Legislative Council Panel on Housing

Energy Saving Initiatives in New Public Housing Developments

PURPOSE

This paper is to brief and update Members on the energy saving initiatives implemented in new public housing developments (PHD) by the Hong Kong Housing Authority (HA).

BACKGROUND

2. The HA is committed to implementing energy saving measures in new PHD to reduce electricity consumption and carbon footprint. In February 2013, we briefed Members on the energy saving initiatives implemented in new PHD and the way forward for enhancing energy performance of the HA's buildings (vide Legislative Council (LegCo) Paper No. CB(1)516/12-13(03)).

3. In the past two years, the HA has been strengthening various energy saving initiatives and achieved remarkable results. As compared with 2011/12, the annual electricity consumption in communal areas of a typical public housing domestic block has been successfully reduced by 10% in 2014/15 (see **Annex**).

ENERGY SAVING INITIATIVES

4. The HA's primary principle is to adopt passive design for all new PHD and make the best use of natural lighting and ventilation, thereby reducing the use of energy for artificial lighting, mechanical ventilation and air conditioning as far as possible. Coupled with more greening in new PHD, we have reduced urban heat island effect and air temperature, leading to less cooling load for air conditioning in the neighbourhood. These measures all help reduce energy consumption both for PHD tenants as well as the HA.

5. In terms of energy use for communal facilities in PHD, about 55% is for lighting, 20% for lifts, and 25% for other services including water pumps, fire services, ventilation and security system installations. The latest energy saving initiatives implemented in new PHD by the HA are summarised below –

(a) Energy Saving System

(i) Lighting

Lighting is the most electricity consuming system in domestic block and hence it has all along been the HA's main focus in terms of energy saving. In addition to the optimisation of illumination levels in communal areas, utilisation of daylight [1] and adoption of energy-efficient electronic ballasts and T-5 fluorescent tubes, the HA has implemented two-level lighting control system [2] and completed a large-scale installation of LED bulkheads for trial in recent years.

Since December 2008, the HA has implemented the two-level lighting control system for lift lobbies, corridors and staircases in the design of new PHD to fulfill the requirement of increased illumination level for the visually impaired under the Building Department's Design Manual: Barrier Free Access (2008), and at the same time, to minimise electricity consumption through adopting the lighting-on-demand principle. We have assessed the energy saving performance of the first batch of projects [3] installed with two-level lighting control systems. The result shows that the above control systems can save energy by more than 30% on average.

In 2013, we have completed a large-scale installation of LED bulkheads for trial in one of the domestic blocks of Kai Ching Estate[4] to evaluate the product performance. The performance of the installed LED bulkheads is found to be satisfactory, and as compared with conventional bulkheads using compact fluorescent lamps, the energy saving is more than 40%.

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[1] Utilisation of daylight is optimised by means of passive design and employment of photo sensor / time switches to control the operation of lighting at open corridors or corridors with fenestrations to suit the daylight periods throughout the year.

[2] For details, please refer to LegCo Paper No. CB(1)1909/09-10(01).

[3] The first batch of projects includes Lower Ngau Tau Kok Estate Phase 1, Shek Kip Mei Estate Phases 2 and 5, Un Chau Estate Phase 5 and Tung Tau Estate Phase 9. These projects were completed between December 2011 and April 2012.

[4] Kai Ching Estate is a pioneer public rental housing estate equipped with the latest energy saving initiatives, including two-level lighting control system, LED bulkheads, gearless lift drive, lift regenerative power system and grid-connected PV system. The estate was completed in April 2013 and comprises more than 5 000 domestic flats.

(ii) Lift

Lift is the second-most electricity consuming system in domestic block. While the HA has been adopting energy-efficient variable voltage variable frequency (VVVF) type lift power systems for many years, since 2013, the HA has taken a further step to adopt state-of-the-art lift technologies, viz. lift regenerative power for large lift motors and gearless lift drive, to save more energy. Gearless lift drives coupled with VVVF power systems can reduce energy consumption by more than 10% as compared with conventional geared lift drive systems.

Lifts equipped with regenerative power feature can capture and condition the regenerated electricity [5] for feeding directly into the power grid for immediate consumption by communal facilities. The amount of energy saving arising from lift regenerative power varies with the lift traffic pattern. We have assessed the lift systems in Kai Ching Estate and found that the amount of energy regenerated is generally up to 20% to 30% of the energy consumed by the lifts.

(iii) Renewable Energy

Since May 2011, the HA has been implementing grid-connected photovoltaic (PV) system in the domestic blocks of new public rental housing estates to provide at least 1.5% of the communal electricity. Mono-crystalline silicon PV panels have generally been adopted due to their higher solar conversion efficiency. In Kai Ching Estate, we have recorded an average annual electricity generation of about 1 090 kWh per kWp capacity, surpassing the estimated amount by more than 5%.

To fully utilise the improved and emerging PV technologies, we have also tried out other types of commercially available PV panels in Yau Lai Estate and Tak Long Estate to evaluate their performance. These include poly-crystalline silicon, amorphous silicon and copper indium gallium diselenide (CIGS) thin film PV panels.

