



Environment Bureau



Electrical and Mechanical Services Department

## Business Impact Assessment on Mandatory Implementation of the Building Energy Codes

July 2009

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Reference 0092517

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## CONTENTS

<b>1</b>	<b>EXECUTIVE SUMMARY</b>	<b>1</b>
<b>1.1</b>	<b>INTRODUCTION</b>	<b>1</b>
<b>1.2</b>	<b>THE STUDY OBJECTIVES</b>	<b>1</b>
<b>1.3</b>	<b>THE PROPOSED LEGISLATION</b>	<b>1</b>
<b>1.4</b>	<b>REVIEW OF MANDATORY SCHEMES IN VICTORIA, AUSTRALIA AND SINGAPORE</b>	<b>2</b>
<b>1.4.1</b>	<i>Victoria, Australia</i>	<b>2</b>
<b>1.4.2</b>	<i>Singapore</i>	<b>3</b>
<b>1.5</b>	<b>BUILDING BUSINESS STRUCTURE IN HONG KONG</b>	<b>4</b>
<b>1.5.1</b>	<i>Key Stakeholders of Building Business and its Interactions</i>	<b>4</b>
<b>1.5.2</b>	<i>Identification of Building Stocks for New Buildings</i>	<b>5</b>
<b>1.5.3</b>	<i>Identification of Building Stocks for Existing Buildings</i>	<b>6</b>
<b>1.6</b>	<b>STAKEHOLDER VIEWS</b>	<b>6</b>
<b>1.6.1</b>	<i>Summary of Previous Consultation Findings</i>	<b>6</b>
<b>1.6.2</b>	<i>ERM Stakeholder View-Seeking</i>	<b>6</b>
<b>1.7</b>	<b>IMPACT ASSESSMENT</b>	<b>7</b>
<b>1.7.1</b>	<i>Approach of Cost-Benefit Analysis (CBA)</i>	<b>7</b>
<b>1.7.2</b>	<i>Costs of Regulatory Scheme (2009-2019)</i>	<b>8</b>
<b>1.7.3</b>	<i>Major Costs and Benefits Items (2009-2019)</i>	<b>9</b>
<b>1.7.4</b>	<i>Cost of Regulatory Scheme (2009-2030)</i>	<b>11</b>
<b>1.7.5</b>	<i>Major Costs and Benefits Items (2009-2030)</i>	<b>13</b>
<b>1.7.6</b>	<i>Other Benefits of the Proposed Mandatory Scheme</i>	<b>14</b>
<b>1.7.7</b>	<i>Impact on SMEs and Compliance Difficulties</i>	<b>15</b>
<b>1.7.8</b>	<i>Competition Assessment</i>	<b>16</b>
<b>1.8</b>	<b>RECOMMENDATIONS</b>	<b>17</b>
<b>1.8.1</b>	<i>Recommended Approach</i>	<b>17</b>
<b>1.8.2</b>	<i>Mitigation Measures</i>	<b>17</b>
<b>1.8.3</b>	<i>Measures prior to Implementing the Proposed Legislation</i>	<b>18</b>
<b>1.8.4</b>	<i>Recommendations on Enforcement Strategies</i>	<b>18</b>
<b>1.8.5</b>	<i>Monitoring Measures</i>	<b>19</b>

# 1 EXECUTIVE SUMMARY

## 1.1 INTRODUCTION

Since 1998, the Electrical and Mechanical Services Department (EMSD) has developed and practiced a voluntary Hong Kong Energy Efficiency Registration Scheme for Buildings (HKEERSB) to promote compliance with the Building Energy Codes (BEC). The BEC stipulates the minimum energy efficiency standards and requirements on four key types of fixed building services installations (namely lighting, air-conditioning, electrical, lift and escalator). A performance-based BEC was also established to provide an alternative approach to demonstrate compliance with the energy efficiency requirements through assessment of the total energy efficiency performance of a building. The participation rate of the private sector in the voluntary scheme has been low in the past decade.

Based on the feedback from a previous public consultation, the Environment Bureau (ENB) and the Electrical and Mechanical Services Department (EMSD) of the Government of the Hong Kong Special Administrative Region (HKSARG) is now considering the mandatory implementation of the BEC through legislative means.

ERM-Hong Kong, Limited (ERM) was commissioned by the ENB and EMSD to carry out the *Business Impact Assessment on Mandatory Implementation of the Building Energy Codes* (the Study). This report summarises the key findings and recommendations of the Study.

## 1.2 THE STUDY OBJECTIVES

The objectives of the Study were to:

- Evaluate the coverage and requirements of the proposed legislation;
- Evaluate the potential benefits and impacts of the proposed legislation to stakeholders and the society; and
- Develop compliance, mitigation and monitoring measures for the implementation of the proposed legislation.

## 1.3 THE PROPOSED LEGISLATION

The key provisions of the proposed legislation examined in the BIA are summarised as follows:

*For New Buildings*

- The building services installations of certain new buildings and premises should comply with BEC. Such building types include commercial

buildings, hotels and guesthouses, commercial portion and common area of composite buildings, common area of residential buildings, common area of industrial buildings, educational buildings, community buildings, municipal buildings, hospitals and clinics and institutional buildings.

- Developers of these new buildings are required to submit a 2-stage Self Declaration certified by an Authorised Engineers (AE) <sup>(1)</sup> to EMSD during new building design and construction stages and apply for a Certificate of Compliance Registration (COCR) from EMSD.
- Once occupied, the 'Responsible Person' for the buildings or premises (i.e. owners, tenants, occupiers who hold control of the premises, and their agents) are required to arrange for certification of other building services installations by an AE to ensure compliance with the BEC requirements. The COCR should be renewed once every 10 years. In addition, commercial building or commercial portions of composite buildings are required to arrange for an energy audit when renewing the COCR.

