ENERGY AND CARBON EFFICIENCY IN BUILDINGS AND INFRASTRUCTURE
Saving energy is not only possible but profitable. Energy saving is the most critical means for Hong Kong to continuously reduce carbon emissions where there will also be an air quality benefit.
Energy saving is important for all times. While we will continue to improve energy saving for new buildings, our main focus is on existing buildings and public infrastructure. Our 4T partnership with the major commercial and institutional building owners to upgrade existing buildings will also help stimulate a local energy efficiency market. Changing behaviour in energy use and management through partnership is also a priority.

Energy and Carbon Efficiency

Saving energy is not only possible but profitable. Energy saving is the most critical means for Hong Kong to continuously reduce carbon emissions where there will also be an air quality benefit. Design and technological development, good integrative management to save energy, and behaviour change make all the difference. Our ability to save energy may even help us to reduce our electricity generation capacity in the longer-term future.

Our Energy Saving Plan is the sister document to this chapter. It laid out an overall 40% energy intensity reduction target by 2025 using 2005 as the base. It represents the foundation from which we plan our energy saving work and from which we will stretch efforts to 2030 in carbon emissions terms.

This chapter covers the two major areas where Hong Kong can save energy – in our public and private sector buildings; and also our infrastructure many of which are in the public sector.

Energy Saving in Buildings

The major source of carbon emissions in cities is the building sector. Hong Kong’s buildings account for about 90% of the city’s electricity usage. Over 60% of our carbon emissions are attributable to generating electricity for our buildings. Thus, achieving energy saving in the buildings sector is our primary target for the short-and-long-term. Our strategies include:

- Government taking the lead in public sector buildings;
- Promote the ‘4Ts’ and work with stakeholders to energise continuous improvement; and
- Stimulate a new energy efficiency market so that building owners can access the capital they need to invest in energy efficiency.

New Buildings

Our Energy Saving Plan already discussed the importance of promoting green buildings by means of tightening standards, promoting rating through the BEAM Plus system giving economic incentive to new buildings (through granting gross floor area (GFA) concessions in development projects) and leading by example on the part of the Government for public sector buildings. Since 2010, over 880 projects with nearly 26 million square metres space were registered under BEAM Plus assessment, which represented about 40% of all new buildings completed up until September 2016.
Use Low Carbon Construction Materials

The construction industry consumes 40% of materials entering the global economy. The embodied carbon of construction materials used can contribute up to a significant portion of a building’s lifetime carbon footprint. It is thus important to minimise the carbon emissions through the prudent selection of low carbon construction products.

The government-industry supported Construction Industry Council (CIC) initiated the Carbon Labelling Scheme for Construction Products to provide verifiable and accurate information on the carbon footprint of construction products for the building design and construction sector. It currently covers four categories of carbon-intensive construction products: cement, reinforcing bars, structural steel and ready-mixed concrete. More product categories will be added.

The Hong Kong Green Building Council (HKGBC) devised a locally-based labelling scheme – HKGBC Green Product Accreditation and Standard (HK G-PASS) – to certify environmentally-friendly building materials, products and building services components. Since its launch in January 2015, HK G-PASS now covers 20 product categories to help stimulate the supply and demand of greener materials and products for the building sector.

At the same time, the Nano and Advanced Materials Institute (NAMI) and others are working on a range of materials relevant to the construction sector that are energy efficient (See Chapter 9).

Use low carbon construction materials.

- Use low carbon construction materials.
As to the direction going forward for new buildings, Development Bureau and Buildings Department (BD) will review the current arrangement where BEAM Plus registration is a prerequisite for a project to be eligible to GFA concessions for its green and amenity features, with a view to promoting green building in the private sector.

**Existing Buildings**

Our key focus going forward is existing buildings, since these represent the majority of buildings where the potential for energy saving is very significant. Figure 12 shows the electricity consumption of Hong Kong by sector. With 65% of the electricity being consumed by the commercial sector, which includes government and institutional buildings, this is where we must focus our early attention.

![Figure 12: Electricity Consumption by Sector, 2014](image)

**Figure 13**

*Percentage of electricity in commercial sector (includes government and institutional buildings)*

-Equivalent to 20% of total electricity use in Hong Kong
Figure 13 further shows the electricity consumption shares of the major existing public sector and commercial buildings groups. Together, these buildings represent 30% of the electricity used in the commercial sector or about 20% of the total electricity consumed in Hong Kong. They are our primary targets for energy saving in the coming years.

It makes sense for the Government and public sector to take the lead in energy saving in public sector existing buildings. Our efforts are combined with promoting green building since the two are intimately connected. We will study and consider how to do so.

