南京綠色建築

(節能＋減排＋綠色建築)

2014 經驗交流會

2014.9.26

聯合主辦單位

Asian Institute of Intelligent Buildings
亞洲智能建築學會

HKAEE 香港能源工程師學會
Hong Kong Association of Energy Engineers

香港註冊通風系統承建商協會
HONG KONG REGISTERED VENTILATION CONTRACTORS ASSOCIATION

南京工業大學
NANJING TECH UNIVERSITY

協辦單位：上海建築智能化專家委員會. 程大章教授. 澳門物業管理設施協會.
揚子石化 - 巴斯夫有限責任公司 . Association of Energy Engineers (USA)

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(節能 + 減排 + 綠建築)2014經驗交流會

舉辦日期： 2014 年 9 月 25 日至 2014 年 9 月 28 日(周四至周日)
舉行時間： 2014 年 9 月 26 日下午 2 時
舉行地點： 城市名人酒店會議廳
南京市鼓樓區中山北路 30 號

會議流程 主持: 陳德興

時間	摘要	負責人
2:00 – 2:05	主持宣佈交流會開始 介紹出席嘉賓及參會各人	陳德興
2:05 – 2:08	大學代表致歡迎辭	龔延風教授
2:08 – 2:11	香港三會代表致啓動辭	陳家龍博士
2:11 – 2:31	第一篇論文演講 (南京工業大學)	
2:31 – 2:51	第二篇論文演講 (HKAEE)	周冠雄博士
2:51 – 3:10	第三篇論文演講 (揚子石化-巴斯夫有限責任公司)	丁超先生
3:10 – 3:25	互動時間 (Question & Answer)	陳德興先生
3:25 – 3:40	休息時間	
3:40 – 4:00	第四篇論文演講 (HKRVCA)	許華川先生
4:00 – 4:20	第五篇論文演講 (上海建築智能化專家委員會)	程大章教授
4:20 – 4:40	第六篇論文演講 (MPF / AIIB)	何雄威先生
4:40 – 5:00	第七篇論文演講 (南京工業大學)	
5:00 – 5:15	互動時間 (Question & Answer)	陳德興先生
5:15 – 5:20	致謝辭	鄧社堅先生
6:00	聯歡晚宴 (名人酒店中餐廳)	聯合主持

What is Happening in 2014 Hong Kong?
An Energy Audit Update on
Commercial Buildings and Shopping Malls

Dr Leonard K H Chow

2011 Energy Engineer of the Year (Awarded by AEE USA)
Association of Energy Engineers (AEE) Hong Kong Chapter – Past President
Hong Kong Association of Energy Engineers (HKAEE) - Chairman

ABSTRACT

About 90% of total electricity consumption in Hong Kong is contributed by buildings. Through enhancement of building energy efficiency, greenhouse gas emissions can be effectively reduced. In October 1998, the Electrical and Mechanical Services Department of Hong Kong Government launched the voluntary Hong Kong Energy Efficiency Registration Scheme for Buildings to promote the application of Building Energy Codes. To further building energy efficiency, the Government enacted the Buildings Energy Efficiency Ordinance (CAP 610) which came into full operation from 21 September 2012. This mandatory requirement has impacts to all new building designs and existing building for major retrofits and energy audit. The ordinance has created a professional called "Registered Energy Assessor" who has the authority to sign various energy forms for building energy design and installation, and energy audit to the minimum standards complying with the energy codes in the ordinance.

Dr Leonard Chow's company has completed energy audits for over 400 buildings in the past years. The audits consisted of various building types such as Government buildings, markets, shopping malls, commercial buildings, etc. A statistical analysis with research was carried out to benchmark with possible co-relation the different types of buildings in Hong Kong. The information will be very useful in future planning, prediction, recommendation of energy retrofit opportunities. The result will be presented in the paper.