#### *For Existing Buildings*

- Certain existing buildings and premises are required to comply with the legislative requirement during major retrofitting or renovation of the building services installations in buildings.
- Existing commercial buildings and commercial portion of a composite buildings with an internal floor area of 500 m<sup>2</sup> or above are required to carry out energy audit once every ten years.

## **1.4 REVIEW OF MANDATORY SCHEMES IN VICTORIA, AUSTRALIA AND SINGAPORE**

A review of regulations implemented in Victoria, Australia and Singapore was undertaken to identify possible impacts of, and approaches to, energy efficiency regulations. The review was carried out through a desktop study of the relevant legislation and discussions with selected stakeholders in these jurisdictions to understand their concerns and impacts. Key review findings are summarised as follows:

### **1.4.1 Victoria, Australia**

The principal background to the introduction of the updated energy efficiency requirements was a Council of Australian Governments (COAG) agreement, and change to the Australian Building Codes Board (ABCB) mandate to include sustainability considerations into buildings.

The goal of the Building Code of Australia (BCA) is to enable the efficient achievement of nationally consistent, minimum necessary standards for relevant health, safety (including structural safety and safety from fire),

(1) Recognised professionals with appropriate qualifications and experience can register as an AE under the legislation to carry out the duties stipulated in the proposed legislation. The terminology may be revised subject to the discussion in the Technical Task Force on the Mandatory Implementation of the Building Energy Codes.

amenity and sustainability objectives. Section J of the BCA - Energy Efficiency covers building fabric, external glazing, building sealing, air movement, air-conditioned and ventilation systems, artificial lighting and power, hot water supply and access for maintenance.

The principal form of compliance is through building permit approval. There is no mandatory requirement for energy audits. Although there is no data as yet on the amount of energy saving and conservation achieved, the advantages of a performance-based BCA were seen as allowing cost savings in building construction by allowing for the use of alternative materials, forms of construction or designs to the prescriptive requirements.

#### 1.4.2

##### *Singapore*

The Singapore Government is promoting sustainability in the built environment and raising environmental awareness among developers, designers and contractors throughout the life-cycle of buildings. This is being done through implementation of a framework for performance-based building codes established in the *Building Control Regulations* and the promotion of the Building and Construction Authority's (BCA) Green Mark scheme for green buildings. Referenced within these is Singapore Standards (SS 530).

The revised Singapore Standard, SS 530:2006, or *Code of Practice for Energy Efficiency Standard for Building Services and Equipment* (formerly CP 24:1999) includes key revisions to improve the minimum energy efficiency standards which will lead to more energy efficient buildings. SS 530 sets minimum energy efficiency standards for building equipment such as air-conditioning equipment, water heaters, electric motors and high efficiency lightings. The review of the standard was initiated by the National Environment Agency and the National Energy Efficiency Committee / Building Sub-committee to keep abreast of international standards in energy efficiency. It also supports the Building and Construction Authority's (BCA) Building Energy Efficiency Master Plan.

SS 530 itself is not a mandatory code, however it is a referenced standard in the Building Control Regulations under the supporting Approved Document - Acceptable Solutions. This Approved Document provides a set of acceptable solutions' for ensuring compliance, however these are not in their own right compulsory because a person may utilise alternative solutions if these solutions satisfy the prescribed objectives and performance requirements.

Compliance with SS 530 will also contribute to the achievement of BCA Green Mark, and will be a reference standard under the new *Building Control (Environmental Sustainability) Regulations 2008*, which requires a minimum level of achievement for Green Mark.

*Key Stakeholders of Building Business and its Interactions*

ERM with the support of the sub-consultant, Knight Frank, studied the building business structure and dynamics in Hong Kong. The review was undertaken based on the review of publicly available information sources, discussions with the industry and the Knight Frank's knowledge of the building business sectors in Hong Kong. The key stakeholder groups that could be impacted by the proposed legislation were identified as follows:

- **Property developers.** This business segment comprises a few major developers (e.g. Sun Hung Kai Properties, Cheung Kong Properties and Henderson Land Development) who build a significant stock of commercial and residential buildings in Hong Kong and some medium-sized developers (e.g. Nan Fung Group and K. Wah International Holdings). Whilst the intention of the proposed legislation is not to withhold the issue of the Occupation Permit (OP) prior to compliance, under the proposed regulation an inspection to confirm BEC compliance is required to be undertaken by an Authorised Engineer (AE) within a specified period after occupation approval so as to prepare a Certificate of Compliance Registration (COCR) application.
- **Multi-owned building owners.** A building with multiple ownerships is a common arrangement for most buildings in Hong Kong. There are a number of disparate groups of stakeholders that are affected differently and the ownership arrangement will depend on the type of building they partly own. In general, well managed buildings will have a sinking fund to pay for the assessment and any required works to ensure compliance, and it is probable that professional property managers will be employed to process any relevant compliance requirements.
- **Single-owned building owners.** In view of the high cost of sole ownership of buildings it is not envisaged that this segment to be as sizeable as the multi-owned building owners. However, Hong Kong does contain a number of the largest commercial buildings within the main business districts, i.e. Grade A<sup>(1)</sup> stock in Central and Island East, which are predominately owned by sizable landlords e.g. Hongkong Land and Swire Properties.

(1) Extracted from *Hong Kong Property Review 2008*, Ratings and Valuation Department, HKSARG.

