2008 for educational purpose.

HKHA has various plans to continue to explore practical means to save energy, including through adopting new technologies. In light of the fact that HKHA has a very large building stock, including shopping malls associated with housing estates, and a substantial building programme stretching out many years in Hong Kong, it will continue to play a pioneering role in saving energy in the residential sector.

## URA and HKHS

The URA deals with regeneration of dilapidated areas, while the HKHS plays an active role in the provision of public rental units for low-income households and the development of subsidised sale projects. They are both pioneers and leaders in green building with clear policies to implement sustainable practices in their projects. As such, energy efficient building design and practices have become a core part of their work, such as sun-shading provisions, energy efficiency of electrical, lighting, lift and escalator installations, high thermal performance structural fabric, solar hot water system, energy saving air-conditioning devices, water-cooled chiller system, heat recovery system, etc. Many of their projects have received BEAM or BEAM Plus Platinum rating, such as URA's Florient Rise, i-Home, Lime Stardom, Mount Davis 33, Vision City, Island Crest, Queen's Cube, and Baker Residences; and the HKHS's Heya Green and Tanner Hill (provisional rating). The URA's De Novo project (i.e. Kai-Tak Flat-for-Flat Development), which is currently under construction, has also received the BEAM Plus Provisional Platinum rating.

We have set a new target of 5% electricity reduction for government buildings to be achieved within 5 years using 2013-14 as the base. It would be possible for the Government to consider setting further targets in 2020, 2025 and to continue up until 2035. Each round of targets would need to be critically assessed as the easier gains are reaped. Further savings may involve substantial capital investments and long payback periods, which will obviously require further community discussion.

Beyond the above steps, energy saving may arise from good management (see below). In 2015, each bureau and department will appoint a Green Manager at directorate level to show the importance the Government attaches to energy saving. We will rationalise the current system of appointing Green Managers in each department

and an Energy Warden for each government premise. This change aims to help raise energy saving awareness internally and ensure annual reports are prepared, and audits are done so that performances could be benchmarked. These steps, taken together, will enable the Government as a whole to be much more 'Energy Aware' and 'Energy Wise'.

## 2. Private sector buildings

While the Government will continue to lead in the public sector, the challenge for existing buildings is how to get private sector to invest in energy saving upgrades. Of the buildings in the private sector, there should be an understanding among stakeholders where the best potentials for energy savings are so that effort may be focussed on how to capture those potentials in the next 20 years.

### Government building audits

All existing government buildings with floor area of more than 10,000m<sup>2</sup> should aim to carry out regular carbon audit to track the effectiveness of greenhouse gas emission reduction efforts. Carbon audit results and findings should be reflected in departmental annual Environmental Performance Report. In 2012, the Government commenced a

3-year programme to conduct energy-cum-carbon audits at 120 government buildings.

The purpose of energy audit is to identify energy management opportunities and improve energy efficiency of buildings through a systematic review of the energy consuming equipment/systems in a building. All major government

buildings with annual electricity consumption over 500,000 kWh and good energy saving potential (about 350 buildings) will be required to conduct energy audit. Government buildings with annual electricity consumption over 500,000 kWh account for about 90% of total electricity consumption of all government buildings.

The BEEO requires owners and inhabitants of existing buildings to comply with the BEC when major retrofitting works are carried out with respect to air-conditioning, lighting, and electrical and lift/escalator installation.

The already closed HK\$450 million BEEFS was designed to stimulate private sector building owners to invest in improvements. The new matching schemes put in place in 2014 that will run till 2018 by the two electricity companies will inject about \$100 million from the utilities to support energy saving improvements with priority given to single residential buildings. We believe this total sum of about \$550 million represents one of the largest available in cities around the world to trigger energy saving installations and practices.<sup>29</sup>

Once we have gathered more of the final results under BEEFS in the coming year, and we can see how the new Energy Efficiency Funds operated by the power companies are performing, we will be better placed to consider whether and how private sector buildings could be given further impetus to upgrade their energy efficiency performance, which may include building owners working with energy services companies (ESCO) that are in the business of entering into energy saving performance-based contracts. We must emphasise the limit of any public subsidy scheme since

only a limited number of buildings may benefit, and it would be difficult to justify using public funds to subsidise private property. A more tenable and sustainable option is to encourage the growth of the energy services market, which has the potential to become a significant part of Hong Kong's environmental industry.

Stakeholders have also suggested favourable treatment in relation to government rates, stamp duty and tax concession to be granted. Needless to say, we need to consider such suggestions very carefully.

## **Good Management and Inhabitants' Behaviour**

### **1. Influencing choice for appliances**

It is widely accepted around the world that electrical appliances should be labelled to give buyers easily understandable information about energy saving. Such appliances are all used in buildings, thus energy saving in buildings and the choice of appliances go hand-in-hand. It is especially so for residential buildings, since individuals choose which models to buy for personal use. Tightening the energy efficient grading standards of the 5 prescribed products under MEELS will affect the most prevalent appliances used in homes in Hong Kong, which account for about 60% of residential electricity consumption.

29. Regarding the \$100 million funds launched by CLP and HEC, the actual total amount available may be different as the amount is only a current estimate based on present values.

On 31 October 2014, we gazetted the tightening of the grading standards for room air-conditioners, refrigerators and washing machines so that the trade can prepare for the import of more energy efficient products before 25 November 2015 when the standards become effective. We expect this will save energy by about 300 million kWh or 1,080 TJ per year. Furthermore, we will extend the coverage of MEELS to more appliances, such as television, electric storage water heater, reverse cycle air-conditioners and induction cooker after consultation with the trade and then completing the necessary legislative amendment. We expect the extension will save energy by about 200 million kWh or 720 TJ per year.

There could be two more reviews on tightening of energy efficiency grading levels as per MEELS by 2025, and possibly another 2 before 2035, with the potential aggregated saving subject to latest prevailing technologies, international practices and public aspirations. The rough estimated saving is another 300 million kWh or 1,080 TJ per year upon completion of the review and upgrading works.

## 2. Beyond efficiency

The improvement in energy efficiency of products or even buildings is helpful for the community as a whole but it cannot be over-emphasised that energy conservation is just as important. Figure 22 shows the criticality of building inhabitants' behaviour beyond building structure and the choice of

appliances. It may sound idealistic but being 'Energy Aware' so that we can be 'Energy Wise' is a matter of daily discipline, and an environmentally-conscious public that chooses to change behaviour and lifestyle can result in large gains. There are many ways for building inhabitants to moderate their demand for energy. EMSD, the two power utilities and many non-government organisations provide useful tips on what we can do. Our collective efforts may be tracked over time through our per capita energy consumption.

## Developing an energy saving culture

As the various mandatory requirements relating to BEEO begin to 'bite' in the building sector in Hong Kong, and as developers and building owners study the energy audits of their commercial buildings, we believe this will create greater interest for those who are in-charge of not only building management but also finance to invest in energy efficiency whether for new buildings or existing buildings. The key to success in the performance of a building or portfolio of buildings depends on what process the owners adopt to make decisions, what technologies they adopt, and whether the people involved in making and implementing the decisions are knowledgeable and able to optimise opportunities.

## Driving change – Information disclosure

- **Current structure**

The regulatory controls imposed by BEEO also serve to provide important energy and environmental performance information to property developers and built environment professionals to encourage them to ‘green’ their buildings, and at the same time the information can also serve to inform property buyers and inhabitants about the performance of buildings. Coupled with other tools, society as a whole can have fuller information about building performance through:

- (i) BEAM Plus assessment;
- (ii) Disclosure of any BEAM Plus assessment and GFA concessions granted for first-hand residential properties;<sup>30</sup>
- (iii) Building energy audits under BEEO; and
- (iv) Labelling of electrical appliances under MEELS to help buyers to make energy efficient choices.

