

## **STANDBY POWER IN PRIVATE OFFICES – A POTENTIAL FOR ELECTRICITY REDUCTION**

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### **ABSTRACT:**

Standby power is electrical power consumed by appliance when it is in the lowest possible electricity consuming mode or not performing their primary functions, but plugged in to a source of power and ready to be used.<sup>1</sup> It is not uncommon that the standby power consumes about 10% of the electricity in offices, and is an area where much can be performed to reduce the scale of consumption. So far, the electricity consumption per capita of the world shows an upward trend as the public is looking for improvement in life quality, and convenience in workplace. The Energy Efficiency Office of Electrical & Mechanical Services Department has completed a pilot study in 2007 on the standby power consumption in private offices<sup>2</sup> in the Territories to investigate the consumption pattern of the commonly used office equipment. This paper will focus/report on the findings and experience gained upon conducting the survey. The study will provide an insight into the consumption pattern and assist the Hong Kong government to formulate policy in energy saving initiatives (reduction of standby power to reduce electricity consumption from consumer side).

**KEYWORDS:** Standby power; Private office; Energy saving

### **1. INTRODUCTION**

The total energy and electricity consumed by end-uses in Hong Kong are rising in the year 1997 to 2006<sup>3</sup> (Figure 1). The total end-use energy and electricity consumed in Hong Kong in year 2006 are respectively 288,158 TJ and 145,204 TJ as compared to corresponding figures of 262,305 TJ and 116,061 TJ in year 1997.

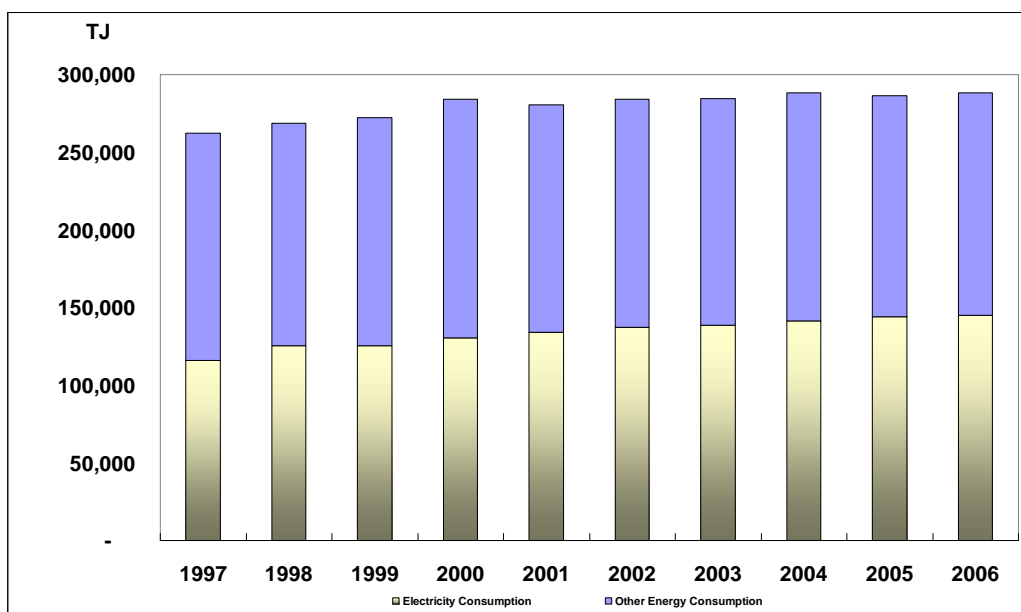
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<sup>1</sup> Definition from International Energy Agency (IEA)

