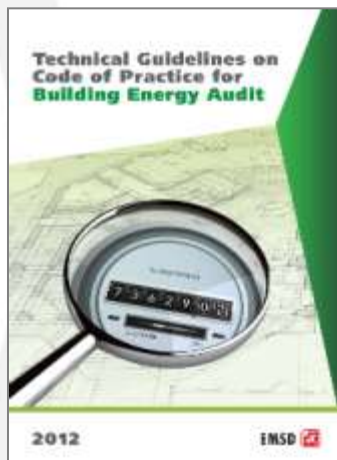


Technical Guidelines on Code of Practice for Building Energy Audit (TG-EAC)



Briefing Session for
Registered Energy Assessors

Buildings Energy Efficiency Ordinance



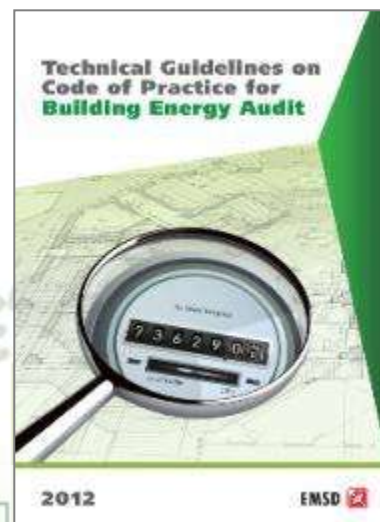
➤ Buildings Energy Efficiency Ordinance (BEEO) fully implemented on 21 Sep 2012 - combat climate change

➤ Require commercial buildings to undergo energy audit in accordance with the Code of Practice for Building Energy Audit (EAC) issued by EMSD in Feb 2012

➤ **Technical Guidelines on Code of Practice for Building Energy Audit (TG-EAC or TG)** issued by EMSD on 18 Mar 2013 – explains BEEO & EAC contents

➤ Addendum no. TG-EAC01 (9 Aug 2013)

➤ Good Practice – to exceed EAC min requirements

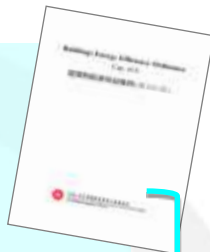


TG Contents



➤ 9 sections

- 1 - Introduction
- 2 - Interpretations & Abbreviations
- 3 - Application
- 4 - Technical Compliance with BEEO

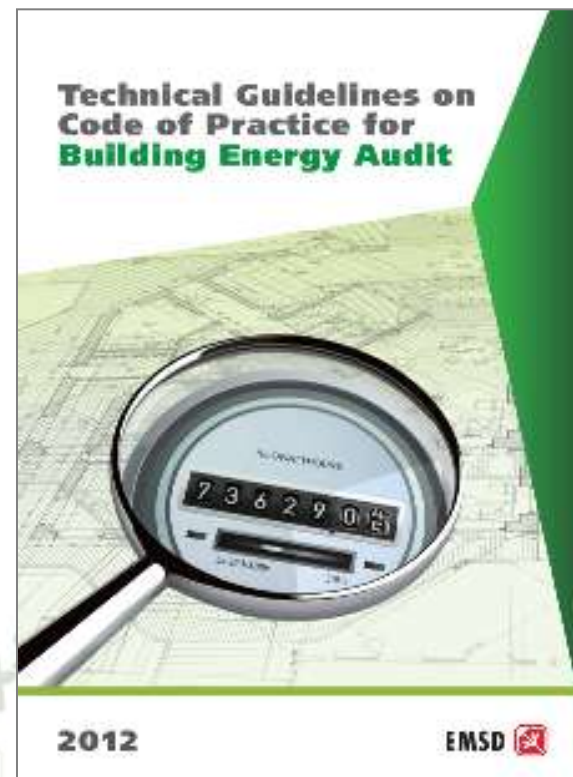


Overview & explanation of BEEO compliance process

- 5 – Objectives of EA
- 6 – Overview of EA
- 7 – EA Requirements
- 8 – EA Report
- 9 – EA Form



Explanations of EAC's technical requirements with examples



TG – Compliance Process

Buildings Governed

Buildings requiring
Energy Audit (BEEO Sch 4)

- Commercial building
- Commercial portion of composite building

Commercial building	Composite building		
	Commercial portion	Non-commercial portion	
Non-CBSI *1	CBSI	Non-CBSI *1	

Energy Audit requirements apply

CBSI – central building services installation (not solely serving a unit, e.g. common area lighting, central chilled water plant)
(Composite - commercial & industrial, or commercial & residential)

BEEO does not govern
(BEEO sec 4 & Sch 2)

- Small building (3-storey each $\leq 65 \text{ m}^2$)



- Building with approved electrical load $\leq 100\text{A}$



- Historical or Monument building



- Building to be demolished in 12 months



- BS installations, with specific operational & technical natures such as fire protection, life safety, industrial undertaking etc.