Keywords: The Buildings Energy Efficiency Ordinance (CAP 610),
Hong Kong Energy Efficiency Registration Scheme for Buildings (HKEERSB)

INTRODUCTION

In 2007, the Asia-Pacific Economic Co-operation (APEC) had attached increasing importance to the issue of climate change. APEC economies pledged at the APEC Leaders' Declaration on Climate Change, Energy Security and Clean Development to seek to achieve a reduction in energy intensity (i.e. total primary energy supply per unit of GDP) of at least 25% by 2030, with 2005 as the base year. In 2011, APEC Leaders set a higher target to reduce energy intensity by at least 45% by 2035. As the member economy of the APEC, Hong Kong is committed to improve energy efficiency and support the use of cleaner and more efficient energy technologies by setting goals and action plans.

In 2010, the the Environment Bureau of the HKSAR Government issued consultation document that the HKSAR Government would moving forward to face "Climate Change" with strategies and action agenda. Since then, various schemes were issued to promoting carbon reduction and energy efficiency. The forthcoming sections will concentrate on schemes and assessments for buildings.

(I) From the HKSAR Government, there is one mandatory requirement:

- ✧ The Buildings Energy Efficiency Ordinance (CAP 610)

(II) From the HKSAR Government, there were some voluntary schemes:

- ✧ The Building Energy Efficiency Funding Scheme
  - ■ Energy-cum-carbon Audit Projects (ECA)
  - ■ Energy Efficiency Projects (EEP)
- ✧ Fresh Water Cooling Towers Scheme for Air Conditioning Systems
- ✧ Hong Kong Energy Efficiency Registration Scheme for Buildings (HKEERSB)
- ✧ Good Energy Performance Certification
- ✧ Green Building Labeling Scheme

1. GOVERNMENT MANADATORY

About 90% of total electricity consumption in Hong Kong is contributed by buildings. Through enhancement of building energy efficiency, greenhouse gas emissions can be effectively reduced. In October 1998, the Electrical and Mechanical Services Department launched the voluntary Hong Kong Energy Efficiency Registration Scheme for Buildings to promote the application of Building Energy Code. To further promote building energy efficiency, the Government enacted the Buildings Energy Efficiency Ordinance (CAP 610) which came into full operation from 21 September 2012.

There are 3 key requirements of the Ordinance:

- The developers or building owners of newly constructed buildings should ensure that the 4 key types of building services installation therein, namely, air-conditioning installation, lighting installation, electrical installation as well as lift and escalator installation, comply with the design standards of the Building Energy Code (BEC).

- The responsible persons (i.e. owners, tenants or occupiers etc.) in buildings should ensure that the 4 key types of building services installation therein comply with the design standards of the BEC when " Major Retrofitting Works " are carried out.

- The owners of commercial buildings (including the commercial portions of composite buildings, e.g. shopping malls under residential storeys) should carry out energy audit for the 4 key types of central building services installation therein in accordance with the Energy Audit Code (EAC) every 10 years.

This mandatory requirement has impacts to all new building designs and existing building for major retrofits and energy audit. The ordinance has created a professional called "Registered Energy Assessor" who has the authority to sign various energy forms for building energy design and installation, and energy audit to the minimum standards complying with the energy codes in the ordinance.

2. ENERGY AUDIT REQUIREMENTS

The Buildings Energy Efficiency Ordinance (CAP 610) has included Energy Audit as one of the important issue in the Ordinance. The owners of commercial buildings

and the commercial portions of composite buildings should comply with when carrying out energy audit upon full implementation of the Buildings Energy Efficiency Ordinance (BEEO) on 21 September 2012. For the detailed interpretations and requirements, the Building Energy Code (BEC) and the Energy Audit Code (EAC) should be referred to.

Under regulations, the owner of a commercial building or the commercial portion of a composite building (irrespective of newly constructed or existing one), every 10 years, is required to engage a Registered Energy Assessor to carry out energy audit for 4 key types of central building services installation, namely, air-conditioning installation, electrical installation, lighting installation as well as lift and escalator installation, in accordance with the latest edition of the EAC. Pursuant to clause 4.2 of the EAC, in the case of a composite building, the energy audit requirement should only be applicable to the central building services installation solely serving the commercial portions.