<sup>2</sup> Government offices were excluded

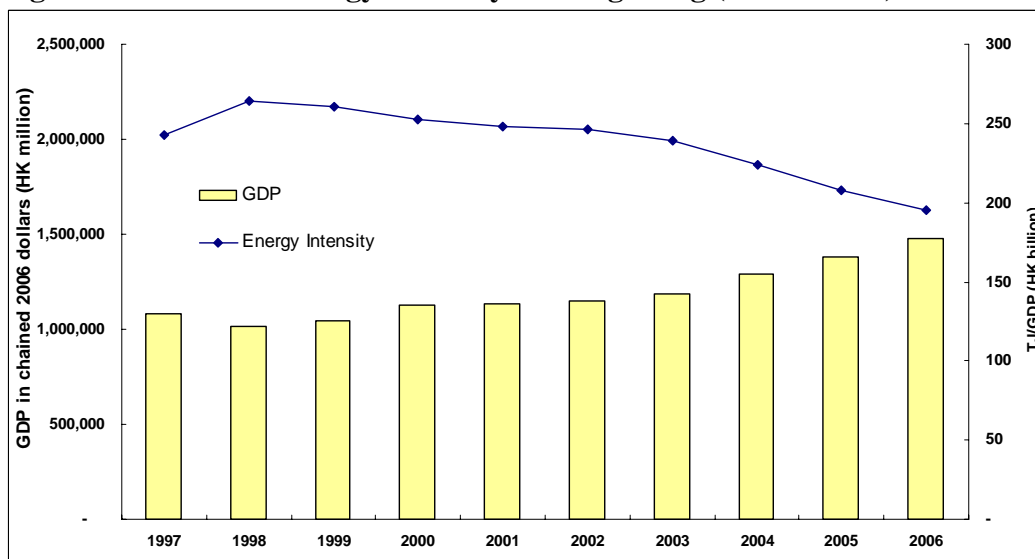
<sup>3</sup> Data extracted from Hong Kong Energy End-use Data 2008

**Figure 1 - Energy Consumption in Hong Kong (1997 – 2006)**



The consumption of energy is closely related to the derivation of economic products and sustaining our quality of life. In the same period of time, with an increase in the commercial activities in Hong Kong, the amount of energy consumed increases with GDP generally in a proportional manner despite the energy intensity<sup>4</sup> has improved showing a decreasing trend (Figure 2). The energy intensity in year 1997 and 2006 are 242 and 195 TJ per GDP HK billion dollar respectively.

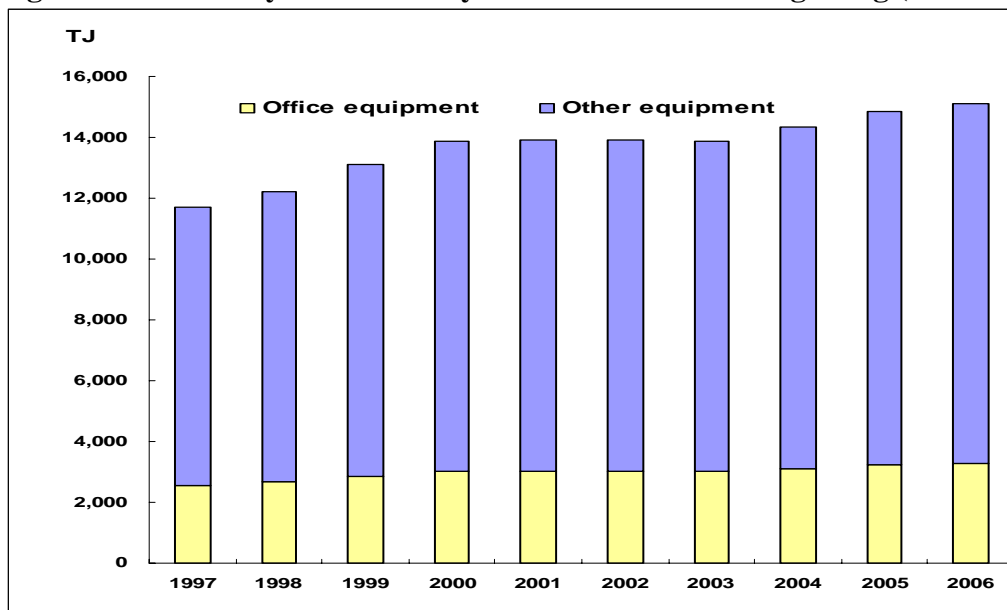
**Figure 2 - GDP and Energy Intensity in Hong Kong (1997 – 2006)**



During the same period of time, the amount of electricity consumed by the private offices has increased from 11,686 TJ to 15,085 TJ (Figure 3).