ENERGY SAVING IN GOVERNMENT BUILDINGS AND SCHOOLS

Government buildings use about 54% of the electricity that the Government consumes. The Government set a 5% electricity consumption reduction target for government buildings in 2015 to be achieved by 2020. The Government would allocate no less than $500 million for departments to implement electricity saving projects or procure energy saving equipment starting from 2017. Moreover, Architectural Services Department (ArchSD) is considering how to combine energy saving potential at public schools with providing real-time data monitoring systems to students. Thus, such projects could include student participation to show how people’s behaviour could influence energy saving.

Kai Tak Fire Station, BEAM Plus (New Buildings) Platinum

Redevelopment of Kowloon Junior School, BEAM Plus (New Buildings) Certification
## REVIEW OF POSSIBLE PATHWAYS FOR LARGE EXISTING BUILDING STRATEGIES

<table>
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<tr>
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<th>Existing Policies</th>
<th>Going Forward by 2030</th>
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<tr>
<td><strong>ENERGY AUDIT</strong></td>
<td>Energy Audit Code (EAC) requires audit every 10 years for 4 types of building services installations of prescribed buildings</td>
<td>Require more frequent audit for air conditioning system for major energy use buildings</td>
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<td><strong>BENCHMARKING</strong></td>
<td>Buildings Energy Efficiency Ordinance requires disclosure of Energy Utilization Index (EUI)</td>
<td>Voluntary sharing of data moving to mandatory system</td>
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<tr>
<td><strong>RETRO-COMMISSIONING</strong></td>
<td>No requirement and not a common practice yet</td>
<td>Promote good practice in public sector buildings and co-learn with private sector and professionals</td>
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<tr>
<td><strong>RETROFITTING</strong></td>
<td>EAC audit provides recommendations but no requirement to carry them out</td>
<td>Promote recommendations to be carried out</td>
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<tr>
<td><strong>GREEN BUILDING STANDARD</strong></td>
<td>A new BEAM Plus rating with the option of selective assessment in addition to comprehensive assessment has been developed for existing buildings</td>
<td>Encourage building owners to consider using the new rating when retro-fitting buildings</td>
</tr>
<tr>
<td><strong>BEYOND COMPLIANCE</strong></td>
<td>Created ‘Dialogue Platform’ for public-private sector collaboration</td>
<td>Continue to energise energy saving in existing buildings</td>
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As noted in the Energy Saving Plan, the Secretary for the Environment created a Dialogue Platform to collaborate with the key stakeholders of the building sector. The first focus of attention has been the owners and managers of the commercial sector, which includes institutional buildings. This group of buildings consists of the heaviest electricity users (Figure 13).

Through several rounds of gatherings and information exchange with the Government and each other, a broad consensus has been reached for the building sector to partner under the voluntary 4T framework to reduce electricity consumption on an on-going basis. The partnership includes:

- Setting energy saving targets according to a timeline that would eventually dovetail with that of the Paris Agreement reporting timeline (as per Figure 2);
- Carrying out building energy audits and implementing recommendations;
- Conducting retro-commissioning periodically;
- Procuring green products that would help to save energy;
- Out-performing the Building Energy Code for new buildings and major retrofit where possible;
- Applying BEAM Plus rating or equivalent for new and existing buildings; and
- Joining the Government’s Energy Saving Charter (see Chapter 9).

The outcome of these energy saving efforts has also been agreed for both the public and private sector buildings. This will add transparency to the energy saving achievements of Hong Kong’s buildings. This partnership will be on-going and we welcome more stakeholders to join. While it is early days, we believe it has the potential to strengthen the capacity of Hong Kong to save energy. It will also enable building developers and managers to co-learn and share best practices, as well as professionals in building design, construction and management to upgrade their knowledge and skills continuously.
4T PARTNERSHIP BETWEEN GOVERNMENT AND BUILDING SECTOR

TOGETHER

HONG KONG GOVERNMENT

Showcase Green Building

5 YEARS
Plan, set TARGET and TIMELINE

Retro-commissioning

Out-perform Building Energy Code (BEC) for new buildings

Audit and implement energy management opportunities through retrofit

Green procurement

BUILDING SECTOR

TRANSPARENCY
The Government is working on retro-commissioning and retrofitting projects of government buildings. Property developers and managers have also started to issue green bonds that include retrofitting existing buildings (see Chapter 9). Moreover, the 4Ts partnership with public sector bodies, as well as with the private property sector will also help to stimulate energy efficiency market in the immediate years ahead. We believe that our partnership with HKGBC and the built environment sector will take energy saving and building transformation for existing buildings from a secondary activity to being mainstream in the next decade.