2.1 Procedure for Carrying Out an Energy Audit

(i) The owner of a commercial building or the commercial portion of a composite building (irrespective of newly constructed or existing one) every 10 years, is required to engage a Registered Energy Assessor to carry out energy audit for the 4 key types of central building services installation.

(ii) That owner is required to obtain an Energy Audit Form (Specified Form EE5) and an energy audit report from the Registered Energy Assessor as soon as possible.

(iii) The Registered Energy Assessor is required to submit a copy of the Energy Audit Form and the energy audit report to the EMSD for record within 30 days after issuing the Energy Audit Form.

(iv) That owner is required to exhibit the valid Energy Audit Form in a conspicuous position at the main entrance of the building

(v) The Energy Audit Form is valid for 10 year starting from the completion date of the Energy audit. Before the expiry of Energy Audit Form, the owner is required to reserve adequate time to engage a Registered Energy Assessor to complete another energy audit and obtain a new valid Energy Audit Form which should be exhibited in a conspicuous position at the main entrance of

the building.

3. ENERGY AUDIT FINDINGS

Over 450 buildings were audited in the past 4 years. Within them, there are 200 buildings which belong to the category of "Commercial Building or the Commercial portion of a Composite Building".

In simplified terms, this category will consist of the following 3 types:

- Office Building with Shopping Mall
- Shopping Mall Only
- Office Buildings Only

The above 3 types will cover all the buildings required for energy audit under BEEO.

Under these 3 building types, there are some sub-categories like:

- With Central Air-conditioning
- Without Central Air-conditioning
- With Carpark
- Without Carpark

With or without central air-conditioning and with or without carpark will result on different EUIs.

It is understood that EMSD includes area of car park into the total building GFA calculations. The bigger the carpark area the lower will be the total Energy Utilization Index (EUI). This is simply because no air-conditioning provisions will be given to all carpark. There are also buildings which have only G/F entrance lobby and office from 1/F upward without not even a café, a shop and a restaurant above and G/F. These buildings are classified as "Office Building only", i.e. pure office building.

Analyses was made to this category of "Commercial Building or the Commercial portion of a Composite Building" on Energy Utilization Index (EUI) in the next 3 sections and with presentations in tables and figures..

3.1 Office Building with Shopping Mall

		Average EUI (MJ/m^2/annum)	Max	Min
With Central A/C	Without Carpark	**492.25**	1,049.80	158.79
	With Carpark	**459.22**	1,108.80	110.72
Without Central A/C	Without Carpark	**108.03**	199.53	50.80
	With Carpark	**175.37**	185.32	46.43
Overall		**392.20**		