“Grade A - modern with high quality finishes; flexible layout; large floor plates; spacious, well decorated lobbies and circulation areas; effective central air-conditioning; good lift services zoned for passengers and goods deliveries; management; parking facilities normally available.

Grade B - ordinary design with good quality finishes; flexible layout; average-sized floor plates; adequate lobbies; central or free-standing air-conditioning; adequate lift services, good management; parking facilities not essential.

Grade C - plain with basic finishes; less flexible layout; small floor plates; basic lobbies; generally without central air-conditioning; barely adequate or inadequate lift services; minimal to average management; no parking facilities.”

- **Property management companies.** There are about 80 major property management companies in Hong Kong<sup>(1)</sup>. This stakeholder group includes those that are the subsidiary of the major property developers (e.g. Hong Yip Service Co. under Sun Hung Kai Properties and Goodwell Property Management under Cheung Kong Group) and those that are not affiliated with the developers (e.g. Savills Hong Kong). Property management companies act as the agent of building owners for the management and regular maintenance of building services installations in the common areas of buildings.
- **Tenants.** In addition to the many small tenants in Hong Kong, there are a few major tenants, including financial institutions, major supermarket chains and department stores, cinemas, large restaurants, fitness and entertainment centres. Under the proposed regulatory framework, tenants will be responsible for obtaining the Form of Compliance (FOC) from the AE after any major retrofitting works and undertaking energy audits for commercial premises that are over 500 m<sup>2</sup>.
- **Electrical and mechanical (E&M) industry.** This business segment includes equipment suppliers, contractors and consultants. They supply the E&M equipment, carry out the installation in buildings, and provide professional advice to the property developers, building owners and property management companies as well as tenants.
- **Recognised professional bodies.** Based on a desktop review by Knight Frank of recognised professional associations in Hong Kong, it is estimated that there are about 60 professional associations actively involved in the building business sector. However, it should be noted that other smaller and less active professional bodies may be involved so the actual number of professional bodies involved may be higher. Under the proposed legislative framework, recognised professionals with appropriate qualification and experiences can be registered as AE.

### 1.5.2

#### *Identification of Building Stocks for New Buildings*

The information on new building stock is estimated based on the issue of Occupation Permit (OP) by the Building Authority in Hong Kong each month. Review of *Monthly Digests* by Buildings Department (BD)<sup>(2)</sup>, about 754 new buildings were ready for occupation in 2008, including about 514 residential buildings, 18 industrial buildings, 53 commercial buildings and 108 composite buildings.

(1) Source: Hong Kong Association of Property Management Companies Limited.

(2) Tables 1.3 and 5.6 of *Monthly Digests* in 2008, Buildings Department, 2008.



### 1.5.3 *Identification of Building Stocks for Existing Buildings*

As of December 2008, there were about 41,000 buildings in Hong Kong, including about 21,000 residential buildings, 1,900 industrial buildings, 2,300 commercial buildings and 11,000 composite buildings.<sup>(1)</sup>

## 1.6 *STAKEHOLDER VIEWS*

### 1.6.1 *Summary of Previous Consultation Findings*

In December 2007, ENB and EMSD carried out a public consultation on the mandatory implementation of the BEC. In total, 134 submissions were received in response to the consultation document, including those that were received after the consultation deadline.

The vast majority of the views received supported the implementation of the proposed mandatory scheme for the BEC and the inclusion of existing buildings in the proposed mandatory scheme. However, some comments were raised by the stakeholders, particularly on the aspects in relation to energy saving measures that could reduce the energy consumption in buildings and whether financial and technical assistance will be provided by the Government to implement the mandatory scheme.

### 1.6.2 *ERM Stakeholder View-Seeking*

ERM carried out view-seeking exercise of stakeholders through focus group discussions (FGDs), face-to-face interviews (F2Fs) and case studies. The findings from each of these exercises are summarised below.

#### *Focus Group Discussions*

ERM drafted and prepared for the FGD sessions by drafting and sending out 526 invitations to the identified stakeholders. 69 stakeholders attended the FGD sessions which were held at ERM's Hong Kong office between 17 and 24 November 2008. A total of 5 sessions were completed with the various groups of stakeholders during this period, including one session conducted in English and the remaining four sessions conducted in Cantonese. Scribes documented the discussions for each session. Key concerns raised by the stakeholders included

- Definition of the key terms in the proposed legislation should be clarified.
- Potential compliance difficulties for tenants and owners during major retrofitting.
- Funding for energy audits in existing buildings.
- Capabilities and responsibilities of AEs.

(1) Based on the information provided by the Buildings Department in December 2008.

### *Face-to-Face Interviews*

16 F2Fs were conducted with various stakeholders during the Study period to discuss the impact of the proposed legislation. Key findings of the F2Fs included:

- Some stakeholders considered that it might be difficult to ensure compliance with the legislative requirements in tenanted areas, as tenants may not be aware of the requirements.
- There was a concern that the timing for COCR applications approval may create some administrative burdens to the developers.
- There were some concerns about costs and availability of energy efficient equipment in the market.
- It was suggested that the energy audit should start with old buildings first in order to identify the improvement opportunities earlier and hence generate the maximum benefits from the proposed legislation.

