Energy Management in Government Buildings of Hong Kong

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Abstract
Buildings are major energy consumers, which contribute to about 90% of the electricity consumption in Hong Kong. The Electrical and Mechanical Services Department (EMSD) of the Hong Kong Special Administrative Region Government (HKSARG) plays an important role in both regulatory side and implementation side in promoting and enforcing energy efficiency related legislation in Hong Kong.

Headquarters and Office buildings of a HKSARG disciplinary force, which operate round the clock, are selected in this paper to demonstrate the implementation of smart use of energy in buildings. In the past 5 years, over 70 numbers of energy-retrofit projects and energy audits have been implemented resulting in annual electricity saving of over 20 million kWh in these buildings. These projects/audits also help the disciplinary force to achieve an overall 10% energy consumption reduction in the past five years in these buildings.

Keywords
Energy efficiency, Energy management, Energy-retrofit project, Energy audit

1. INTRODUCTION

Energy is crucial to the development of modern society. For a metropolis like Hong Kong, energy is of fundamental important to all economic activities, therein 54% of total energy end use in Hong Kong is in the form of electricity while about 90% of the electricity is consumed in buildings. The total electricity consumption remains on a rising trend in past years.

To effectively promote and enforce energy efficiency related legislation in Hong Kong, the EMSD plays an important role in both regulatory side and implementation side.

2. REGULATORY ROLE

The Energy Efficiency Office (EEO) was established in 1994 under EMSD to promote energy efficiency and conservation in Hong Kong. The EEO is currently responsible for enforcing the Buildings Energy Efficiency Ordinance, (Cap. 610) (BEEO) that has come into full operation since Sep 2012.

The roadmap of the development and enforcement of the BEEO is shown in Figure 1.

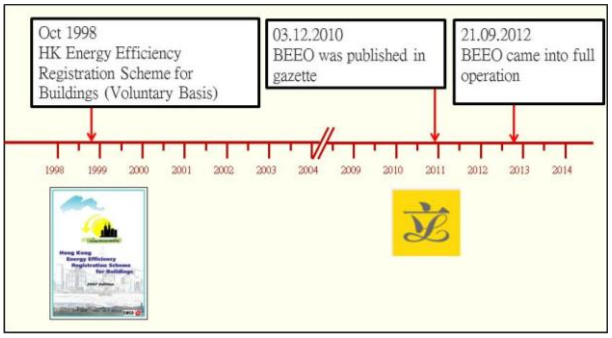

Fig. 1 The roadmap of thedevelopment and enforcement of BEEO

The BEEO stipulates energy efficiency standard requirements of a building both for its design and the means to evaluate its energy efficiency performance in operation. Under the BEEO, there are two codes of practice, namely Building Energy Code (BEC) (Figure 2) and Energy Audit Code (EAC) (Figure 3), for compliance.

2.1 Building Energy Code (BEC)

For building design, the BEC sets out the technical guidance and details in respect of the minimum energy efficiency requirements governing the building services installations defined in the BEEO. It is applicable to the prescribed building services installations of a building or a unit in that building, belonging to one of the categories of buildings prescribed in Schedule 1 of the BEEO.

The BEC requires the compliance with its design requirements in respect of the design of 4 key types of building services installations in newly constructed buildings and major retrofitting works in existing buildings. The design requirements cover lighting installation, air-conditioning installation, electrical installation and lift & escalator installation. All four sets of design requirements shall be complied with or, alternatively, a performance-based approach can be adopted for its compliances.

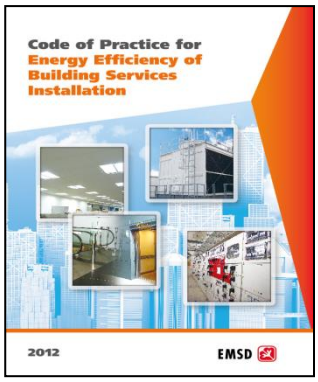

Fig. 2 Code of Practice for Energy Efficiency of Building Services Installation

2.2 Energy Audit Code (EAC)

The BEEO also requires energy audit to be carried out, according to the EAC, for central building services installations in commercial buildings and commercial portions of composite buildings every 10 years. After the energy audit, the building's energy utilization index (EUI, in MJ/m^2/annum & kWh/m^2/annum) that reflects the building's energy usage intensity or energy performance will be evaluated. According to the BEEO, the EUI information is required to be exhibited in a conspicuous position at the main entrance of the building.