Table 1 – EUI of Office Building with Shopping Mall

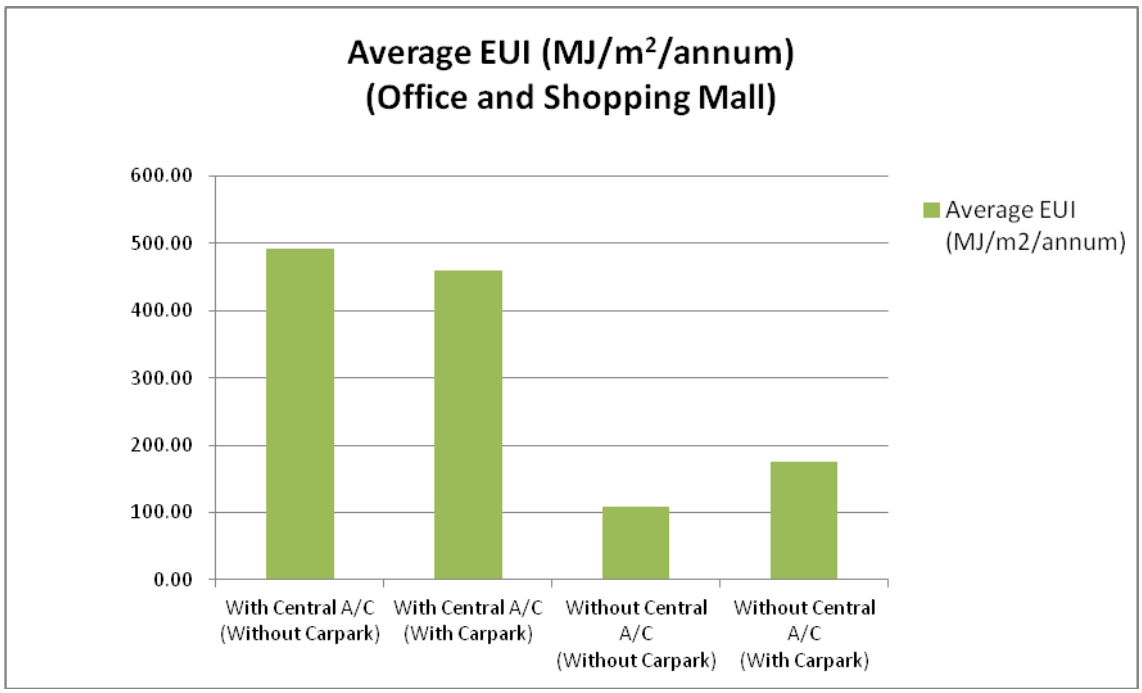

Figure 1 – Average EUI of Office Building with Shopping Mall

3.2 Shopping Mall Only

		Average EUI (MJ/m^2/annum)	Max	Min
With Central A/C	Without Carpark	**877.67**	1,810.00	214.38
	With Carpark	**632.96**	1,604.54	287.36
Without Central A/C	Without Carpark	**185.07**	382.17	69.23
	With Carpark	**82.86**	120.63	36.16
Overall		**569.53**		