Moreover, in order to maximise the energy saving potential of existing buildings, we need to adopt a multi-faceted approach on the basis of a thorough cost-benefit analysis to determine the optimal combination of energy saving measures appropriate to each particular building. This can be achieved by the engagement of energy experts to compile and analyse energy data and to conduct energy assessment with a view to recommending a basket of appropriate energy saving measures, which may include retrofitting, retro-commissioning and green management measures, etc. Retro-commissioning is a cost-effective systematic process to periodically check an existing building performance. The process identifies operational improvements that can save energy and thus lower energy bills. EMSD has commissioned a consultancy to develop technical guidelines on retro-commissioning, and engaged different providers to conduct pilot retro-commissioning for six existing government buildings. The technical guidelines on retro-commissioning are expected to be finalised for publication in mid-2017, and the results of the pilot project for demonstration purposes will be released at the same time, which will be useful for our ongoing partnership with other organisations.
ENERGY SAVING IN INFRASTRUCTURE

Government infrastructure uses about 46% of all the electricity that the Government consumes. All relevant departments will work on improving their energy performance.

As could be seen from Figure 14, WSD and DSD use the largest portion of electricity among government infrastructure (almost 75%) because their services require constant pumping and thus need significant energy. As such, they have on-going plans to maximise energy efficiency in their treatment works and pumping stations, as well as to replace or renovate aged facilities with highly energy efficient ones and optimise their operations etc. Through saving energy and generating RE, as per Chapter 4, WSD and DSD can improve their overall energy performance and reduce their carbon footprint even as population increases. As for street lighting, with the development of LED technology, HyD can use low-to-medium wattage LED lights in appropriate parts of the public lighting system to save energy. Similarly, LCSD also plans to deploy available resources in phases to implement energy saving projects such as replacing mercury-halogen and discharge lamps with LED lights at the venues that it manages.

Wah Fu Salt Water Pumping Station

Saving Energy in Sea Water Supply for Flushing

Wah Fu Salt Water Pumping Station is the first salt water pumping station equipped with variable speed pumps in Hong Kong. Despite higher cost of equipment, variable speed pumping at this site can help optimise machine operation in accordance with the fluctuating demand and reduce the energy consumption up to 20%.
REDUCING ENERGY IN AIR-CONDITIONING

Among the various electricity uses, air-conditioning is the largest portion (about 30%) of consumption in hot and humid Hong Kong. Saving energy here makes a lot of difference to the final outcome. EMSD’s fresh water cooling tower scheme and the phased implementation of the district cooling system at Kai Tak Development represent very major effort.

**Fresh Water Cooling Towers (FWCT)**
Most existing commercial buildings use the traditional air-cooled air-conditioning systems. However, water-cooled air-conditioning system is more energy efficient, using up to 20% less electricity even though it requires some water for cooling purpose. Since the launch of the FWCT Scheme in 2000, more than 2,000 new and replacement fresh water cooling tower projects have been completed by end-2016 resulting in an annual saving of 410 million kWh. The Government will continue to promote the wider use of FWCT, including an increase in designated areas for adoption of FWCTs. The number of designated areas has increased from 6 in 2000 to 114 as of 2016.

**District Cooling Systems (DCS)**
DCS is a centralised energy saving infrastructure. It is 35% more efficient than the conventional air-cooled air-conditioning system. The implementation of DCS at Kai Tak Development (KTD) to provide more energy efficient air-conditioning services for all non-domestic buildings is the first of its kind in Hong Kong. The annual saving in electricity consumption upon completion is estimated to be 85 million kWh. The Government is exploring the feasibility of proposed DCS in a number of areas, namely the Topside Development of Hong Kong Boundary Crossing Facilities Island of the Hong Kong-Zhuhai-Macao Bridge, Tung Chung New Town Extension, as well as Kwu Tung North and other new development areas (NDAs).

![District Cooling System at Kai Tak Development](image)

**DISTRICT COOLING SYSTEM**

1. **Seawater Intake**
2. **Central Chiller Plant**
3. **Underground water pipe network**
4. **Heat Exchangers**
5. **User buildings**
Changing Behaviour and Energy Saving

Buildings, equipment, electrical products and systems, including smart meters are operated by inhabitants of buildings. Promoting energy saving to them can have a major impact on the overall outcome. One of the most effective regulatory means is the Mandatory Energy Efficiency Labelling Scheme (MEELS), which provides energy use information for the major electrical appliances. People can choose to buy the more energy efficient products, while the Government continues to tighten standards of these products and to add more products to the scheme.

Beyond MEELS, we are partnering with businesses, social enterprises and non-profit organisations specialising in promoting energy saving services to ride on their expertise to extend awareness. Their innovative ways are being adopted by building developers and managers, institutional bodies and universities to help building inhabitants to reduce energy use.