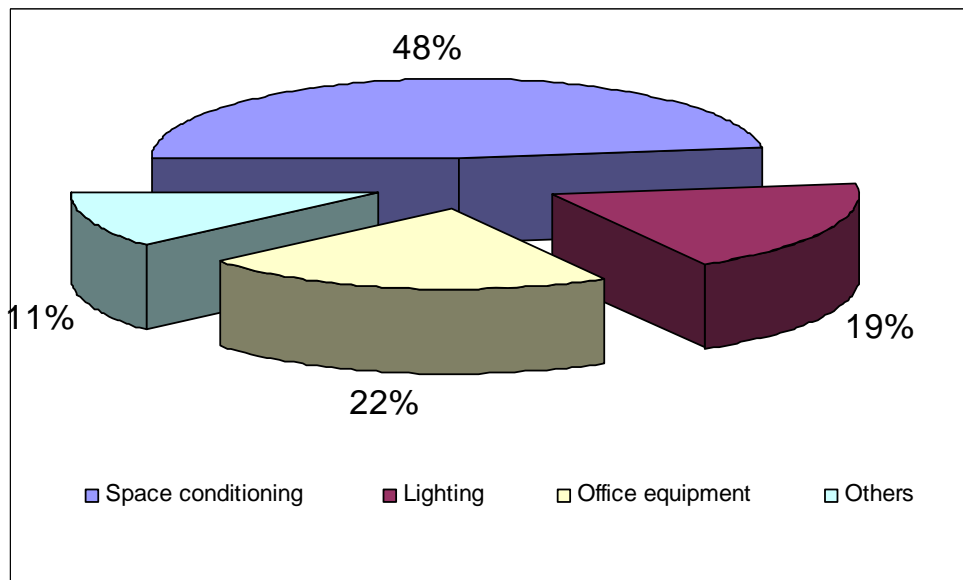
<sup>4</sup> Energy intensity as used in this context refers to the amount of energy consumed per unit of GDP produced in the same period of time

**Figure 3 - Electricity Consumed by Private Offices in Hong Kong (1997- 2006)**



The electricity was consumed primarily by space conditioning, lighting and office equipment. The electricity consumed by office equipment in the private offices in Hong Kong in year 1997 and 2006 is 2,548 and 3,291 TJ (Figure 3) respectively, constituting around 22% of the energy consumed by the private offices in both years (Figure 4).

**Figure 4 – Composition of Energy Consumed by Private Offices (1997 and 2006)**



This paper looks into energy consumption pattern in the private office environment in Hong Kong and estimates the saving potential that can be achieved with better energy management practices implemented after office hour.

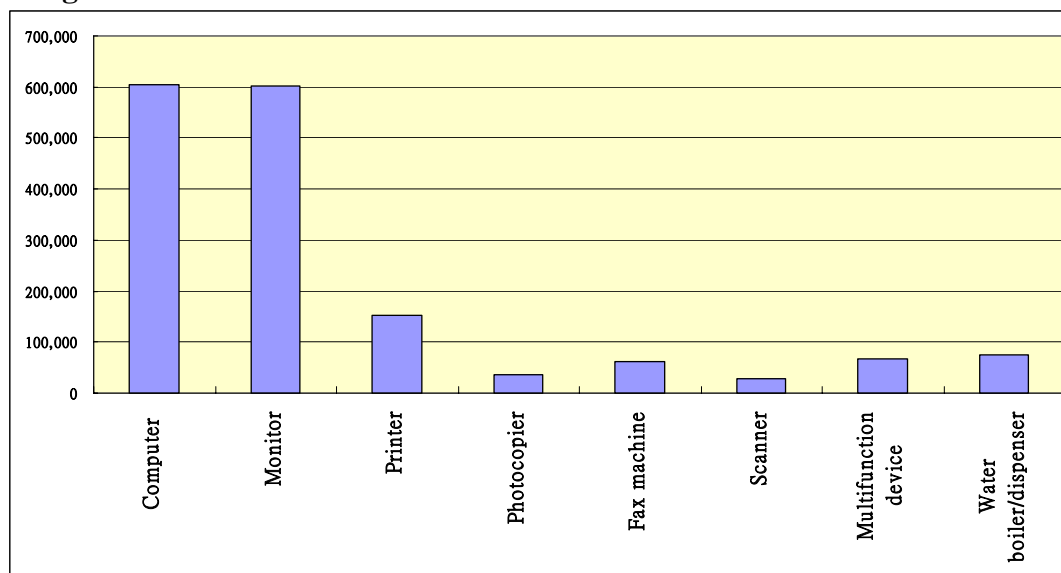
## 2. SURVEY

To study the situation, a small scale survey was conducted by the Hong Kong SAR Government in year 2007 on office equipment in the private offices with a view to

quantifying the amount of electricity consumed by the office equipment in standby mode and assessing the potential for further saving.