Table 2 – EUI of Shopping Mall only

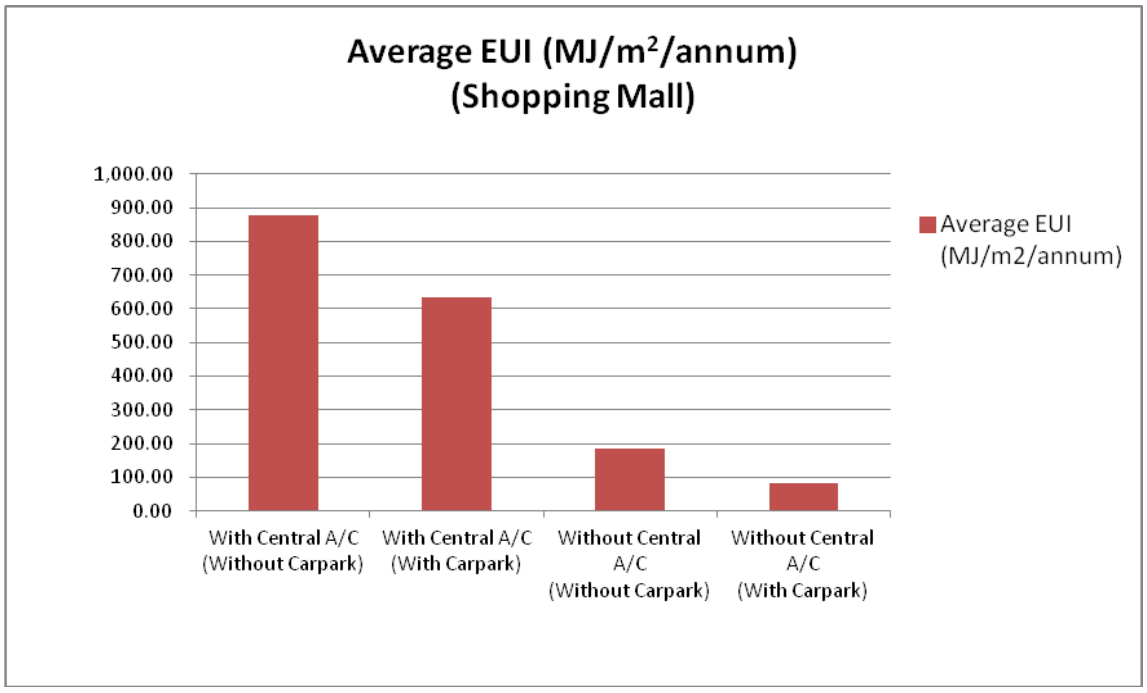

Figure 2 – Average EUI of Shopping Mall only

3.3 Office Building Only

		Average EUI (MJ/m^2/annum)	Max	Min
With Central A/C	Without Carpark	**492.85**	705.58	304.82
	With Carpark	**422.28**	884.32	261.97
Without Central A/C	Without Carpark	**121.52**	161.23	81.80
	With Carpark	**N/A**	N/A	N/A
Overall		**404.52**		

Table 3 – EUI of Office Building only

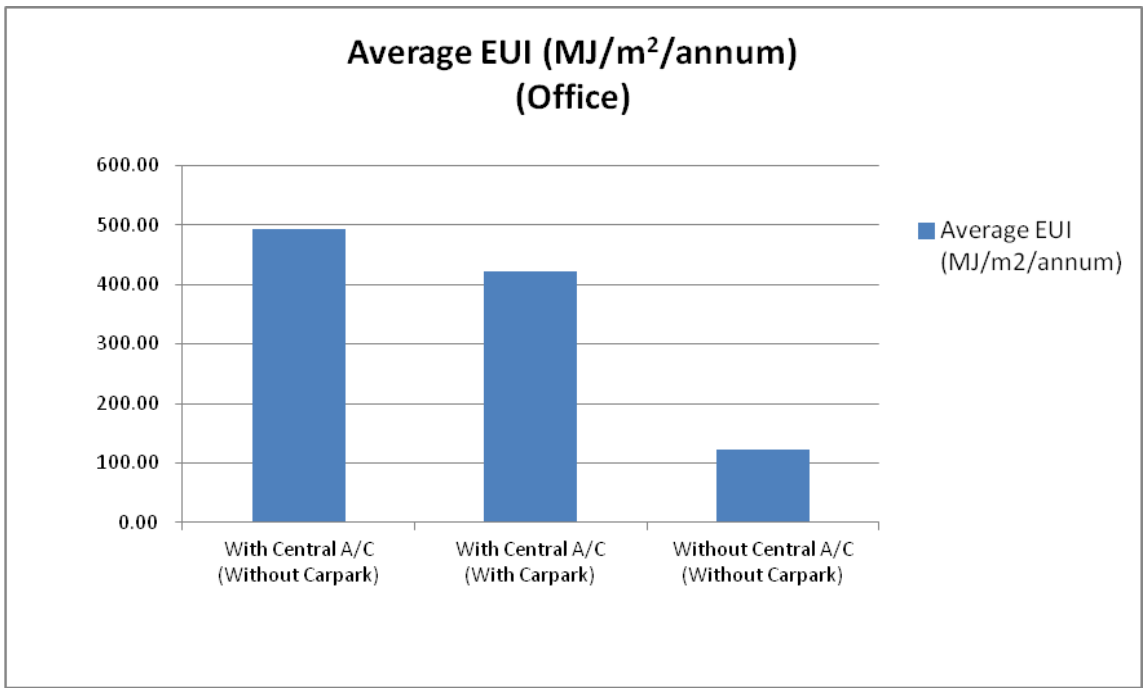

Figure 3 – Average EUI of Office Building only

4. DISCUSSIONS

For "Office Building with Shopping Mall", there is an average EUI of 459 to 492 MJ/m^2/annum with central air-conditioning. These are composite buildings of reasonably large buildings. If there is no central air- conditioning, the EUI are quite low and at the range of 108 – 175 MJ/m^2/annum. There is no reference benchmarking from EMSD's web site on this type of building.

For "Shopping Mall Only" buildings, there is an average EUI of 632 to 877 MJ/m^2/annum with central air-conditioning. These are shopping malls are of reasonably large when they have carpark. If there is no central air- conditioning, the EUI are low and at the range of 82 – 185 MJ/m^2/annum. These shopping malls are not large particularly if no carpark. There is a reference benchmarking from EMSD's web site http://ecib.emsd.gov.hk/en/indicator_cmc.htm on this type of building. In Principal Group 7 – Central Services for Shopping Arcade, the figure is 2,302 MJ/m^2/annum which is higher than 881 (average high) or absolute high 1,801.