- **Mandatory audit information of commercial buildings**

Hong Kong’s BEEO imposed a statutory responsibility on owners of commercial and composite buildings (some 6,000 buildings in total) to conduct energy audits every 10 years and for the first round of audits to be done by September 2016. The law



also requires the relevant building owners to exhibit a copy of the Energy Audit Form, which contains the annual energy utilisation index of the past 12-month period, in a conspicuous position at the main entrance of the building. This disclosure requirement will enable us to gather vital information about these buildings, which can be analysed to gain more insights as to how to promote energy saving, and there will be more and more buildings providing audits each year from 2016.

- **Voluntary disclosure by listed companies**

Hong Kong’s publicly listed companies, which includes many property companies owning and managing buildings, are taking steps

to disclose a variety of environmentally-related information under the Hong Kong Exchanges and Clearing Limited’s (HKEx) voluntary Environmental, Social and Governance Reporting Guide issued in August 2012. One of the key performance indicators relates to energy consumption data. A number of companies have started to disclose their total electricity consumption for their operations in Hong Kong and more are expected to do so. HKEx plans to consult in 2015 whether voluntary reporting may be turned into a “comply or explain” arrangement. The Environmental Protection Department has also developed a carbon footprint repository to facilitate listed companies to make disclosure, which includes energy-related information.



30. See Residential Properties (First-hand Sales) Ordinance and its disclosure requirements.

- **Example of New York**

While Hong Kong has gone some way to provide more information about buildings, overseas experience indicates other cities are also attempting to use disclosure to drive change. To reduce energy consumption in buildings, New York's strategy is through better information disclosure. Since 2011, the city requires its largest buildings (amounting to about 15,000 properties that covers almost 50% of citywide square footage) to annually measure their energy and water consumption through using an on-line benchmarking tool. Through this annual benchmarking exercise, the information is then publicly disclosed via a city government website.<sup>31</sup>

The aim of New York's disclosure requirement is that building owners and inhabitants could continuously consider what improvements to make to save energy and water. The authorities in New York also believe such information will help them to fine tune their energy policy over time. However, this initiative is not without controversy. A building with high energy consumption does not necessarily imply that it is energy inefficient. There are concerns that the

data released do not take into account building size and forms, the functional requirements of building users and the operation characteristics of the different buildings. For example, a tall office tower with high speed lifts will consume more energy than a low-rise one.

In Hong Kong's case, the energy information of a building regulated by the BEEO is posted at the main entrance of the building. It may be said that in both New York's and Hong Kong's case, the balance between differentiation and disclosure has yet to be better struck although the principle of disclosure is recognised.

- **Promote 'green lease'**

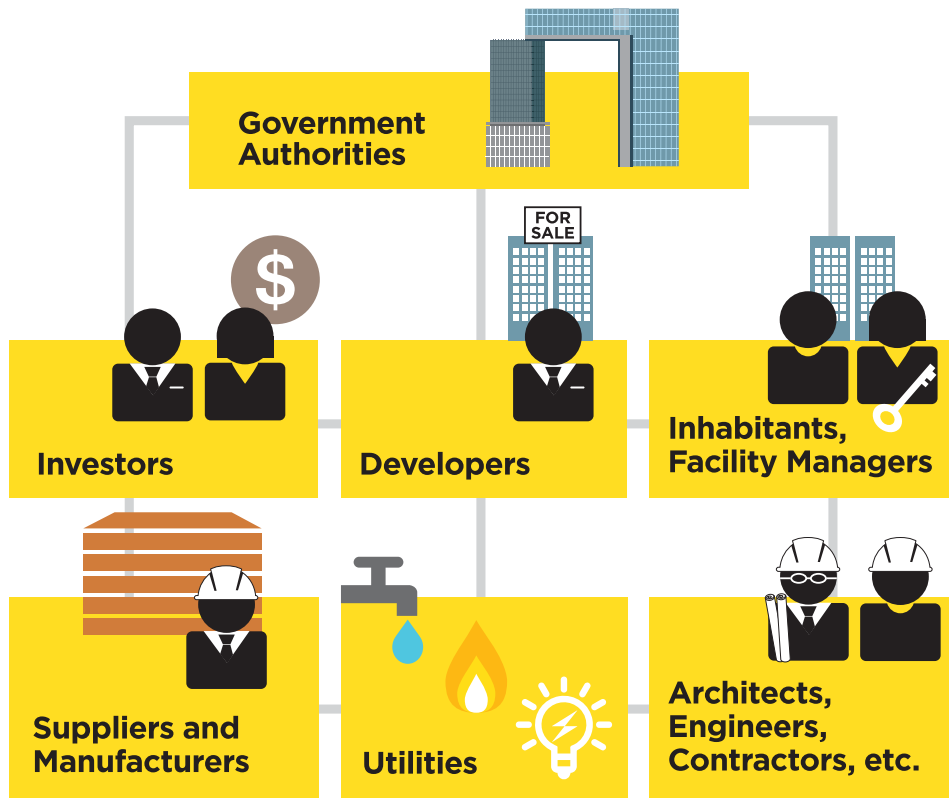
There is also the challenge of split incentives. In cases where tenants are charged an overall bill that includes management fees and electricity charges, there is often little transparency to the tenants of how much electricity they used, and energy savings by tenants benefit the landlord. One possible solution is being pioneered by the Hong Kong Science and Technology Park (HKSTP), where the landlord has connected a smart meter to monitor its tenants' energy consumption. Real-time building performance is publicly

displayed, so tenants can also see how they use energy. For example, tenants can see their energy wastage during non-business hours, which enables them to consider how they may save energy. This kind of transparency should be conducive to encouraging an energy saving mind-set. In parallel to promoting transparency of energy use, the HKSTP is also applying the 'pay-for-use' principle on air-conditioning consumption among its tenants.

In addition, the HKGBC launched its Green Tenancy Driver for Office Buildings in November 2014 to encourage green tenancy for office buildings. Its campaign is a step-by-step approach for the commercial sector to adopt green leasing, starting with raising awareness among landlords and tenants to collaborate closely to promote sustainable operation and management of buildings and premises, leading to dealing with the split incentives and eventually adopting green leasing. This represents a paradigm shift for commercial leasing in Hong Kong, where typically tenants pay a flat management fee, irrespective of how much air-conditioning they actually use.

31. New York's building benchmarking information can be found at <http://www.nyc.gov/l184.data>. The law does not give the authorities the power to disclose the specific performance of an individual building by name thus the authorities disclose the information by the address of the building. However, New York's initiative is not without controversy. There are concerns that using an on-line benchmarking tool does not reflect the actual operation need of specific buildings.



**Figure 24** Improving building performance requires wide collaboration

The most successful cases are those where change is driven from the top in a consistent and sustained manner, such as with the HKHA. In such cases, the institutional governance structure steers and instructs the execution of high energy performance, which results in necessary skills and competence being developed internally, and such sustained leadership leads to a long-lasting ‘saving’ culture. There is much that the private sector can learn here.