The survey work included face to face interview, on-site observation, on-site measurement, as well as desk top study. Thirty-two companies from various business sectors including manufacturing, import/export, wholesale, construction, transport, storage and communication, financing, insurance, real estate and business services, community, social and personal services participated in this survey. Over 770 items of office equipment were surveyed and grouped into eight key types, namely computer, monitor, printer, photocopier, fax machine, scanner, multifunctional device and electric water boiler/dispenser. They are used to represent the usage pattern of all the office equipment in the private offices in Hong Kong. The estimated number of various types of office equipment in the private offices in Hong Kong is shown in Figure 5.

**Figure 5 – Estimated Stock Level of Office Equipment in the Private Offices in Hong Kong**



### 3. POWER CONSUMPTION MODE

In the survey, the operation of the office equipment is classified into several modes of operation as listed in Table 1.

**Table 1 – Power Consumption Mode of Office Equipment**

Mode	Remarks
Switch off	The equipment is switched off, i.e. disconnected from the main electricity supply. This is the preferred mode when the equipment is not in use for a relative long period of time. Say after office hour, during lunch hours.
Shut down	The equipment is turned off by a button located on the equipment, but is still connected to the main electricity supply.
Passive standby	The equipment is switched on, but is in sleep or power saving condition.
Active standby	The equipment is switched on and in idling stage. It is not performing its

	primary function such as printing, copying, processing data.
Operation	The equipment is performing its primary function. This is not a standby mode and does not contribute to standby power saving.

It should be noted that only when the appliance is being operated in the “operation” mode, then the appliance is performing its primary function and producing business output. The “operation” mode primarily takes place during office hour.

The “standby” mode, in the context of this study, includes the above “active standby”, “passive standby” and “shut down” modes. Under these standby modes of operation, the equipment is still consuming electricity, but is not contributing directly to producing business output. The amount of electricity so consumed, over any period of time, is regarded as energy consumed in standby mode. These operation or standby modes of operation can take place during office hour as well as after office hour.

On average per week, only about one third of the time is office hour, with two-third being non-office or after office hour. A lot of electricity would thus be consumed if the appliances are left not switched off after office hour. The electricity consumed during this period can be saved as far as practical without degrading the level of productivity.

In the survey, the percentage of equipment operated after office hour by each power consumption mode was identified in Table 2.

**Table 2 – Percentage of Equipment by Power Consumption Mode After Office Hour**

Type of Equipment	Active Standby	Passive Standby	Shut Down	Switch Off
Computer	0.33%	2.68%	92.64%	4.35%
Monitor	0.34%	1.01%	82.83%	15.82%
Printer	3.03%	1.52%	89.39%	6.06%
Photocopier	0.00%	6.25%	87.50%	6.25%
Fax machine	85.19%	0.00%	11.11%	3.70%
Scanner	8.33%	0.00%	91.67%	0.00%
Multifunction device	31.03%	24.14%	44.83%	0.00%
Water boiler/dispenser	57.58%	0.00%	0.00%	42.42%

With the exception of water boiler/dispenser, most of the appliances are not being switched off after office hour. When the appliances stay in standby mode(s) and not being switch off, the appliances are still consuming electricity continuously.

#### 4. SAVING POTENTIAL

It was further identified in the survey that most of the appliances not being switched off are not used for conducting business operation. Only a small percentage of the appliances, such as computers and fax machines are reported to be in business operation continuously

after office hour. For the appliances not conducting business operation, they can be theoretically switched off after office hour without degrading the level of business output. The amount of electricity so saved is estimated in Table 3. It is estimated that a total of 59.59 GWh of electricity can be saved per annum.

**Table 3 – Electricity Saving After Office Hour**

Type of Equipment	From active standby to switch off (GWh)	From passive standby to switch off (GWh)	From shut down to switch off (GWh)	Total (GWh)
Computer	0.00	0.66	25.00	25.66
Monitor	0.00	0.38	1.74	2.12
Printer	0.93	0.27	3.26	4.46
Photocopier	0.00	0.60	2.39	2.99
Fax machine	1.29	0.00	0.00	1.29
Scanner	0.24	0.00	0.01	0.25
Multifunction device	0.57	2.92	0.61	4.10
Water boiler/dispenser	18.72	0.00	0.00	18.72
	21.75	4.83	33.01	59.59