TG – Compliance Process

Energy Audit Form & Energy Audit Report



- Building owner to engage REA to carry out energy audit according to prescribed time frame
- Obtain from REA the Energy Audit Form with Energy Utilization Index (EUI in MJ/m²/annum or kWh/m²/annum) and Energy Audit Report
- Exhibit Energy Audit Form at building main entrance

能源審核報告
EA Report

第1類措施 (Cat 1)

第2類措施 (Cat 2)

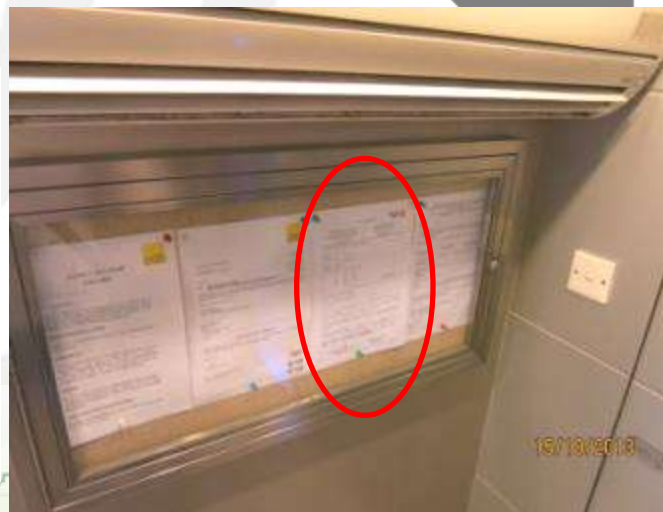
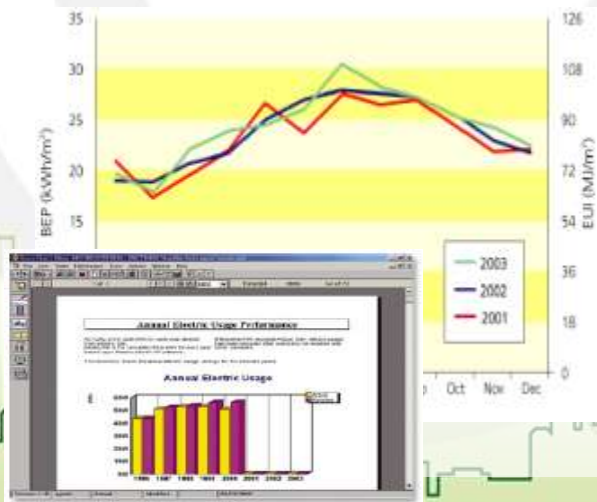
第3類措施 (Cat 3)

Form EES 表格 EES
機電工程署 EMSD

The Government of the Hong Kong Special Administrative Region
Buildings Energy Efficiency Ordinance (Chapter 610, Section 2D)
Energy Audit Form