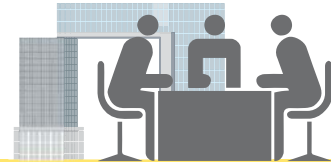
#### Arriving at an ‘agreed’ greener and greater plan

We wish to work with private sector leaders, the power suppliers for electricity and town gas, building professionals and academics, such as the HKGBC, CIC, Business Environment Council, Real Estate Developers Association, the universities, the relevant professional bodies and Vocational Training Council to promote green building in Hong Kong. Many developers and investors have yet to fully appreciate the ‘life cycle’ cost of buildings and the longer-term benefit of investing in energy efficiency design, technologies and practices.



BEAM Pro Ceremony 2010

The Secretary for the Environment will invite leaders in the power and built environment sectors to dialogue with him and government bureaux and departments over the next two years with the view of expediting green building adoption in the private sector. The Secretary will ask them to join the Government in:



- Visualising the timeline for possible actions already embedded in existing legislation and administrative practices when building and appliances standards would be reviewed;
- Identifying where the best potentials for energy saving are within Hong Kong's existing building stock to focus efforts for retro-commissioning and retrofits; and
- Promoting good housekeeping practices in building management to realise energy saving potentials over the operational lives of buildings.

In addition, top-management in the private property and building sectors, including those responsible for finance and building management, will be invited to explore the following issues as well:



- Achieving energy saving alongside environmental and financial goals;
- Discussing the role of improving energy data transparency, benchmarking, and data-sharing between landlords and tenants, as well as promoting green leases;
- Increasing and spreading energy-related competence among BEAM and other professionals and affiliates as well as other related professionals, and promoting innovation across the built environment sector, including BEAM Plus NB and EB, BEAM Plus Interiors and BEAM Plus Neighbourhood Development assessments, as well as promoting zero-carbon demonstration projects, and relevant R&D;
- Identifying what role there may be for ESCO in developing an energy efficiency and green building market in Hong Kong;
- Supporting the training for mechanical, electrical and green building skills, as companies and consumers demand more energy-saving services; and
- Promoting Green Building Week and Green Building Awards.

## 4 ENERGY AND TRANSPORTATION

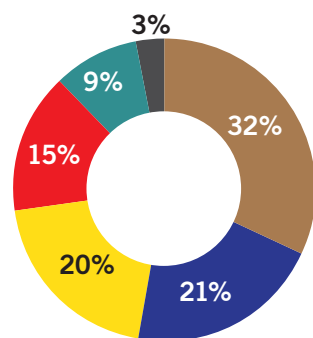
The energy types that matter in the transport sector in Hong Kong, which covers public transport modes, private and commercial vehicles and local ships,<sup>32</sup> are electricity, oil products and LPG. Electricity which powers the railway network helps to move the largest number of people day in day out, oil products in the forms of gasoline and diesel power the vast majority of vehicles on our roads, while marine diesel powers local ships, and LPG powers taxi and 67% of PLB, as well as 25% of private light buses.

The total annual energy consumption of the transport sector in 2012 is about 92,512 TJ or about 32% of total energy end-use, of which 88% is consumed in vehicular transportation, about 9% in marine transportation and 3% in railway.

### Electricity and mass transport in Hong Kong

Railway is the backbone of our public transport system. The MTR Corporation Limited operates 9 heavy rail lines, the Airport Express and a Light Rail network, covering about 220 km, and is the largest single electricity user in Hong Kong. The MTR Corporation Limited carries an average of about 5 million passengers each day or about 40% of the daily travelling public.<sup>33</sup> There are currently 4 new railway projects under construction, which when completed will increase the existing network by about 25%.

**Figure 25** Transport sector energy end-uses, 2012



■ Buses  
■ Taxis  
■ Cars and Motorcycles  
■ Goods vehicles  
■ Rail  
■ Marine and other transportation

(Source: Hong Kong Energy End-use Data, EMSD)

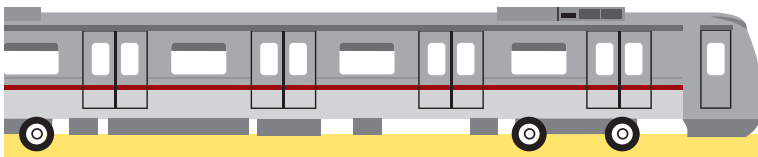
32. This document does not include energy used in international aviation and shipping.

33. In 2013, the average daily passenger journeys by different modes of transport were: MTR lines 4.357 million, Light Rail 470,300; and Tramway 198,000 - [http://www.td.gov.hk/filemanager/en/content\\_4665/table21s.pdf](http://www.td.gov.hk/filemanager/en/content_4665/table21s.pdf). See also Hong Kong Fact Sheet <http://www.gov.hk/en/about/abouthk/factsheets/docs/transport.pdf>.

The Railway Development Strategy 2014 released by the Government in September 2014 shows there are further expansion plans in the future. Meanwhile, Hong Kong Tramway Limited operates the electric tram line along the northern shore of Hong Kong Island, which carries about 198,000 on average per day.

Besides the railway and tram, there are other transport facilities for tourism or recreational purposes that also consume electricity, such as the Peak Tramway and cable cars at Ocean Park and Ngong Ping.

Although electricity helps to provide mobility to a very large number of people in Hong Kong, it accounts for a very small share of Hong Kong's total electricity consumed.



### MTR Corporation Limited's energy saving efforts

MTR Corporation Limited consumes around 1,425 million kWh of electricity per year for its transport-related operations including rail traction energy, auxiliary energy in trains, and electricity in stations and depots for heavy rails, light rail and buses. It also consumes about 7 million litres of diesel per year for feeder bus services and over 800,000 litres of diesel for various operations.

Energy and utilities make up the largest non-staff cost for the company's rail operations. Thus, energy saving is very important. An Energy Management Working Group under the Operations Division monitors electricity consumption, promotes energy conservation among staff and explores the trial energy initiatives by means of a dedicated budget.

Energy consumption reports are provided regularly to management. The company has set a target to reduce by 21% the amount of electricity consumed per passenger-km by 2020 compared to 2008 levels. As of 2012, a 14% reduction has been achieved.

The company has implemented a series of major technical measures to save electricity, such as realigning railway tracks to optimise energy saving; installing regenerative braking systems on trains to capture residual energy; and adding super-capacitors technology to store energy arising from the braking system. Other measures include a tailored LED lighting system that has been installed on 93 trains, and achieved up to 50% saving relative to conventional lighting systems;

using LED lighting in stations and advertising panels; better managing temperature change from entrance to concourse to train platforms, which could lead to energy saving of 3-5% per °C; and applying solar control window film at Olympic Station to reduce solar heating gains.

In 2013, the company asked its employees to help identify energy saving measures and offered awards to those who provided the most impactful ideas. Measures implemented include more efficient use of lights above railway maintenance tracks, turning-off air-conditioning when train shunting takes place, and partially switching-off trackway and tunnel exhaust fans particularly during late evening. The campaign generated potential savings of more than \$4 million per year.

At the same time, there are about 2,100 electric vehicles (including private cars and a small number of motorcycles, taxis, goods vehicles and coaches) in Hong Kong using an insignificant amount of electricity. While we expect the numbers to grow in the coming years, the promotion of electric vehicles is not the subject here.