### *Case Studies on Existing Buildings*

To examine the buildings and building services installations (BSIs) and the associated impacts with various stakeholders within each building type, ERM carried out case studies on five types of impacted buildings in Hong Kong, namely commercial buildings, industrial buildings, residential buildings, shopping malls and hotels. The case studies were carried out through discussion with the property management companies or the resident facilities manager. In general, some building had implemented energy saving measures but no energy audit has been undertaken in these buildings. Some property managers considered that compliance with the BEC would increase the property/rental value but also had concerns on the use of energy efficient equipment as it might require more costs during the initial stage of equipment installation. However, they believed that the use of energy efficient equipment would achieve more energy and cost savings in the long run.

## **1.7 IMPACT ASSESSMENT**

### **1.7.1 Approach of Cost-Benefit Analysis (CBA)**

With information and data from the view-seeking exercise and a variety of sources, a CBA was carried out in order to assess the impacts of the proposed legislation to Hong Kong business as a whole as well as key stakeholder groups and building types. Monetized costs and benefits (as calculated in 2008 Hong Kong dollars) were estimated for each key stakeholder group and building type. Two time periods, 2009 to 2019 and 2009 to 2030 were being considered. Monetized costs and benefits from each year under consideration were brought together into Discounted Cash Flows (DCF) (using a 4% discount rate) and presented as Net Present Values (NPVs).

## 1.7.2 *Costs of Regulatory Scheme (2009-2019)*

Table 1.1, Table 1.2 and Table 1.3 present the total cost to business in Hong Kong and for each key stakeholder group and scheme from 2009 to 2019 as ranges in Net Present Values (NPVs) respectively.

**Table 1.1** *Total Cost to Business, in NPV (2009-2019), (HK\$ Millions)*

<i>(2008 HK\$, Million)</i>	<b>Minimum</b>	<b>Base Case</b>	<b>Maximum</b>
Total cost NPV	-7,780	-5,997	-5,713

Note:

- (1) Benefits were taken as negative costs in the analysis.
- (2) The minimum and maximum values represent 10<sup>th</sup> and 90<sup>th</sup> percentile of the analysis.

The total cost range shown in Table 1.1 (HK\$5,713 million to HK\$7,780 million total benefits in NPV) reflects the large number of variables involved in predicting the impact of the legislation. It should be noted that the total cost in NPV (2009-2019) is negative, indicating the business impact of the policy option in the long term is positive.

**Table 1.2** *Cost in NPV of each key stakeholder group (2009-2019), (HK\$ Millions)*

<i>(2008 HK\$, Million)</i>	<b>Minimum</b>	<b>Base Case</b>	<b>Maximum</b>
Developers	96	104	134
Owners and Tenants	-7,640	-5,921	-4,221
AEs	-238	-134	-70
Contractors	-18	-9	-5
Suppliers	-64	-37	-29

Note:

- (1) Benefits were taken as negative costs in the analysis.
- (2) The minimum and maximum values represent 10<sup>th</sup> and 90<sup>th</sup> percentile of the analysis.

Under the CBA, all major stakeholders (except developers) would obtain benefits under the mandatory scheme. For **developers**, the total NPV over the period between 2009 and 2019 is from a cost of HK\$96 million to a cost of HK\$134 million. It includes additional cost of installing energy efficient equipment, fees paid to AEs during the first and second self-declarations and the fee paid to EMSD for COCR application. It is noted that while these costs will fall on the developers initially, they will eventually be passed on to the property owners and tenants, and thus the real cost to developers is very low. The additional costs to developers are close to zero from the second year till the end of the assessment period. The NPV for developers shown in the CBA is close to the additional costs in the first year of the assessment period, which represents a relatively small portion of additional costs when compared with the number of new buildings constructed and covered under the mandatory scheme each year.

**Property Owners** pay fees to AEs and EMSD during COCR renewal. The **Tenants** and some owners pay FOC certification and energy audit fees and get the energy saving benefit. The total benefits in NPV are from HK\$4,221 million to HK\$7,640 million from 2009 to 2019. **Tenants** and **property**

**owners** will get most of the benefits but also pay most of the additional cost ultimately.

**Authorised Engineers** are likely to earn a profit from the scheme, from HK\$70 million to HK\$238 million in NPV between 2009 and 2019

**Contractors** earn additional profits associated with installing BEC compliant equipment, ranging from HK\$5 million to HK\$18 million in NPV from 2009 to 2019.

The estimated benefits to **Suppliers** are between HK\$29 million and HK\$64 million in NPV from 2009 to 2019 and are mainly from the selling of BEC compliant equipment.

**Table 1.3** *Cost in NPV of each scheme (2009-2019), (HK\$ Millions)*

<i>(2008 HK\$, Million)</i>	<b>Minimum</b>	<b>Base Case</b>	<b>Maximum</b>
Scheme Setup	10	13	17
New Buildings	-2,063	-1,582	-1,406
Existing Buildings: major retrofitting	-4,115	-2,542	-2,207
Energy Audit	-2,109	-1,886	-1,656

Note:

- (1) Benefits were taken as negative costs in the analysis.
- (2) The minimum and maximum values represent 10<sup>th</sup> and 90<sup>th</sup> percentile of the analysis.

The total amount of **Scheme Setup** cost is relatively small (from HK\$10 million to HK\$17 million in NPV over the 10 year period) and is mainly from AE costs associated in application for registration.

**New Buildings'** benefit ranges from HK\$1,406 million to HK\$2,063 million in NPV within 10 years, depending mainly on the energy saving and additional cost associated with the compliance.

The ranges of total income for major retrofit of **Existing Buildings** are between HK\$2,207 million and HK\$4,115 million in NPV (2009-2019). The uncertainties are not only associated with energy saving, additional cost from installation of BEC compliant equipment and administrative cost, but also related to the frequency that major retrofitting works are undertaken in different types of existing buildings.