Section A 甲部: General information 一般資料

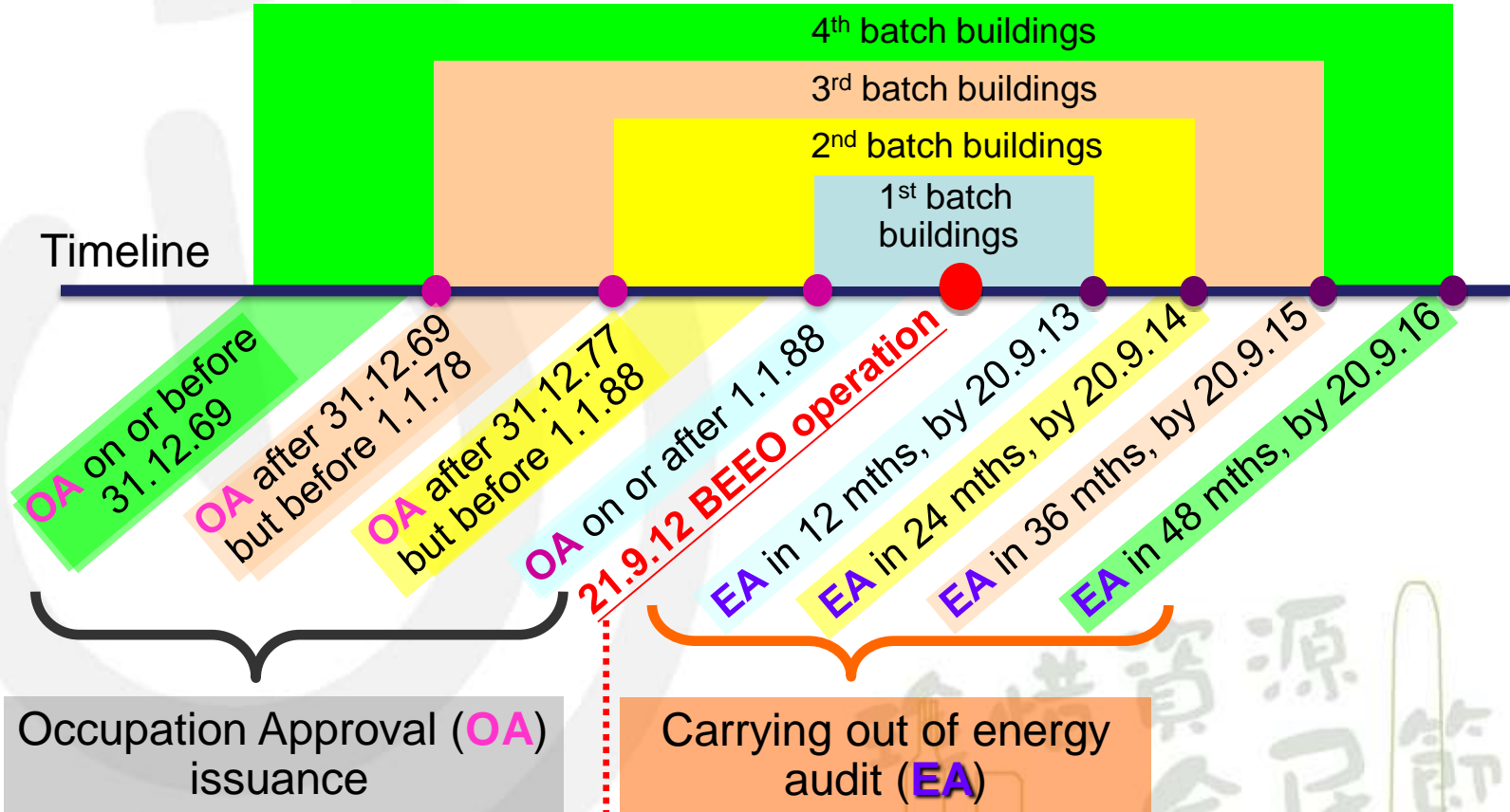
Section B 乙部: Declaration 聲明



TG – Compliance Process



Timeframe for Existing Buildings



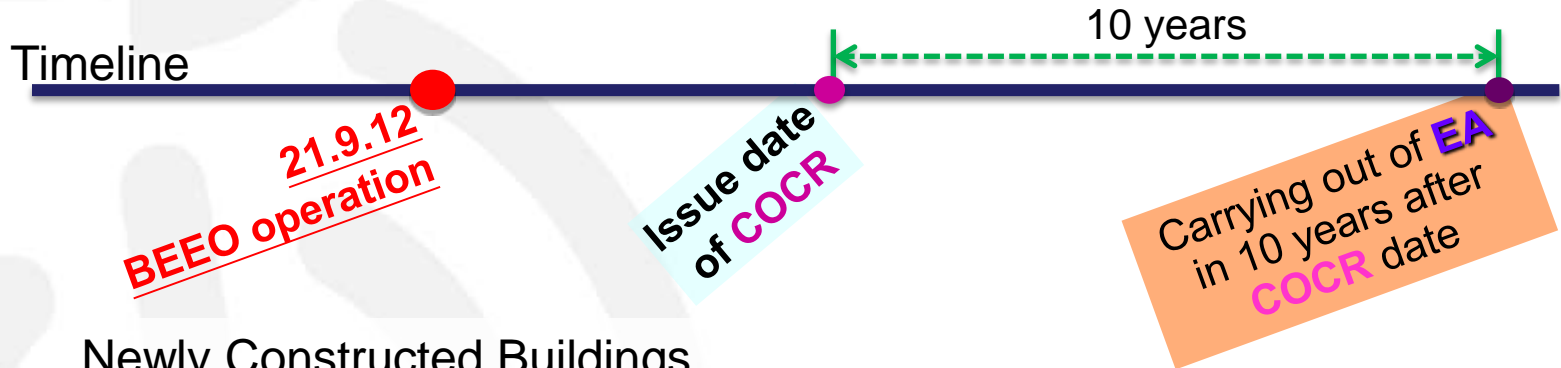
Existing Buildings

Having obtained the consent to the commencement of building works for superstructure construction from Building Authority **on or before 21 Sep 2012**