For "Office Buildings Only", there is an average EUI of 422 to 492 MJ/m^2/annum with central air-conditioning. If there is no central air- conditioning, the EUI are low and at 121 MJ/m^2/annum. There is a reference benchmarking from EMSD's web site on this type of building. In Principal Group 8 – Private Office, has Subgroup B27 with central air-conditioning and Subgroup B29 without central air-conditioning. The figure in B27 is 944 MJ/m^2/annum which is higher than 422 - 492. The figure in B29 is 196 MJ/m^2/annum which is also higher than 161.

5. CONCLUSION

From the energy audited EUI figures, the buildings are quite scattered apart. It is known that building design will dictate the future energy performance of the buildings at a very large extend. For example 2 buildings with the same building area, a relatively low building with larger site area will have lower energy consumption than a taller building. It is quite obvious that taller buildings have much more high speed lifts, more façade glazing area, less internal area, etc.

Moreover, the system adopted for calculating the Office Buildings without central air-conditioning does not include the amount of air-conditioning energy used by individual tenants. Therefore, it is not a complete answer to reflect the total building performance.

Overall, the energy audit exercise could still satisfy the purpose of comparing energy consumption of buildings and provide a recommendation for energy management opportunities for future improvement.

6. REFERENCE

(i) Hong Kong's Climate Change Strategy and Action Agenda, Environment Bureau, HKSAR Government, 2010.

(ii) EMSD web site: http://www.beeo.emsd.gov.hk/en/mibec_beeo.html

(iii) Hong Kong Energy Efficiency Registration Scheme for Buildings 2007 Edition, EMSD

(iv) EMSD web on benchmarking: http://ecib.emsd.gov.hk/en/indicator_cmc.htm

(v) Chow KHL and Zhou SWW, An Overview of the various Energy and Carbon Certification and Assessment Schemes in Hong Kong, Fuzhou Presentation, 2013.

(vi) Chow KHL, Energy Benchmarking Update of Commercial Buildings and Shopping Malls in Hong Kong, Technical Forum 2014, Hong Kong.

7. COURTESY

Special thanks to Ms Charlene Kwong in assisting in data and report preparation.

8. AUTHOR

Ir Dr Leonard Chow is the Immediate Past President of the Association of Energy Engineers (AEE) Hong Kong Chapter. He is currently also Chairman of HKAEE and the past Chairman of Asian Institute of Intelligent Buildings (AIIB).

In 2011, he was awarded International title of the "2011 Energy Engineer of the Year" by AEE USA. In 2013, he was granted the one of the ten "Fellow of AEE" which indicates his significant contribution to the energy industry worldwide. He is also appointed as the "Court Member" of Imperial College London since 2012.

He achieved the title of Certified Energy Manager (CEM) in 2005 and the Certified Building Commissioning Professional (CBCP) in 2006 granted by the Association of Energy Engineers (USA). He was graduated at the Mechanical Engineering Department with First Class Honours at the Imperial College of Science and Technology U.K. He practices as a Mechanical and Building Services Engineer for over 20 years. Subsequently, he obtained his Master MSc and PhD degree in

Engineering at the University of Hong Kong. Dr Chow is currently a chartered engineer in UK, a registered professional engineer in Hong Kong and a chartered professional engineer in Australia. He establishes his own company ISPL Consulting Ltd in the mid 1995 and will celebrate the 20th year anniversary in 2015. His company is the consultants in Mechanical, Structure, Safety and Environmental (Energy & IAQ) aspects with about 35 employees. Dr. Chow is actively involved in professional institution contributions. He wrote over 50 technical papers, guidelines, manuals and conducted over 25 technical seminars in Hong Kong, USA (Atlanta), Tokyo, Beijing, Xian, Shanghai, Fuzhou and Singapore in the recent years.

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