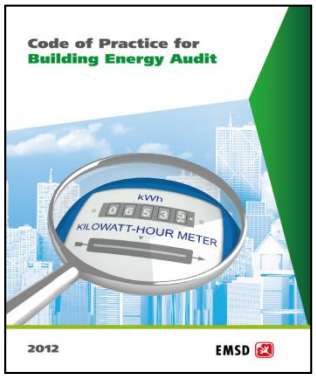

Fig. 3 Code of Practice for Building Energy Audit

3. IMPLEMENTATION ROLE

Apart from the regulatory role, the EMSD also acts as the maintenance services provider of electrical and mechanical installations for the government bureaux and departments (B/Ds). In partnering with B/Ds, the EMSD also provides necessary assistance to help implementation of energy saving initiatives. The administration had set a target to reduce 5% total electricity consumption, under comparable operating conditions, of government buildings during the period from fiscal year (FY) 2009/2010 to FY2013/14. To meet this target, an energy saving "SMART" programme has been developed and implemented in the venues of a disciplinary force.

3.1 Overview of "SMART" Programme

All the components of the "SMART" programme are depicted in Figure 4. These components are the sharing housekeeping experiences, monitoring energy performance, assessing energy use, renewable energy, and technologies and applications. With implementation of the "SMART" programme, the department can smartly use the energy in their buildings, which are operated round the clock.

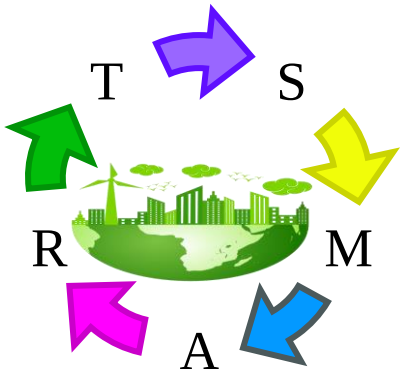

Fig. 4 "SMART" Programme

S - Sharing housekeeping experiences
M - Monitoring energy performance
A - Assessing energy use
R - Renewable energy
T - Technologies and applications

"SMART" programme refers to reducing energy consumption through efficient energy use, conservation energy and use of renewable energy (RE)

3.2 Sharing Housekeeping Experiences

Housekeeping is one of the low cost for energy-saving measures which can be defined as an excellent starting point for improving the methodology of operation. Implementation of housekeeping measures is relatively easy and fast and the cost is usually low. To share the housekeeping experiences, EMSD organized seminars and conducted more than 30 energy walk-throughs for sharing energy saving tips. Some common energy saving tips shared are as follows :

- Set and maintain air-conditioned room temperature at 25.5 deg C in summer;
- Set office equipment and computers to energy saving mode;
- Switch off or unplug at wall socket outlets and extension cables for office equipment and computers after office hours to reduce standby power consumption;
- Procure energy efficient office equipment with recognition energy labels and appliances with Grade 1 energy labels; and
- Arrange a last-man-out to check and switch off the power source to all equipment and system that are not in use when leaving office,

3.3 Monitoring Energy Performance

A Steering Committee on Green Management was set up to oversee the formulation and implementation of energy saving matters. It serves as the focal point for monitoring energy performance for the disciplinary venues. The committee further assigned green managers at various formations to monitor the energy performance of their own venues, to identify opportunities to reduce energy consumption and implement the energy saving measures. It also coordinates and oversees the energy audit, energy consumption analysis, energy management opportunities and energy walk-through. In the past five years, more than twenty energy audits and forty energy walk-throughs had been conducted.

Fig. 5 Steering Committee on Green Management

3.4 Assessing Energy Use

The energy use of the disciplinary building is assessed. The distribution of electricity consumption for different installations is derived for analysis. It provides an important data to formulate the energy saving opportunity. As shown in Figure 6, the air-conditioning plant accounts for about 45% annual electricity consumption of a disciplinary building. Replacement of old chillers can contribute more saving in electricity consumption.

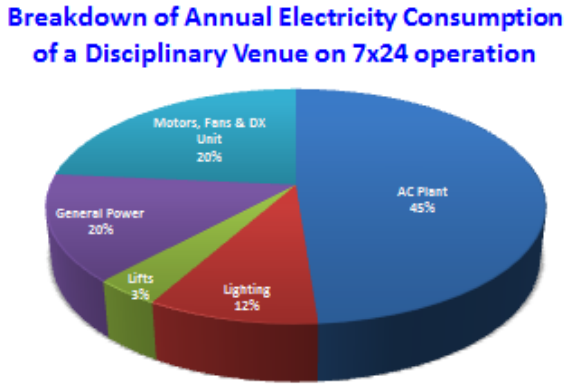

Fig. 6 Breakdown of Annual Electricity Consumption of a Disciplinary Venue

3.5 Renewable Energy

Adoption of RE technologies is also explored for disciplinary buildings as one of the energy saving opportunities. Among various RE technologies, solar street lighting and solar water heating system are considered as reasonably practical for implementation. The installations are shown in Figure 7 & 8.