While not commonly counted as a form of transport, electricity operates the Central to Mid-Levels Escalator and Walkway System that carries about 85,000 people per day and also the newer Centre Street Escalator Link that carries about 15,000 people per day.<sup>34</sup>

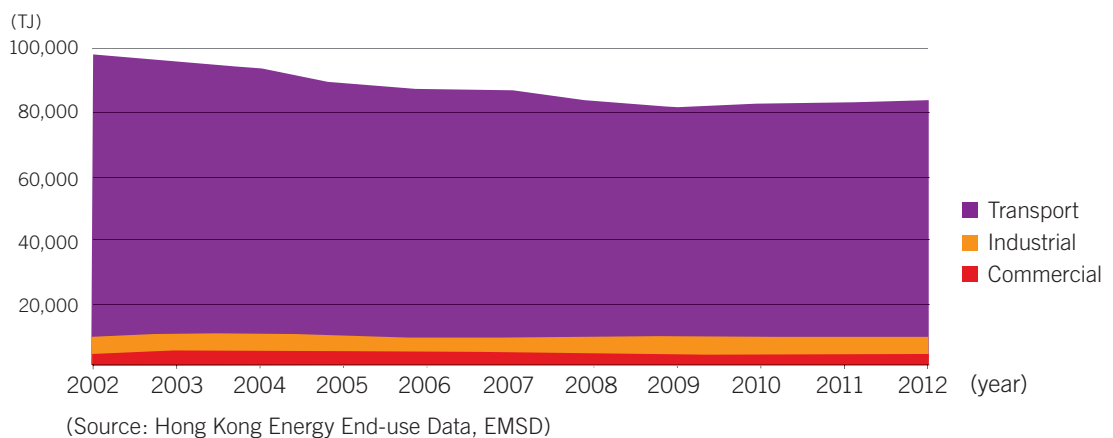


### Vehicles and fuel use

The vehicular transport modes, comprising buses and light buses, taxis, goods vehicles and trucks, private cars and motorcycles, is the largest category of user of oil products in Hong Kong accounting for 66,213 TJ or about 80% of the total consumption (83,275 TJ). Despite the increase in the number of vehicles, there has been a reduction in consumption (Figure 26), which is due to vehicles becoming more and more fuel efficient.

There are approximately 750,000 private and commercial vehicles registered in Hong Kong. Private cars are mostly powered by petrol, while commercial vehicles, such as trucks, light goods vehicles and buses (including franchised buses) are mostly powered by diesel. Taxis and a large portion of light buses use LPG. As already noted, there are currently about 1,200 electric vehicles in Hong Kong using an insignificant amount of electricity.

**Figure 26** Consumption of oil products by Sector, 2002-12

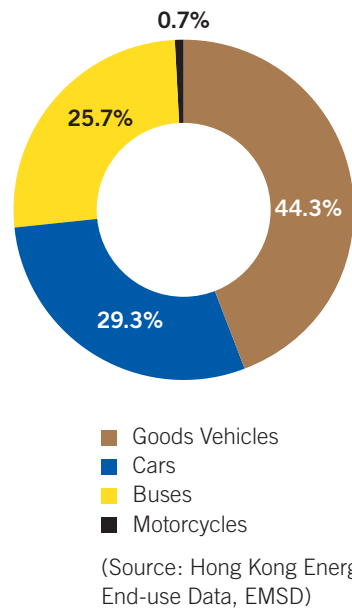


34. The Central to Mid-Levels Escalator and Walkway System is used by about 85,000 people daily by end August 2014. See Hong Kong Fact Sheet <http://www.gov.hk/en/about/abouthk/factsheets/docs/transport.pdf>. As for the Centre Street Escalator Link, see <http://www.legco.gov.hk/yr08-09/english/panels/tp/papers/tp0424cb1-1323-1-e.pdf>.

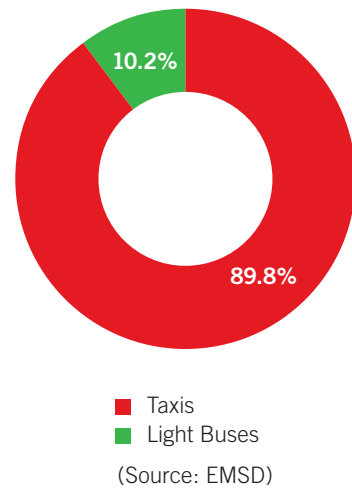
In terms of oil products consumption of 66,213 TJ in vehicular transport, goods vehicles account for 29,318 TJ (44.3% of total consumption), cars account for 19,428 TJ (29.3%), buses account for 17,032 TJ (25.7%) and motorcycles account for 435 TJ (0.7%). Figure 27 shows the transport sector’s oil products by end-use.

The vehicular use of LPG is 15,384 TJ, which is about 31% of Hong Kong’s total consumption of town gas and LPG (49,616 TJ) in 2012. As already noted above, nearly all taxis use LPG, a large portion (67%) of PLB and a quarter of private light buses use LPG. The LPG consumption distribution of taxis and PLB in 2012 is shown in following Figure 28.

**Figure 27** Share of oil products consumption in vehicular transport, 2012



**Figure 28** Share of transport sector’s LPG consumption by end-use, 2012



## Energy saving and operating bus services

There are 5 privately owned bus companies that provide franchised bus services across Hong Kong, operating more than 550 routes. Currently, there are about 4 million passenger-trips carried by franchised buses every day, representing about 32% of the public transport market. Separately, there are 7,050 non-franchised buses providing services for students, tourists and residents, etc. as at end October 2014.

Fuel cost for bus operators is the largest non-staff expenditure. There are essentially three ways for bus operators (whether franchised buses or other types of operators) to save energy:

### Invest in efficiency and maintenance

Maintaining the fleet will help to save energy and reduce emissions. The larger franchised bus companies also invest in various types of hardware to eliminate fuel spillage, improve the bus air-conditioning system and insulation, use tinted glass windows, use LED lighting

and more efficient tyres. All these help to save energy. By improving the time and ease for passengers boarding and alighting, features such as super-low floor entries, dedicated entrances and exits to facilitate faster flows, wider gangways and straight staircase designs all help to reduce engine idling time and thereby saving fuel.

### Practise demand management

Measures to reduce dead mileage operated by buses, including managing the frequency of refueling and on-street refueling, effectively reduce fuel consumption and enhance fleet management efficiency.

The major franchised bus companies are working with the Transport Department to pursue bus route rationalisation with greater vigour to reduce unnecessary bus trips and enhance network efficiency to better meet the changes in passenger demand and achieve

better operation efficiency. Bus routes and bus stops rationalisation can contribute to energy saving, as does the Bus-Bus-Interchange Schemes (including the Tuen Mun Road Bus-Bus Interchange providing a “hub-and-spoke” network for linking Tuen Mun/Yuen Long to other districts). Implementing bus-only lanes and the Autotoll system all have positive energy saving outcomes too.

### Practise good driving

A commercial bus operator would want its drivers to practise green driving, which contributes not only to lower fuel consumption but also better safety performance. Some operators have installed a real-time driver feedback system to assist bus captains in understanding if they are driving in a fuel efficient manner by displaying real time alerts when there are occurrences of over-speeding, harsh braking, harsh acceleration, engine over-revving or excessive idling, so that the drivers can correct their driving behaviour accordingly.



## Fuel efficiency for private and commercial vehicles



The fuel efficiency (also referred to as fuel economy or fuel consumption) of a vehicle is calculated as a ratio of distance travelled per unit of fuel consumed (km/L) or fuel consumption per travel distance (e.g. L/100 km). Thus, the greater the distance travelled per unit of fuel, the higher the fuel efficiency of a particular vehicle model. In general, the more fuel efficient a model is, the less pollutant emissions it emits. Technological advancement and the continuous tightening of fuel efficiency and emission standards by governments all around the world have pushed vehicle manufacturers to produce more fuel efficient and cleaner vehicles.