The total benefits from the **Energy Audit** requirements was estimated at between HK\$1,656 million and HK\$2,109 million in NPV from 2009 to 2019. The cost of energy audits could be recovered by the energy savings resulted from implementation of measures being identified by energy audits over time.

### **1.7.3** *Major Costs and Benefits Items (2009-2019)*

Further analysis of average annual cost split reveals that FOC cost of existing buildings is the largest expected cost component (27% of total annual average cost split). This amounts to about HK\$27.5 million per year and is paid for by tenants and owners. The second largest cost component is the additional cost (i.e. marginal cost over non-BEC compliant installations instead of full

system cost) to install BEC compliant equipment in existing buildings. This amount is about HK\$20.1 million per year (or 19.8% of total annual average cost split) and is paid for by tenants and owners. Other significant cost items are additional cost to install BEC compliant equipment in new buildings (HK\$10.6 million per year or 10.4% of total annual average cost split) and FOC preparation for new buildings (HK\$14.2 million per year or 13.9% of total annual average cost split). *Table 1.4* shows the cost breakdown during 2009 to 2019.

**Table 1.4 Cost Breakdown (2009-2019)**

<b>Item</b>	<b>Annual Average (HK\$, Million)</b>	<b>Percentage of Total Annual Average Cost</b>
AE Registration: Cost of AEs	1.5	1.5%
First Self Declaration-New Buildings: Cost of Developers	1.6	1.5%
Additional cost of BEC compliant equipment installation-New Buildings: Cost of Tenants and Owners	10.6	10.4%
COCR Preparation for New Buildings- cost of Developers	8.9	8.8%
FOC-New Buildings: Cost of Tenants and Owners	14.2	13.9%
COCR renewal-New Buildings: Cost of Owners	0.5	0.5%
FOC renewal-New Buildings: Cost of Tenants and Owners	7.8	7.7%
Additional cost of BEC compliant equipment installation-Existing Buildings: Cost of Tenants and Owners	20.1	19.8%
FOC-Existing Buildings: Cost of Tenants and Owners	27.5	27.0%
Energy Audit-Existing Buildings: Cost of Tenants and Owners	9.0	8.8%
<b>Total Annual Average Cost</b>	<b>101.6</b>	<b>100%</b>

Note: The costs in this table do not take benefits into consideration and are different from those in previous sections.

Review of average annual benefits splits indicates that energy savings of tenants and owners are the major benefits of the proposed regulation and are expected to be about HK\$831.7 million annually, of which energy saving in existing buildings are likely to be the highest percentage providing about HK\$342.2 million of savings per year (or 40.5% of total annual average benefits), followed by HK\$248.9 million from new buildings (or 29.5% of total annual average benefits) and HK\$240.6 million resulting from energy audits (or 28.5% of total annual average benefits). In comparison, revenues to AEs, suppliers and contractors are smaller, amounting to about HK\$7.8 million, HK\$4.2 million, and HK\$1.1 million on average per year, respectively. *Table 1.5* shows the benefit breakdown during 2009 to 2019.

**Table 1.5 Benefit Breakdown (2009-2019)**

	<b>Annual Average (HK\$, Million)</b>	<b>Percentage of Total Annual Average Benefit</b>
New Building-Energy Savings	248.9	29.5%

	Annual Average (HK\$, Million)	Percentage of Total Annual Average Benefit
Existing Building-Energy Savings	342.2	40.5%
Energy Audit-Energy Savings	240.6	28.5%
AE Profit	7.8	0.9%
Contractor Profit	1.1	0.1%
Supplier Profit	4.2	0.5%
<b>Total Annual Average Benefit</b>	<b>844.8</b>	<b>100%</b>

Note: Benefits in this table were not taken as negative costs.

#### 1.7.4 *Cost of Regulatory Scheme (2009-2030)*

CBA was also carried out for the period from 2009 to 2030. *Table 1.6, Table 1.7 and Table 1.8* present the total cost to business in Hong Kong and for each key stakeholder group and scheme from 2009 to 2030 as ranges in Net Present Values (NPVs) respectively.

**Table 1.6** *Total Cost to Business, in NPV (2009-2030), (HK\$ Millions)*

(2008 HK\$, Million)	Minimum	Base Case	Maximum
Total cost NPV	-21,476	-16,062	-15,264

Note:

- (1) Benefits were taken as negative costs in the analysis.
- (2) The minimum and maximum values represent 10<sup>th</sup> and 90<sup>th</sup> percentile of the analysis.

The total cost range shown in *Table 1.6* (HK\$15,264 million to HK\$21,476 million total benefits in NPV) reflects the large number of variables involved in predicting the impact of the legislation. It should be noted that the total cost in NPV (2009-2030) is negative, indicating the business impact of the policy option in the long term is positive.

**Table 1.7** *Cost in NPV of each key stakeholder group (2009-2030), (HK\$ Millions)*

(2008 HK\$, Million)	Minimum	Base Case	Maximum
Developers	118	132	164
Owners and Tenants	-21,229	-15,914	-10,870
AEs	-355	-201	-102
Contractors	-30	-16	-9
Suppliers	-113	-63	-48

Note:

- (1) Benefits were taken as negative costs in the analysis.
- (2) The minimum and maximum values represent 10<sup>th</sup> and 90<sup>th</sup> percentile of the analysis.