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[5] A lift equipped with lift regenerative power feature will act as a generator to regenerate electricity under light load up and heavy load down traffic.

(b) Energy Management Tools

(i) Energy Efficiency Registration Scheme for Buildings (EERSB)

The HA has been a pioneer in achieving building energy efficiency. The Building Energy Efficiency Ordinance came into force in September 2012. Date back to early 2000, the HA adopted the non-statutory Building Energy Codes under the voluntary EERSB in the design of new PHD. Up to December 2014, more than 500 Building Energy Certificates have been awarded by the Electrical & Mechanical Services Department in recognition of good energy performance of the HA's buildings.

(ii) Energy Management System (EnMS) to ISO 50001

The HA has implemented EnMS [6] for the design of all domestic blocks in new PHD since December 2011. Up to December 2014, there have been 109 domestic blocks with Energy Estimations endorsed by the HA. As compared with the Energy Baseline in the EnMS, it is estimated that a reduction in communal energy consumption by 14% can be achieved and will bring about a total annual electricity saving of around 6 227 000 kWh for these domestic blocks.

(iii) Carbon Emission Estimation (CEE)

Since February 2011, the HA has implemented CEE[7] at design stages for all domestic blocks in new PHD. Up to December 2014, there are 117 domestic blocks with CEE endorsed by the HA. We have achieved an estimated reduction in carbon emission of around 632 000 tonnes for the whole life cycle of these domestic blocks with design building life span of 100 years, representing an average of 12% reduction as compared with the baseline figure.

[6] The EnMS was developed based on the ISO 50001 energy management best practice framework. The HA had rolled out the EnMS for the design of new public housing in December 2011 and obtained the first ISO 50001 certificate for residential building design in Hong Kong in June 2012.

[7] The CEE model is a design verification tool to gauge the overall performance of a PHD in terms of carbon emission throughout the life cycle of the buildings. It consists of six aspects, namely (i) materials consumed during construction, (ii) materials for building structure, (iii) communal building services installations, (iv) renewable energy, (v) trees planting, and (vi) demolition.

(c) Awareness of Energy Saving

With a view to arousing tenants' awareness of environmental conservation, we have developed a Smart Meter Monitoring and Energy Information Display System (SMM&EIDS) [8] for implementation in new PHD. According to the resident survey for Kai Ching Estate, more than 60% of the residents are aware of the new system, out of which more than 75% consider the system helpful in raising tenants' awareness of the importance of environmental conservation.

OVERALL PERFORMANCE

6. Implementation of the latest initiatives in **paragraph 5(a)** above can bring about substantial energy saving and hence carbon reduction. Taking Kai Ching Estate as an example, the total annual electricity saving achieved through two-level lighting control, LED bulkheads, gearless lift drive, lift regenerative power system and grid-connected PV system is about 240 000 kWh for the domestic block concerned, which equals to a reduction of 168 tonnes carbon emission and 25% of communal electricity consumption at 2000/01 level. Together with the other energy saving initiatives implemented earlier, the overall communal electricity saving for a typical domestic block is around 53% (see **Annex**).

COST EFFECTIVENESS

7. The HA, being a major public sector developer of residential buildings in Hong Kong, plays a key role in reducing energy use and carbon intensity to echo with the carbon reduction target set by the Government on one hand, and must be prudent in evaluating and implementing the various energy saving initiatives to strike a balance between reaping environmental benefits and rational use of the HA's funds on the other hand, in order to achieve value for money.

[8] The SMM&EIDS comprises measuring equipment, display panels as well as processing and network devices, etc. The measuring equipment includes smart electrical meters and digital flow meters which measure the operational parameters of electrical and water supply systems. The display panels are installed in the ground floor lobbies of domestic blocks to show tenants information about the average electricity, water and gas consumption by tenants, communal energy consumption, electricity generated by PV systems and educational broadcast of energy saving and environmental conservation information.

8. According to the electricity saving achieved in Kai Ching Estate as a result of the implementation of various energy saving initiatives detailed in **paragraph 6** above, the corresponding saving in annual electricity cost can well cover the amortised additional capital and maintenance costs of the initiatives over the service life of the systems or equipment[9].

WAY FORWARD

9. Reliability and durability of energy saving equipment would have direct bearing on whether their service life can last as anticipated, so that forecast for electricity cost saving could be realised to offset the additional capital and maintenance costs involved. As the qualities of LED lighting products available in the market vary considerably, the HA has collaborated with the local industry to spearhead a product certification scheme[10] to ensure their reliability and durability for mass application. We are planning to adopt LED bulkheads as a standard lighting provision for the lift lobbies, corridors and staircases of domestic blocks in new PHD when there is adequate supply of quality certified products in the market.

10. Considering the current status of accreditation application by certifying bodies and product certificate application by LED lighting manufacturers, we anticipate that mass application of LED lighting can be rolled out for building contracts due for tender in late 2015. With the mass application of LED bulkheads, we anticipate to further reduce 10% of electricity consumption in communal areas of the domestic blocks in new PHD from 2014/15 to 2016/17 (see **Annex**).