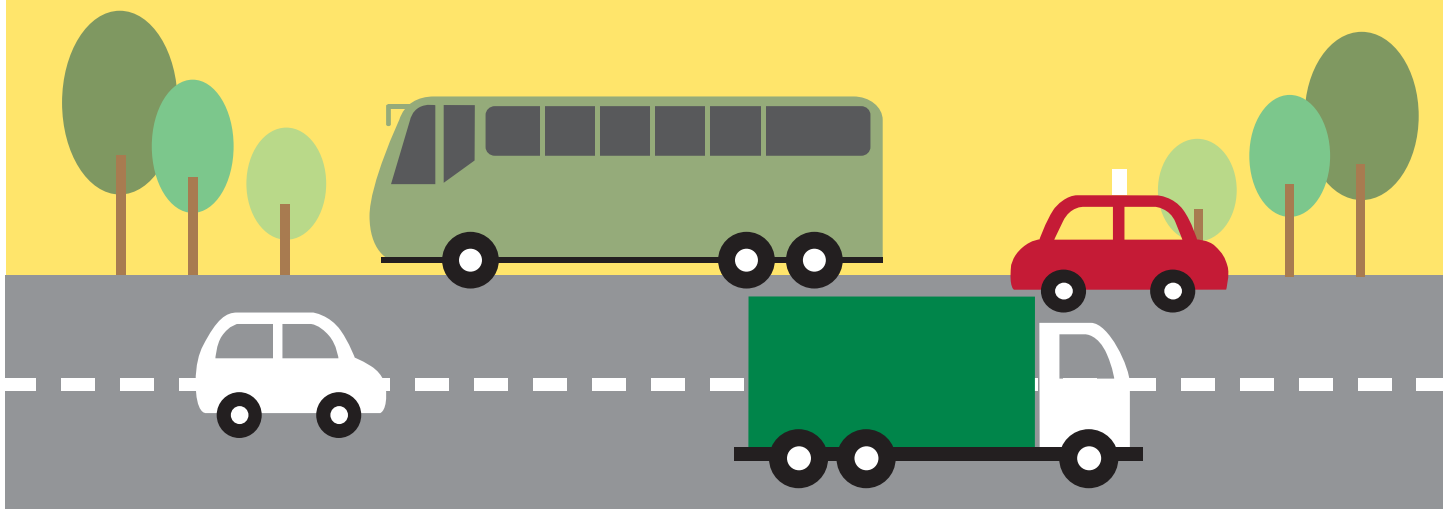
- **First Registration Tax incentive**

The Government had encouraged buyers of petrol private cars to choose models with outstanding fuel efficiency and emission performance. Starting from April 2007, an environment friendly petrol private car incentive scheme has been launched which granted reduction in First Registration Tax (FRT) for petrol private cars which meet the specified fuel efficiency and emission qualifying standards. This scheme will be abolished from 1 April 2015 because the emission reduction technologies for private cars have advanced to such a stage that the scope for further emission reduction is limited. Only electric vehicles with no tailpipe emission will continue to enjoy full FRT waiver and the incentive will last up to March 2017.

- **Fuel consumption and driver behaviour**

How a driver drives his or her car affects fuel consumption. The term 'eco-driving' has come about because engine technology and performance of vehicles has improved rapidly and to capture these advantages, drivers should adapt their driving style. There are several 'golden rule' to eco-driving:

- **Anticipate traffic flow** – to enable steady driving at constant speed;
- **Drive smoothly** – using the highest possible gear;
- **Shift gear at the right time** – this will save fuel;
- **Check tire pressures frequently** – keep tires inflated at the correct pressure;
- **Moderate use of air – conditioner and electrical equipment;** and
- **Maintain vehicle well** – for highest overall performance.





## 5 | SETTING ENERGY SAVING TARGETS FOR HONG KONG

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**T**arget setting is important because it provides a direction of what needs to be achieved within a certain time frame against an overall situation. In setting targets, they must be measurable, achievable and progress can be credibly and transparently shown. The cost of achieving the targets cannot be ignored. Many jurisdictions have set energy-related targets, such as targets to lower energy intensity, reduce primary energy consumption, reduce energy demand in specific economic sectors or improve energy efficiency by a certain percentage over a period of time using a certain year as the base year.<sup>35</sup>

Our energy saving policy in Hong Kong is to manage demand for energy consumption through practical means. As noted in previous chapters, our efforts to date aimed at the Government leading by example, raising public awareness to save energy, promoting energy saving in relation to buildings, and laying the essential legislative framework for further energy saving in the future.

### **Hong Kong's previously committed energy targets**

Hong Kong currently has two numeric targets: the first is an international target linked to improving the overall energy efficiency of the economy; and the second is an absolute reduction target relating to electricity consumption in government buildings as part of our strategy to have the Government lead by example.

### **Reduce energy intensity**

The Policy Address 2007-08 pledged to achieve a reduction in energy intensity of at least 25% by 2030 with 2005 as the base year. Furthermore, the pledge has been extended to reduce Hong Kong energy intensity by 45% by 2035 with 2005 as the base.

### **Reduce consumption**

The Government set three rounds of energy/electricity consumption reduction targets for government buildings under comparable operating conditions of 6% to be met between 2003-04 and 2006-07, using 2002-03 as the base; a further 5% between 2009-10 and 2013-14, using 2007-08 as the base: and we have just set a new 5% target for the next five years.

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35. Primary energy consumption refers to the direct use of energy that has not been transformed. Thus, reducing the use of coal, natural gas and oil are examples of reducing primary energy consumption. China's 12th Five Year Plan set various targets, such as to reduce energy use per industrial value-added output in nine energy intensive industries, including steel and chemical industries; as well as energy efficiency improvement targets.

## APEC's energy intensity reduction targets

As a member of Asian Pacific Economic Cooperation (APEC), Hong Kong signed the Sydney Declaration in 2007 and Honolulu Declaration in 2011 that provided for member economies to reduce their respective energy intensity by at least 25% by 2030, and for APEC economies as a whole to reduce the aggregate energy intensity by 45% by 2035, using 2005 as the base year in both declarations.<sup>36</sup>

### Definition

Energy intensity of an economy (**energy demand** per unit of **economic output**) is a measure of the amount of energy it takes to produce a dollar's worth of economic output; or conversely, the amount of economic output that can be generated by one standardised unit of energy. Energy demand is the aggregate amount of energy consumed by the four major energy consuming end-use sectors (commercial,

residential, industrial and transportation). Economic output is measured by GDP. A low energy intensity economy means it uses a small amount of energy in its economic production.

### Energy Intensity Projection

Energy intensity projection is subject to a large degree of uncertainty, with the extent of uncertainty increasing exponentially into the distant future considering the host of factors involved, such as technological progress, energy consumption behaviour, prices of energy and economic performance as a whole.

Energy intensity varies widely between jurisdictions, depending on their level of industrialisation, the mix of services and manufacturing in their economies, and the attention they pay to energy efficiency. Figure 29 shows the



energy intensities of the APEC economies, and Figure 30 shows those of the European Union (EU) economies.