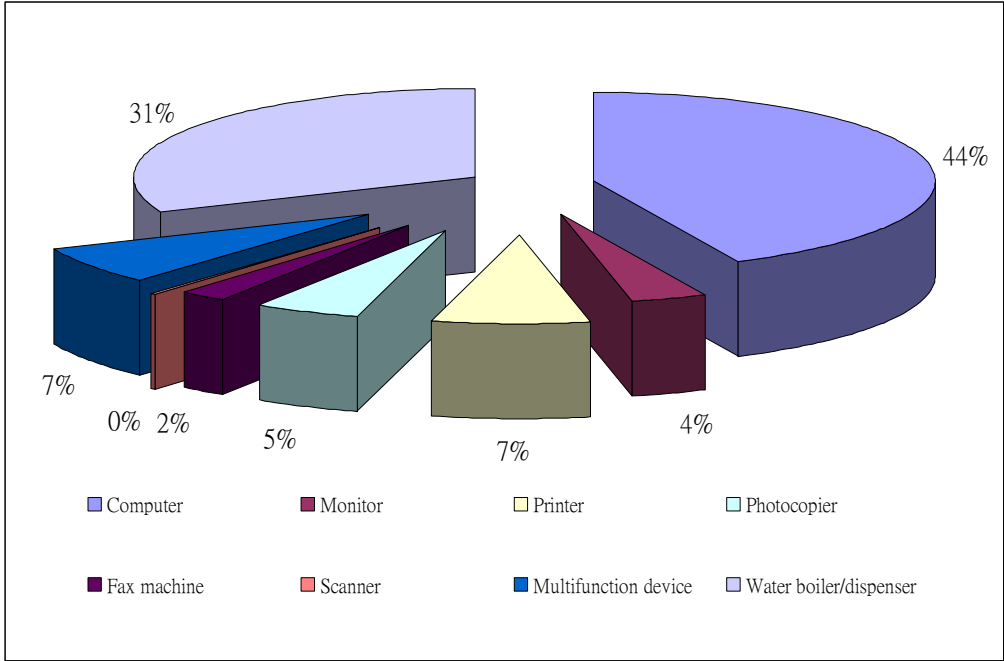
Compared with the estimated electricity consumption during and after office hour, it is estimated that a total of 12.44% of electricity consumed by the office equipment in the private offices in Hong Kong can be saved without affecting the productivity of the businesses (Table 4).

**Table 4 - Estimated Standby Power Saving per Annum for Private Offices in Hong Kong After Office Hour (GWh)**

Type of Equipment	Power Consumption During Office hour	Power Consumption After Office hour	Total Power Consumption (Office and non-office hour)	Total Standby Power	Standby Power as % of Total
Computer	149.07	30.31	179.38	25.66	14.30%
Monitor	45.29	2.30	47.59	2.12	4.45%
Printer	61.96	4.54	66.50	4.46	6.71%
Photocopier	37.96	3.39	41.35	2.99	7.23%
Fax machine	3.44	5.77	9.21	1.29	14.01%
Scanner	1.49	0.27	1.76	0.25	14.20%
Multifunction device	10.00	7.16	17.16	4.10	23.89%
Water boiler/dispenser	97.49	18.72	116.21	18.72	16.11%
	406.70	72.46	479.16	59.59	12.44%

The distribution of the consumption of standby power among various types of equipment is uneven as shown in Figure 6. It is identified in Table 4 that computer and water boiler/dispenser are the key items consuming almost 75% of the after office hour standby power despite the estimated small number of water boiler/dispenser. Effort can be made on these two types of equipment to reduce the standby power further so as to effectively decrease the overall waste percentage.