Under the CBA, all major stakeholders (except developers) would obtain benefits under the mandatory scheme. For **developers**, the total NPV over the period between 2009 and 2030 is from a cost of HK\$118 million to a cost of HK\$164 million. It includes additional cost of installing energy efficient equipment, fees paid to AEs during the first and second self-declarations and the fee paid to EMSD for COCR application. It is noted that while these costs will fall on the developers initially, they will eventually be passed on to the property owners and tenants, and thus the real cost to developers is very low. The additional costs to developers are close to zero from the second year till the end of the assessment period. The NPV for developers shown in the CBA

is close to the additional costs in the first year of the assessment period, which represents a relatively small portion of additional costs when compared with the number of new buildings constructed and covered under the mandatory scheme each year.

**Property Owners** pay fees to AEs and EMSD during COCR renewal. The **Tenants** and some owners pay FOC certification and energy audit fees and get the energy saving benefit. The total benefits in NPV are from HK\$10,870 to HK\$21,229 million from 2009 to 2030.

**Authorised Engineers** are likely to earn a profit from the scheme, from HK\$102 million to HK\$355 million in NPV between 2009 and 2030.

**Contractors** earn additional profits associated with installing BEC compliant equipment, ranging from HK\$9 million to HK\$30 million in NPV from 2009 to 2030.

The estimated benefits of **Suppliers** are between HK\$48 million and HK\$113 million in NPV from 2009 to 2030, mainly from the selling of BEC compliant equipment.

**Table 1.8** *Cost in NPV of each scheme (2009-2030), (HK\$ Millions)*

<i>(2008 HK\$, Million)</i>	<b>Minimum</b>	<b>Base Case</b>	<b>Maximum</b>
Scheme Setup	21	28	34
New Buildings	-5,862	-4,522	-4,075
Existing Buildings: major retrofitting	-12,905	-8,009	-6,976
Energy Audit	-3,981	-3,558	-3,127

Note:

- (1) Benefits were taken as negative costs in the analysis.
- (2) The minimum and maximum values represent 10<sup>th</sup> and 90<sup>th</sup> percentile of the analysis.

The total amount of **Scheme Setup** cost is relatively small (from HK\$21 million to HK\$34 million in NPV over the 20 year period and is mainly from AE cost associated in application for registration.

**New Buildings'** benefit ranges from HK\$4,075 million to HK\$5,862 million in NPV within 20 years, depending mainly on the energy saving and additional cost associated with the compliance.

The ranges of total income for major retrofit of **Existing Buildings** are between HK\$6,976 million and HK\$12,905 million in NPV (2009-2030). The uncertainties are not only associated with energy saving, additional cost from installation of BEC compliant equipment and administrative cost, but also related to the frequency that major retrofitting works are undertaken in different types of existing buildings.

The total **Energy Audit** benefit is between HK\$3,127 million and HK\$3,981 million in NPV from 2009 to 2030. The cost of energy audits could be recovered by the energy savings resulted from implementation of measures being identified by energy audits over time.

### 1.7.5

#### *Major Costs and Benefits Items (2009-2030)*

Review of the average annual costs split reveals that the additional cost (i.e. marginal cost instead of full system cost) to install BEC compliant equipment in existing buildings is the largest expected cost component (24.2% of total average annual cost split). This amounts to about HK\$27.3 million per year and is paid for by tenants and owners. In this regard, responsible persons (including tenants and owners) are expected to benefit from the scheme through reduced energy costs.

The second largest cost component is the cost of obtaining an FOC for existing buildings. This amount is about HK\$27.2 million per year (or 24.2% of total annual average cost split) and is paid for by tenants and owners to an AE. Other significant cost items are the costs of obtaining an FOC cost for new buildings (HK\$12.3 million or 10.9% of total annual average cost split), additional cost to install BEC compliant equipment in new buildings (HK\$10.4 million per year or 9.2% of total annual average cost split). *Table 1.9* summaries the cost breakdown during 2009 to 2030.

**Table 1.9** *Cost Breakdown (2009-2030)*

<b>Item</b>	<b>Annual Average (HK\$, Million)</b>	<b>Percentage of Total Annual Average Cost</b>
AE Registration: Cost of AEs	1.9	1.7%
First Self Declaration-New Buildings: Cost of Developers	1.2	1.0%
Additional cost of BEC compliant equipment installation-New Buildings: Cost of Tenants and Owners	10.4	9.2%
COCR Preparation for New Buildings- cost of Developers	6.7	5.9%
FOC-New Buildings: Cost of Tenants and Owners	12.3	10.9%
COCR renewal-New Buildings: Cost of Owners	10.2	9.0%
FOC renewal-New Buildings: Cost of Tenants and Owners	8.4	7.4%
Additional cost of BEC compliant equipment installation-Existing Buildings: Cost of Tenants and Owners	27.3	24.2%
FOC-Existing Buildings: Cost of Tenants and Owners	27.2	24.2%
Energy Audit-Existing Buildings: Cost of Tenants and Owners	7.2	6.3%
<b>Total Annual Average Cost</b>	<b>112.9</b>	<b>100%</b>

Note: The costs in this table do not take benefits into consideration and are different from those in previous sections.

Review of average annual benefits splits shows that energy savings of tenants and owners are the major benefits of the proposed regulation and it is about HK\$1,343 million annually, of which energy saving of existing buildings is the most, about HK\$672 million per year (or 49.4% of total annual average benefits), followed by HK\$408 million from new buildings (or 30% of total annual average benefits) and HK\$263 million from energy audit (or 19.3% of total annual average benefits). In comparison, revenues to AEs, suppliers



and contractors are smaller, which amounts to about HK\$12.3 million, HK\$4.2 million, and HK\$1.1 million in average per year, respectively. *Table 1.10* summaries the benefit breakdown during 2009 to 2030.