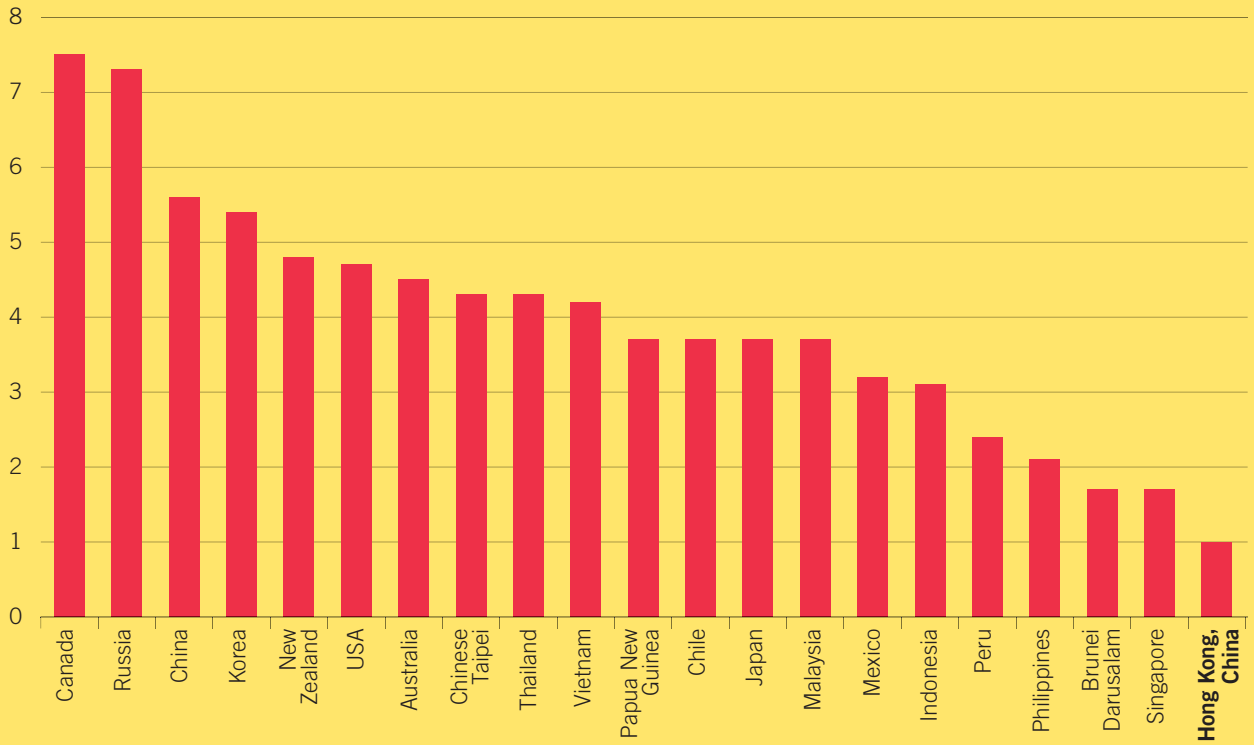
As a small city with a well-developed service-oriented economy, Hong Kong has a good score in terms of energy intensity among the APEC and EU economies. Singapore's energy intensity is much higher than Hong Kong because of the difference in our economic base – Singapore has a large oil refining sector; and even Luxembourg's energy intensity is higher than that of Hong Kong.

Using energy intensity as a measurement remains important for Hong Kong because this is a widely used global method.

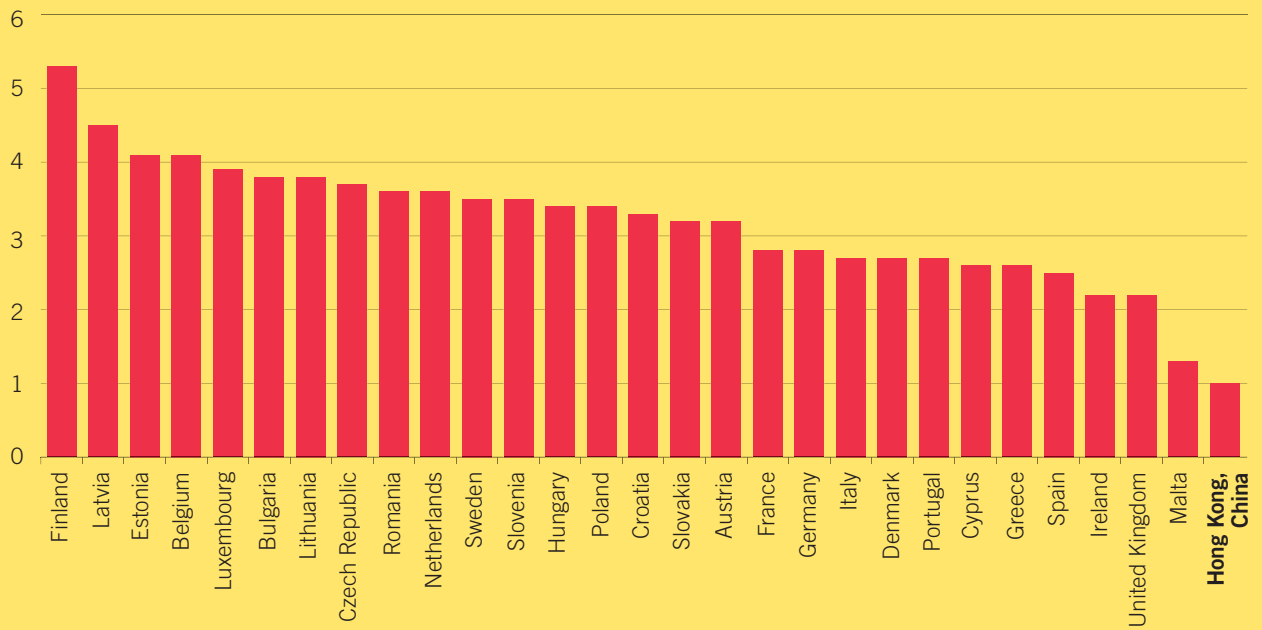
$$\text{Energy Intensity} = \frac{\text{Energy Demand}}{\text{GDP}}$$

36. With respect to the 2035 target, we have taken it to mean that Hong Kong should achieve 45% reduction by 2035 using 2005 as the base year.

**Figure 29** APEC energy intensity ranking, 2012<sup>37</sup>



**Figure 30** EU energy intensity ranking compared to Hong Kong's, 2012



37. APEC Energy Statistics 2012.

## Achieving targets

### APEC targets

The projection of energy intensity reduction involves long term assumptions on a host of factors that affect energy demand, e.g. technological progress, energy consumption behaviour, prices of energy and economic performance, whereas the economic growth assumptions would feature again as the denominator. There is unavoidably some extent of uncertainty on these factors for the near-term projections, and the extent of uncertainty into the distant future is extremely high.

With regard to the APEC targets, up until 2012, Hong Kong's actual final energy intensity had already reduced by roughly 20% using 2005 as the base year. Based on the current projection of GDP, by 2015-16, our estimate is that Hong Kong will likely achieve the first APEC target of 25% energy intensity reduction (i.e. about 15 years ahead of the 2030 deadline). Figure 31 shows the actual energy intensity reduction in Hong Kong's from 2005 to 2012, as well as our estimates from 2013 to 2035.