TG – Compliance Process



Timeframe for Newly Constructed Buildings

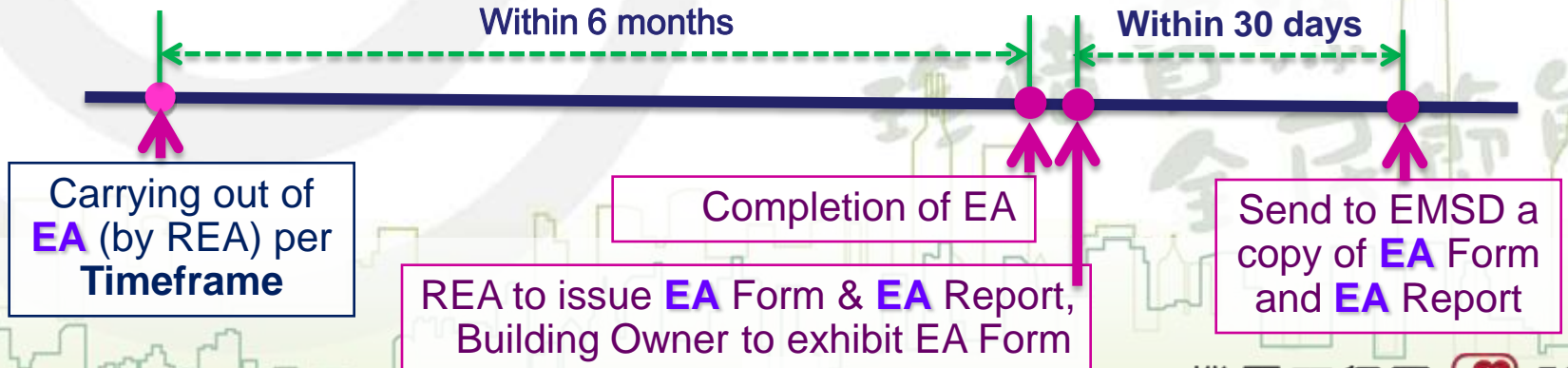


Newly Constructed Buildings

Having obtained the consent to the commencement of building works for superstructure construction **after 21 Sep 2012** (irrespective of date of OA) and issued with EMSD **COCR**