11. In future, the HA will continue to explore every practicable means to further enhance the energy performance of buildings in new PHD.

12. Members are invited to note the content of this paper.

Transport and Housing Bureau
April 2015

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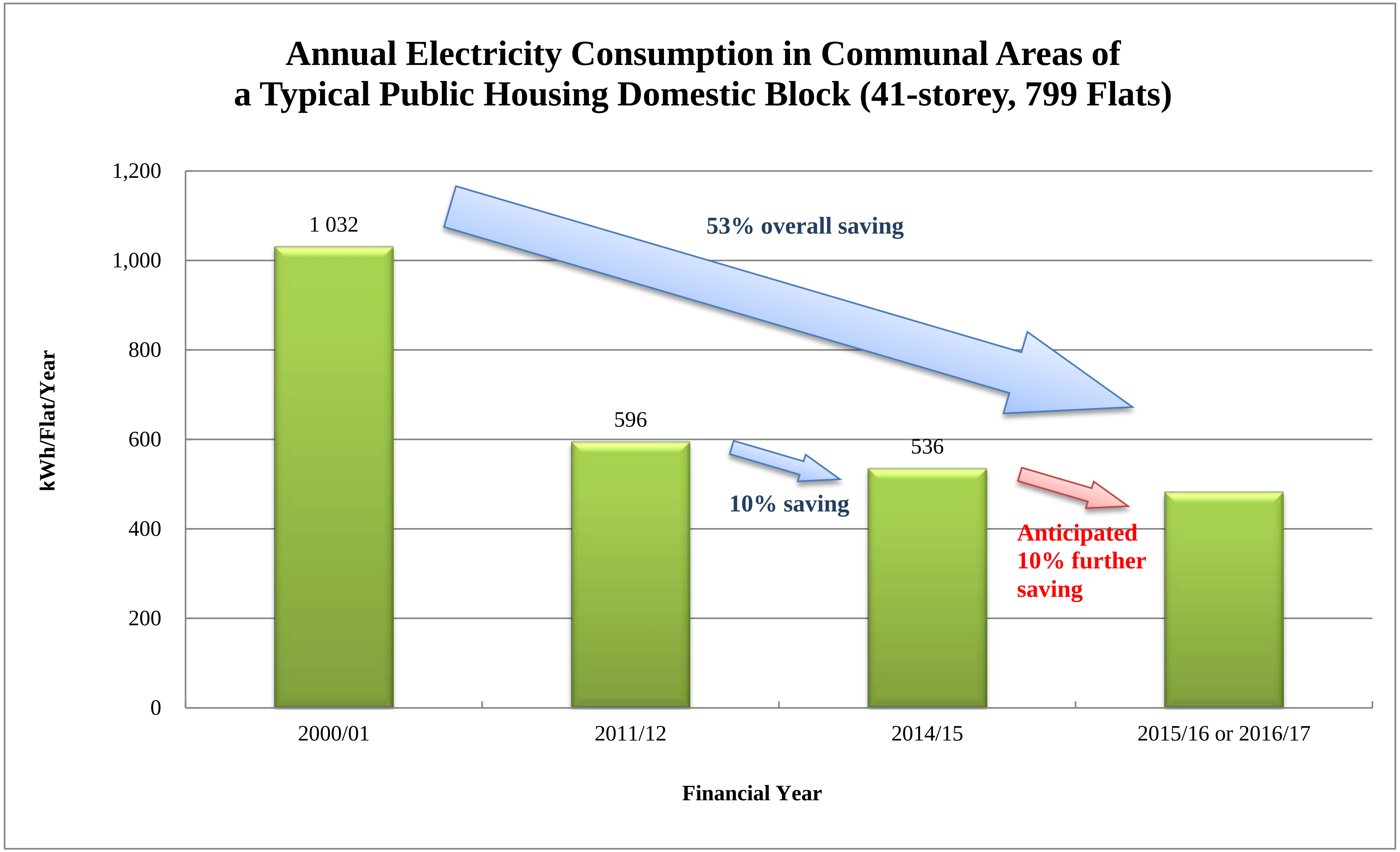
9 Based on the annual electricity saving of 240 000 kWh for the concerned domestic block in Kai Ching Estate due to various energy saving initiatives (**paragraph 6** refers), the cost saving is about $264,000 at $1.10 per kWh electricity. The amortised additional capital and maintenance cost of the initiatives over the service life of the systems or equipment is about $218,000 each year.

10 The product certification scheme for LED lightings (including bulkheads) was launched by the Hong Kong Electronic Industries Association in late 2013 to enhance the upstream quality control of LED lighting products. All certifying bodies shall be accredited by the Hong Kong Accreditation Service.

Annex



Annual Electricity Consumption in Communal Areas of
a Typical Public Housing Domestic Block (41-storey, 799 Flats)
1,200
1,000
800
600
400
200
0
kWh/Flat/Year
1 032
596
536
53% overall saving
10% saving
Anticipated
10% further
saving
2000/01
2011/12
2014/15
2015/16 or 2016/17
Financial Year