With respect to the second APEC target of 45% energy intensity reduction by 2035, our current estimates are based on

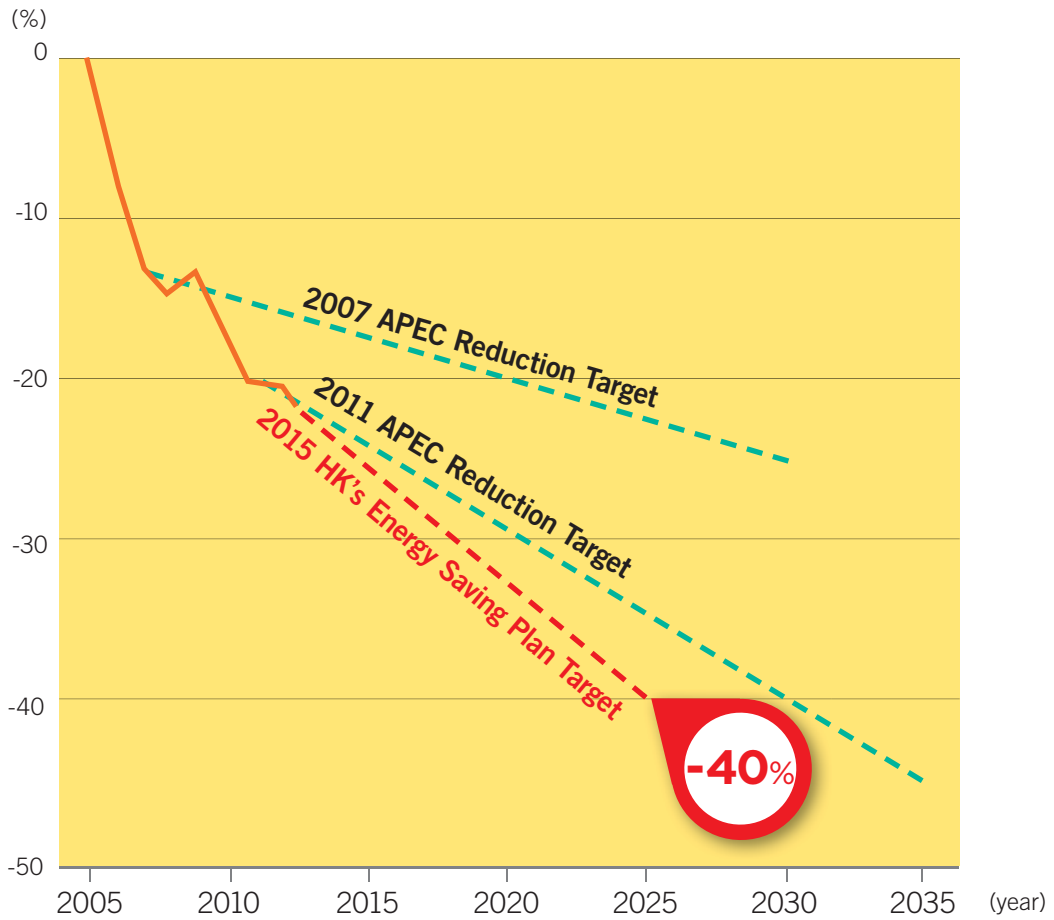
a projection of the existing energy saving measures ('business as usual' BAU case), population forecast (Figure 32),<sup>38</sup> and a lower trend growth. Based on these, Hong Kong is just able to meet the APEC 2035 target. Estimates on population increase and economic growth over such a long period will need to be adjusted from time to time when trends become clearer. In terms of considering how Hong Kong can be more energy efficient, nearer-term considerations are more important since results will come from specific energy saving measures.

Since Hong Kong will likely meet the first APEC 2030 target 15 years ahead of time, the question is whether we should consider giving ourselves a more ambitious but still realistic target. We propose Hong Kong to strive for an energy intensity reduction target of 40% by 2025 using 2005 as the base. (Figure 31) This will require us to focus on specific energy saving measures over the next 10 years (i.e. up until 2025). We wish to emphasise that we can only reach or come close to this target in 2025 by having community support since each specific measure noted below require consultation with stakeholders, as well as legislative amendment in the case of tightening regulatory tools.



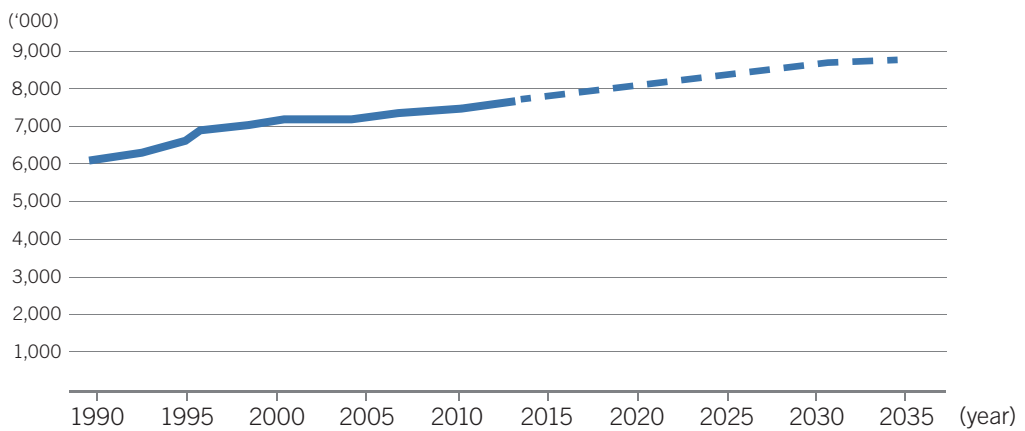
38. Hong Kong Population Projections 2012-2041, Census and Statistics Department, Table 1 <http://www.statistics.gov.hk/pub/B1120015052012XXXXB0100.pdf>.

**Figure 31** Energy intensity, 2005-2035 (2005 as base year)



(Sources: Hong Kong Energy End-use Data, EMSD and C&SD)

**Figure 32** Population of Hong Kong, 1990 to 2035



(Source: C&SD)

**Reduce consumption targets**

As noted in Chapter 3, we have set a new target of 5% electricity reduction for government buildings to be achieved within 5 years (i.e. by 2019-20) using 2013-14 as the base and under comparable operating conditions. The Government could be looking at three sets of further reductions between 2015 and 2025, and to continue up until 2035 although each round of reduction becomes more and more challenging.

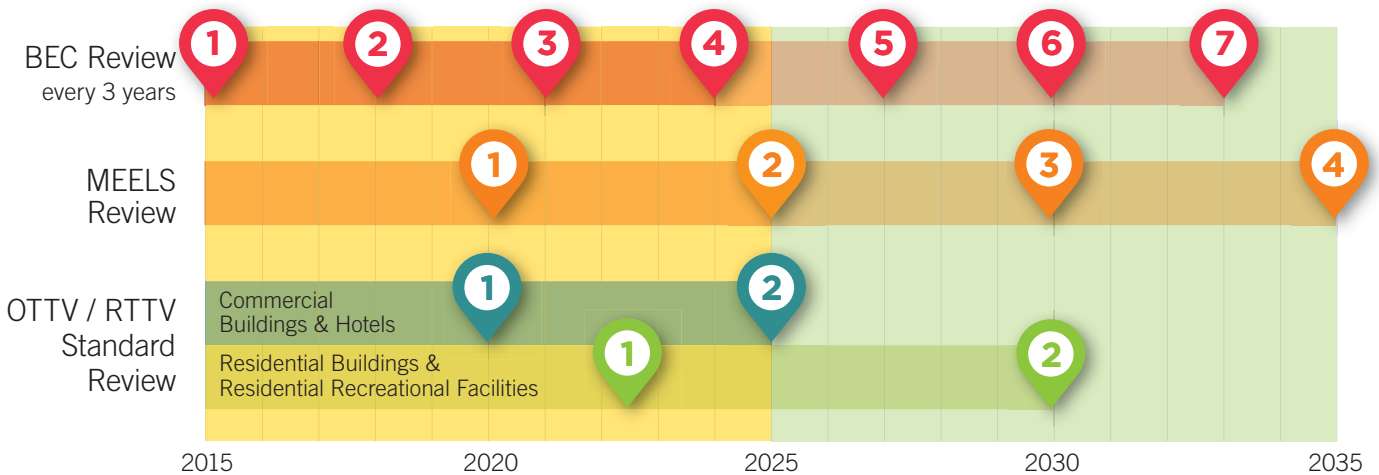
**Tighten regulatory tools**

For estimation purpose, Hong Kong may tighten its three sets of regulatory tools several times between 2015 and 2025, and up until 2035. Each of these efforts would save energy and have a positive