**Table 1.10** *Benefit Breakdown (2009-2030)*

	Annual Average (HK\$, Million)	Percentage of Total Annual Average Benefit
New Building-Energy Savings	408	30.0%
Existing Building-Energy Savings	672	49.4%
Energy Audit-Energy Savings	263	19.3%
AE Profit	12.3	0.9%
Contractor Profit	1.1	0.1%
Supplier Profit	4.2	0.3%
<b>Total Annual Average Benefit</b>	<b>1,360</b>	<b>100%</b>

Note: Benefits in this table were not taken as negative costs.

### 1.7.6 *Other Benefits of the Proposed Mandatory Scheme*

The implementation of the mandatory scheme will bring many potential benefits, including:

- Create job opportunities for recognised professionals in Hong Kong to become AEs under the proposed mandatory scheme;
- Generate positive impact to the corporate image of the developers by incorporating BEC in their building design;
- Enhance the image and performance of Hong Kong in relation to its efforts in alleviating the impacts of climate change through the improvement of energy efficiency in buildings (i.e. reduction of greenhouse gas emissions);
- Promote the energy-efficient design of building service installations and generate energy saving;
- Promote energy efficiency and conservation and encourage the building owners to achieve good energy performance in building;
- Promote the sustainable use of natural resources so as to reduce the impact to the environment while maintain the economic development in Hong Kong and satisfy the needs of the society;
- Raise the public awareness on environmental protection through the use of energy efficient equipment/installations; and
- Avoid Hong Kong becoming or being perceived as a jurisdiction in which substandard equipment/installation can be sold and used.

*Impact on SMEs and Compliance Difficulties*

The Government of the HKSAR defines SMEs as “any manufacturing businesses which employs fewer than 100 persons in Hong Kong; or any non-manufacturing businesses which employs fewer than 50 persons in Hong Kong”. Given the extent of the coverage of the proposed legislation, there were concerns that small and medium enterprises (SMEs) will be particularly impacted by it. As such, an assessment was undertaken to evaluate the likely extent of these impacts.

The findings of this assessment suggested that:

- BEC covers premises with internal floor area of 500m<sup>2</sup> or above for existing building retrofit and energy audit, and this strongly protect SMEs’ interest. Addition or replacement of major component of building services installation, regardless of the size of the internal floor area, the relevant building services installation would also be required to comply with the BEC requirements. The available data<sup>(1)</sup> suggests that average floor areas of small enterprises with less than 10 employees are far below 500m<sup>2</sup>.
- For small to medium sized enterprises, the analysis also suggested that the impact on them is not significant. As many of the tenancy agreements in Hong Kong are about 1-3 years, major retrofitting works to be carried out by SMEs or Responsible Persons (RPs) for all floor areas in premises is unlikely to happen frequently. SMEs or RPs including Property Owners, Tenants, Occupiers who hold control of the premises, and their Agents may consider carrying out major retrofitting works when they are planning on longer occupancy or after considering the cost-effectiveness in doing so. Furthermore, as the proposed mandatory scheme does not require mandatory retrofitting works to meet the BEC standards, small to medium enterprises will take into account its cash flow status in deciding to commence any major retrofitting works, of which the new or replaced building services installations would have to comply with BEC. Such enterprises are unlikely to commence major retrofitting works or may choose to stagger the major retrofitting works should they encounter constraints in cash flow, therefore, the impact of the mandatory scheme to them could also be avoided or minimized.

The study also identified a number of concerns and/ or potential compliance difficulties as follows:

- There was a concern on the availability and cost of AE for energy audits as well as the availability and cost of energy efficient equipment in the market. A related concern was that the registration costs for AE might have impacts on their availability;

(1) Source: Census and Statistics Department, *Report on 2007 Annual Survey of Wholesale, Retail and Import and Export Trades, Restaurants and Hotels, Reports on 2007 Annual Survey of Storage, Communication, Banking, Financing, Insurance, and Business Service.*

- It was felt that there was a lack of knowledge of BEC and the proposed legislation by the general public (including tenants and owners of existing buildings) which prevent compliance with the proposed legislation;
- There was a concern that the timeframe for submitting the 2<sup>nd</sup> self-declaration within four months upon receiving the occupation approval for new buildings might be difficult in some instances;
- There was a concern that the schedule for completing the first round of energy audits in all existing commercial buildings and commercial portion of composite buildings might be too tight; and
- It was felt that some of the key terms in the proposed legislative framework are unclear.

Mitigation measures to tackle these issues are included in *Section 1.8*.

### 1.7.8

#### *Competition Assessment*

In reviewing the mandatory implementation of the BEC against the criteria listed in the UK's Office of Fair Trading's *Guidelines for Competition Assessment*, it is noted that:

- The proposed scheme imposes registration requirements on AEs, including payment of registration fees and qualification requirements. This is a form of licensing and may act as a barrier to entry for new AEs. As practicable, registration requirements and costs should be kept down to minimize this potential impact. This could include streamlining the AE registration approval process by the Government.
- In general, the mandatory requirements on developers, E&M equipment suppliers, owners and tenants are unlikely to indirectly limit the number or range of suppliers. For developers, the marginal costs are considered to be insignificant when compared against the overall development costs. For equipment suppliers, as it is understood that most equipment are already BEC compliant and suppliers do not hold much stock due to cost considerations, the mandatory requirements would not disproportionately affect the SMEs.
- Requiring minimum energy efficiency standards for equipment could act as an entry barrier for E&M equipment suppliers selling equipment not already in compliance with BEC. However, consultations with industry suggest that most equipment is already BEC compliant and, given sufficient time for transitional arrangement, this is considered unlikely to be significant concern as any residual non-compliant stock can be replaced with compliant stock over time.