**Figure 6 - Standby Power Consumption by Types of Equipment**



**5. OFFICE CULTURE AND PRACTICE**

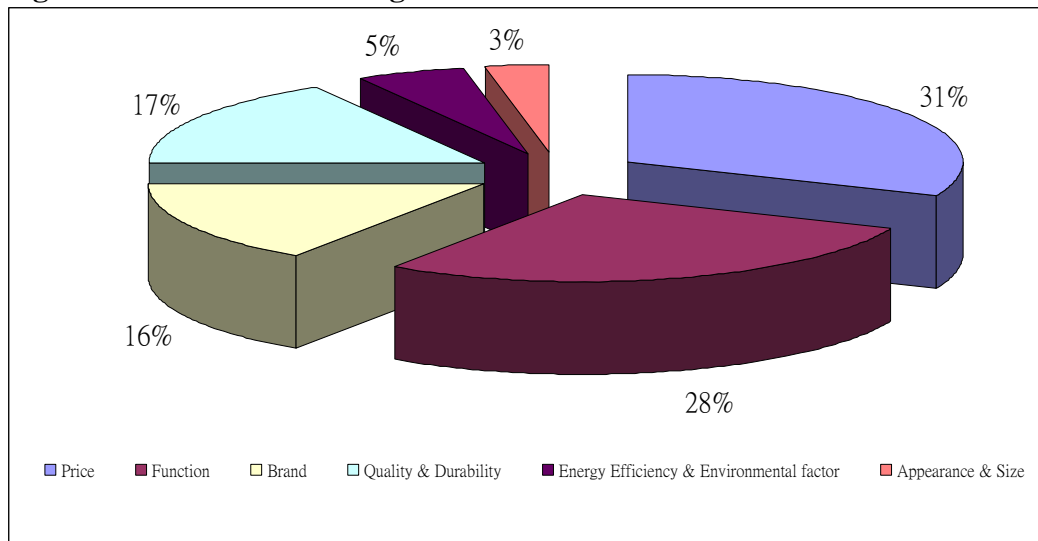
In addition to providing a quantitative analysis on the current practices in operating the office equipment during and after office hour, the survey also attempted to understand the human factors affecting the penetration of office equipment with power management features and the related office culture and practice in the private offices in Hong Kong.

It qualitatively studied the “human factors” of the consumption of the standby power in the private offices in Hong Kong. The survey revealed that not all appliances are currently being switched off after office hour. The reasons for not switching off, as reported by the companies, included the need to communicate with overseas customers/partners, ensure network connectivity, equipment availability, or simply not performing any energy saving practice. It is considered that some of the reasons are acceptable in the sense that switching off the “business critical” appliances, such as fax machines, after office hour may have an impact on the business. However, the rest of the appliances could possibly be switched off after office hour without adverse effect.

As regard the general knowledge of power management features, the survey found that only around one third of the companies are not aware of any power management features. Close to two third of the rest of the companies learnt the relevant information from sources such as equipment suppliers and promotional materials. However, there is still a general

reluctance to select, while purchasing equipment, the power management capability as the most important selection criterion. The survey found that while purchasing office equipment, the major criteria of selection are predominantly price and functionality, with energy efficiency and environmental concern being in the lower priority (Figure 7).

**Figure 7 - Criteria in Making Purchase**



Though the survey shows that only a relatively small percentage of business organisations has put priority on energy efficiency and environmental concern in making purchase, interestingly, the equipment having power management features still enjoys a high penetration rate with over 50% of the companies having a high proportion (81-100%) of their office equipment equipped with such features. It appears that the high penetration rate is relatively independent to the customer's conscious decision and thus the power management features available in the products are not fully utilised by the users. Effort should be made on promoting the social awareness of energy conservation at the consumer level.

## 6. CONCLUSION

This paper provides the background information on energy consumption in Hong Kong. It reports some key findings of a survey on the standby energy of office equipment in the private office segment in Hong Kong. Despite the scale of the survey work which form the basis of the study is relatively small, the study provides some insight into the extent of the issue and provides an estimate on the saving potential that can be achieved through deploying energy efficient equipment and adopting better office culture and practice. Saving can be achieved without compromising the business performance.

Survey results obtained in this study can assist decision makers in private companies to develop action plans to effectively realize the potential saving pertinent to the local situation. The plans should take into consideration the current penetration rate of the office equipment with power saving features and the indifferent attitude of users not switching off equipment after office hour. Based on the analysis of the energy consumption pattern of various types of office equipment during and after office hour, action plans can be tailor made to address and improve the culture and practice in the private offices in Hong Kong. Against such background information, the government, apart from promulgating good practices to reduce standby power consumption, can take the lead in procuring energy efficient equipment and so sustaining the penetration rate.



Though the percentage of saving that can be achieved may seem relatively small compared to the annual energy consumption, the saving potential is certainly a big step forward to enable us to stay afloat in the challenge to combat against climate change. While we can continue to enjoy the benefits, convenience and comfort brought by technology advancement in improving our living standard, we can still contribute a positive effort to save energy without degrading our quality of life and assist to shape a better world.

### **ACKNOWLEDGEMENT**

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