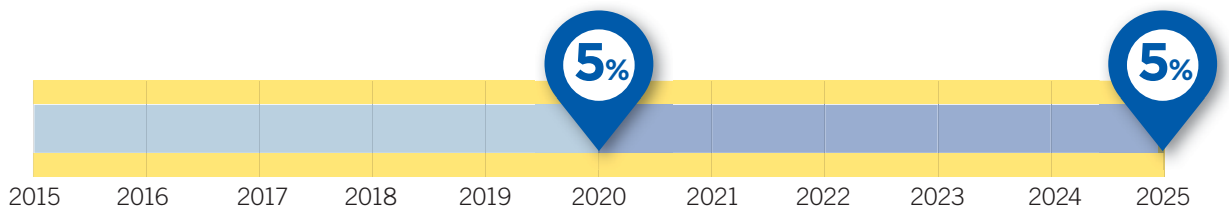
impact on achieving a tighter energy intensity reduction target. Thus, it may be assumed that the following would take place:

- a. The BEC would be reviewed every 3 years, which could result in 4 reviews between 2015 and 2024, and three reviews between 2027 and 2035;
- b. MEELS would be reviewed twice before 2025 and another two times before 2035; and
- c. The OTTV standard for commercial buildings and hotels would be reviewed twice before 2025 and the OTTV standard for residents' club-houses and the RTTV standard for residential buildings would be reviewed twice before 2030.

**Figure 33** Timeline of regulatory tools reviews on energy reduction



**Figure 34** Electricity saving timeline for government buildings (2013/14 data as baseline)



### Combined reduction

In summary, the rough energy reduction estimates from the above combined measures to achieve the more ambitious energy intensity reduction target of about 40% by 2025 using 2005 as base year are:

- a. **Built-in systems** (i.e. central building services installations) – By reviewing the BEC every 3 years, the estimated potential saving arising from the 4 reviews before 2025 would be about 1,000 million kWh (3,600 TJ) per year;
- b. **Plug-in appliances** (i.e. electrical appliances) – Following the next upgrading of MEELS after the current round of consultation with the trade, there could be two further reviews before 2025. Coupled with the extension of the product coverage under MEELS (subject to consultation with stakeholders) the estimated potential energy saving for MEELS upgrading/extension could be about 800 million kWh (2,880 TJ) per year; and

- c. **Electricity saving in government buildings** – The potential electricity saving from the new 5% electricity saving target from 2015-16 to 2019-20 using 2013-14 as the baseline is about 70 million kWh (252 TJ) per year. If another round of 5% electricity saving target could be arranged from 2020 to 2025, the potential additional saving is assumed to be about 70 million kWh (252 TJ) per year;
- d. **Building envelope** – While we will review the OTTV and new RTTV twice before 2025 and 2030 respectively, we still need time to work with experts to analyse what may be the different options in tightening the standards. At this stage we make no estimate of the possible energy saving.

### Enhanced efforts to promote energy saving

Needless to say, we must also continue to enhance our efforts to promote energy saving and green building throughout the community. For instance, the HKGBC will tighten/upgrade the BEAM Plus tools, especially on the assessment of new and existing buildings. We will continue to collaborate with the key stakeholders, professional bodies, power companies, as well as educational institutions and non-governmental organisations.



## Smart Meters



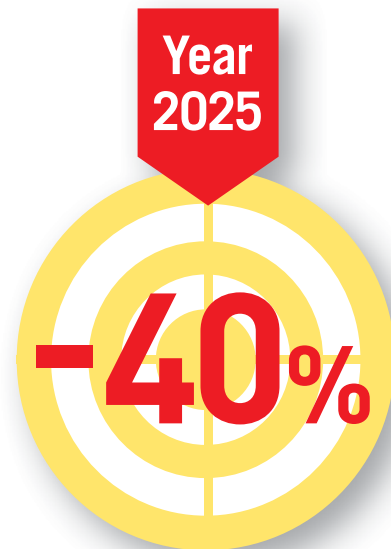
The use of Advanced Metering Infrastructure (smart meters) can provide more information than conventional meters. It can stimulate people to save energy more effectively. The two power companies have started to study and test smart meters for general customers. For example, CLP launched a pilot scheme in

2013 involving 3,000 residential customers and 1,400 small and medium-sized business customers. The programme offers timely information and energy saving tips, as well as tariff incentives and rebates. Customers can also have on-line access through their mobile phones and apps.

## Going Forward

Our target of reducing Hong Kong's energy intensity by 40% by 2025 using 2005 as the base (or about 6% actual reduction in energy consumption in 2012) is less than what some advocates have called for but this level of reduction is not without ambition.

Our assessment is that the public has the capacity to take responsibility to save energy but has yet to take greater action. While many of our actions discussed in this document aim at mobilising the public and specific stakeholder groups to do more, we must re-emphasise the criticality for the whole community to actually take action in the coming years to make a difference. We are prepared to tighten regulations with stakeholders and public support. For those who ask us to go further than this target, we urge them to collaborate with us to change community behaviour so that energy saving becomes second nature to individuals and businesses in Hong Kong.





# ABBREVIATIONS

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APEC	Asia Pacific Economic Cooperation
B5	5% biodiesel blend
BAU	Business as usual
BD	Buildings Department
BEC	Building Energy Codes
BEEFS	Buildings Energy Efficiency Funding Scheme
B(EE)R	Building (Energy Efficiency) Regulation
BIPV	Building integrated photovoltaic
BEEO	Buildings Energy Efficiency Ordinance
CFA	Construction floor area
CIC	Construction Industry Council
C&SD	Census and Statistics Department
CLP	CLP Power Hong Kong
CoP	Code of Practice on Energy Labelling of Products
DSD	Drainage Services Department
EAC	Energy Audit Code
ECF	Environment and Conservation Fund
EELPO	Energy Efficiency (Labelling of Products) Ordinance
EEO	Energy Efficiency Office
EMSD	Electrical and Mechanical Services Department
ESCO	Energy services companies
EU	European Union
FRT	First Registration Tax
GDP	Gross Domestic Product
GFA	Gross floor area
HEC	The Hongkong Electric Company Limited
HKEx	Hong Kong Exchanges and Clearing Limited
HKGBC	Hong Kong Green Building Council
HKHA	Hong Kong Housing Authority
HKHS	Hong Kong Housing Society
HKSTP	Hong Kong Science and Technology Park
IWMF	Integrated Waste Management Facility
JPN	Joint Practice Notes
kWh	Kilowatt-hour
MEELS	Mandatory Energy Efficiency Labelling Scheme
MTR	Mass Transit Railway
Lands D	Lands Department
LPG	Liquid petroleum gas
OWTF	Organic Waste Treatment Facility
OTTV	Overall Thermal Transfer Value
PGBC	Professional Green Building Council
Plan D	Planning Department
PLB	Public Light Buses
PV	Photovoltaic
R&D	Research and development
RE	Renewable energy
REA	Registered Energy Assessor
RTTV	Residential Thermal Transfer Value
SDC	Council for Sustainable Development
TJ	Terajoule
UCO	Used cooking oil
URA	Urban Renewal Authority
VEELS	Voluntary Energy Efficiency Labelling Scheme
WSD	Water Supplies Department
ZCB	Zero Carbon Building