## 1.8 RECOMMENDATIONS

### 1.8.1 *Recommended Approach*

The current impact assessment findings suggest that the proposed regulatory approach will have a net benefit to Hong Kong. The level of benefit will depend very much on the design of building services installations in new buildings in future; the amount of energy savings from the use of BEC compliant equipment, which will increase progressively through technology advancement; the number of buildings that will undergo major retrofitting works, with newly installed equipment and system become BEC compliant; the percentage of buildings that will implement Energy Management Opportunity (EMO) identified through energy audits (which range from simple housekeeping measures to retrofitting of existing and old installation to BEC compliant equipment and installation).

Moreover, the implementation of the mandatory scheme will bring some intangible benefits to Hong Kong, including the creation of job opportunities, positive impact to the corporate image, promotion of energy efficiency and conservation to the public, encouragement of the sustainable use of natural resources and prevention of substandard and energy inefficient equipment from use and sale in Hong Kong. Given the general support were received from the stakeholders and the potential benefits in the long run, ERM recommend that the mandatory scheme should proceed.

However, during the course of the assessment a number of issues were identified with regard to compliance difficulties and possible cost impacts on businesses. As such a number of mitigation measures have been outlined below.

### 1.8.2 *Mitigation Measures*

The following mitigation measures are proposed to minimise the impacts of implementing the mandatory scheme:

- Use of guidelines, training workshops and public campaigns to enhance the understanding of the stakeholders on the regulatory approach and support the roll-out of the mandatory scheme;
- Financial support in the form of Environment and Conservation Fund, tax incentives and loan funding scheme from power companies could be used to encourage the enhancement of energy efficiency in buildings;
- Phased implementation of the legislation. Given that most of the building tenants, especially SMEs, are not aware of BEC requirements, the proposed legislation could be implemented in phases, with the priority focused on the common areas of the buildings where the building owners/property managers have control of, and then extend the coverage of the legislative scheme to the tenant area in the long run. This would apply to the requirement for energy audits and it is recommended that the requirement to undertake energy audits be initially limited to the

common areas of commercial buildings. A decision to extend the coverage to individual tenanted areas could be made upon further examination of the impacts of the proposed legislation (see monitoring measures proposed below);

- A provision for extension of deadlines for 2<sup>nd</sup> self-declarations on a case-by-case basis should be provided;
- Training should be made available to engineers on undertaking energy audits so as to increase the availability of competent energy auditors on the market and hence lower the cost; and
- Government staff should be trained on the enforcement of the legislation, including the verification of information submitted for COCR application and renewal, spot checking of the building services equipment / installation in buildings and investigating the cases that are not in compliance with the legislation.

### 1.8.3 *Measures prior to Implementing the Proposed Legislation*

The following measures should be carried out prior to implementing the proposed legislation:

- **Streamline the COCR application process as far as practicable.** Opportunities for streamlining include simplifying the application forms and information requirement as far as practicable should be considered;
- **Develop and implement promotional campaigns.** This can be achieved via the development of a dedicated Government website (e.g. that for the voluntary energy efficiency registration scheme for buildings on EMSD website), publication of guidance and pamphlets and media broadcasts;
- **Develop grace periods for enforcement (see Section 1.8.4).** It is suggested that a grace period should be arranged such that they will have sufficient time to prepare for the regulatory compliance;
- **Draft regulations and introduce legislation to Legislative Council (LegCo).** The legislation should be developed such that certain provisions are enacted by administrative means rather than by legislative means. Such measures could include the BECs which is subject to review every 3-5 years and it could be changed by administrative means (e.g. through the re-issue of the Code of Practice); and
- **Consult/Inform the industry on the final scheme to be implemented.** This can be achieved by arranging workshops and briefing sessions so as to enhance their understandings on the regulatory approach and any alterations since the previous consultation.

### 1.8.4 *Recommendations on Enforcement Strategies*

The following approaches are proposed in relation to enforcement:

- **Sample site inspection.** The Government should carry out sample site inspections so as to verify the information provided in COCR, FOC and energy audit reports and assist the stakeholders in taking remedial actions for any non-compliance identified;
- **Provision of advice to the stakeholders.** The Government should provide more advice to the stakeholders to enhance their understanding of the proposed legislation. This could be carried out using focussed group workshops and/or public forums; and
- **More tolerance (by the use of improvement notice) in the initial stages of implementation.** The Government should give them opportunity to take remedial actions and monitor their progress of remediation, rather than impose penalty immediately. This will also enhance the public acceptability of the proposed legislation.

### 1.8.5 *Monitoring Measures*

To review the effectiveness of the scheme in meeting its proposed objectives, the following monitoring measures are proposed after the implementation of the scheme:

- **Keep track of the progress of the first round of energy audit.** The progress of the energy audit should be closely monitored and be prepared to extend the timeframe if required and justified.;
- **Consult the trade on the impact of the BEC including evaluating impacts through sample surveys and case studies of actual implementation.** The BEC should be reviewed every 3-5 years through consultation with the trade so as to keep track of the current technological development while not impact the trade significantly;
- **Re-evaluate costs and benefits once scheme is established and actual impact data is available.** Surveys and case studies should be carried out after the roll-out of the regulatory scheme so as to identify the concerns of stakeholders and actual benefits and costs arising from the scheme; and
- **Keep track of related scheme developments overseas.** This is to ensure that the regulatory approach in Hong Kong is inline with international best practices.