Fig. 7 LED Solar Compound Lighting

Fig. 8 Solar Water Heating System

3.6 Technologies and Applications

With the rapid advancement in technologies, the EMSD has explored the latest energy efficient technologies for application in disciplinary buildings. Oil free chiller provides higher coefficient of performance (COP), in particular, under the part-load conditions. Replacement of old chillers with higher COP oil free chillers has been carried out for disciplinary buildings to achieve more energy saving (Figure 9).

Fig. 9 New Air-cooled Oil Free Chillers at a Disciplinary Building

Apart from replacing old chillers with oil free chillers, other energy saving projects are also completed in the past 5 years to strive for additional energy savings. Some of these projects include:

- Replacing CRT monitors with LED monitors for security surveillance systems;
- Replacing T8 and T12 fluorescent tubes with energy-efficient T5 fluorescent tubes;
- Installing of passive infrared motion sensors for lighting control in public areas (Figure 10);
- Carrying out de-lamping exercise in some public areas;
- Applying solar control window films; and
- Installing carbon monoxide sensors for demand control of car park ventilation.

Fig. 10 Motion Sensor for Lighting Control

For replacement of old chillers with high efficiency oil free chiller, the capital cost is increased by about 30% to 40%. The efficiency gain of the new oil free chiller is around 30%. For round the clock operation of disciplinary venue, the electricity saving on the new chiller is estimated at 30%. The payback year is round 5 to 7 years.

4. ACHIEVEMENT IN ENERGY SAVING

The annual electricity consumption for the disciplinary force in past years is shown in Figure 11.

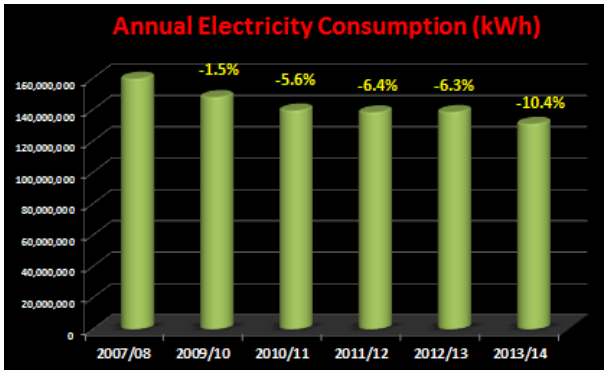

Fig. 11 Annual Electricity Consumption in past 5 years

With the implementation of housekeeping rules and completion of various energy saving projects, the annual electricity consumption by the end of FY2013/14 achieved a saving of 10.4% when compared with the baseline in FY2007/08.

5. CONCLUSION

Both the regulatory side and implementation side are prime importance for energy saving in buildings in Hong Kong. The enforcement of BEEO has not only laid down legitimately the minimum energy efficiency standard requirements for buildings in Hong Kong, but it also serves as one of the key drivers in reducing Hong Kong's overall electricity demand in striving for a low-carbon and livable built environment. EMSD will continue to regularly review and tighten the standards.

On the service delivery side, this paper presented a case in which EMSD has assisted a disciplinary force to develop and implement the "SMART" programme. The programme has effectively helped the disciplinary force to meet the 5% total electricity saving target in the past 5 years ending in FY2013/14. The HKSARG has recently set next round of 5% electricity saving target in the coming 5 years. To meeting this challenging target, EMSD would continue to partner with their clients to explore opportunities to further enhance energy saving performance.

References

HKSAR Government Buildings Energy Efficiency Ordinance (Cap. 610)
http://www.beeo.emsd.gov.hk/

EMSD Code of Practice for Energy Efficiency of Building Services Installation 2012

EMSD Code of Practice for Building Energy Audit 2012

HKSAR Government Energy Efficiency (Labelling of Products) Ordinance (Cap. 598)
http://www.energylabel.emsd.gov.hk/en/about/background.html

EMSD Code of Practice on Energy Labelling of Products 2014

Energy land, EMSD,
http://www.energyland.emsd.gov.hk/en/home/index.html