Energy Audit Carrying Out Time

Applicable to both Newly Constructed Buildings and Existing Buildings



TG – Compliance Process

Exemption

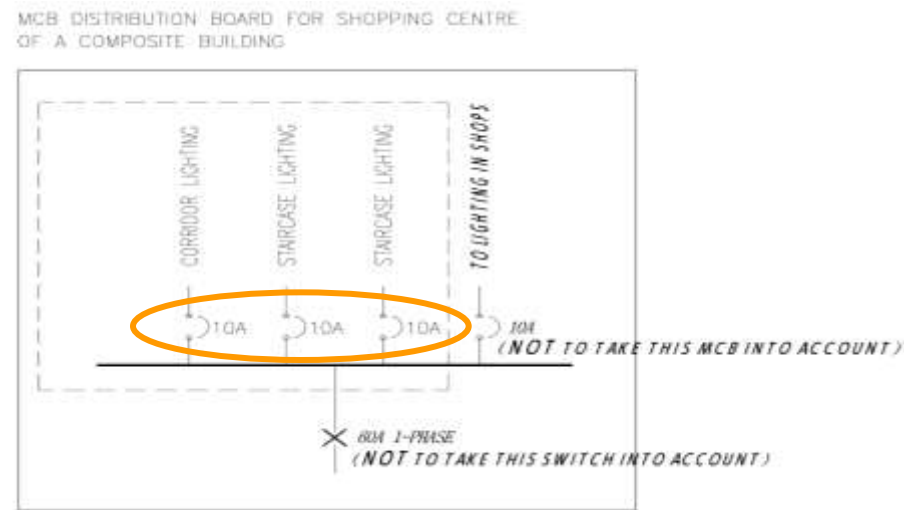
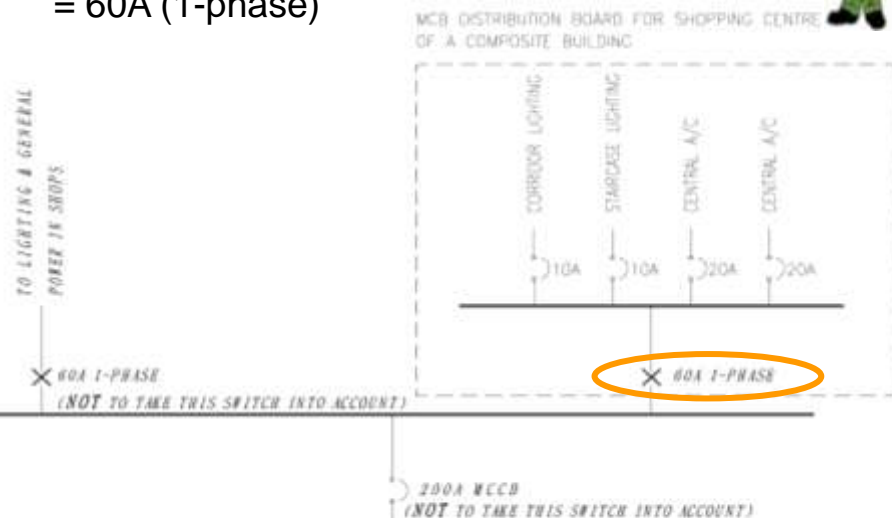


- EAC Addendum no. EAC01 (9 Aug 2013) - exemption (case by case) for a composite building's **CBSI of small scale**
 - (a) Electrical circuits (supply side) total rating (protective device) $\leq 100A$, 1-phase, and
 - (b) Commercial portion's common area $\leq 195 m^2$

Total rating of the electricity supply to CBSI
 = Rating of the sub-main switch of the MCB board
 = 60A (1-phase)



Total rating of the electricity supply to CBSI
 = Total rating of the MCBs (3 nos.) **solely supplying electricity to CBSI** = 3 X 10A
 = 30A (1-phase)



TG – Compliance Process

CBSI & Non-CBSI

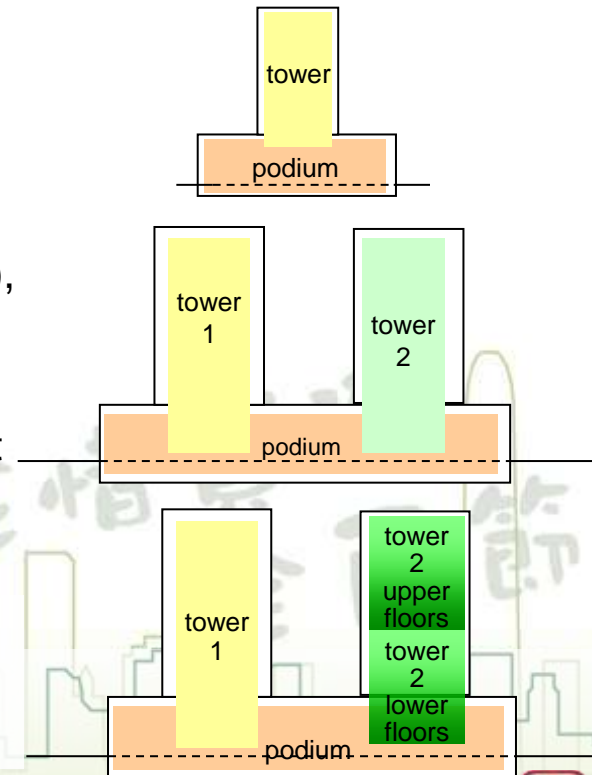


Building type	Common area or unit served by concerned BSI	Ownership of BSI	CBSI or non-CBSI	Justification based on BEEO interpretation
Building with common area (i.e. with deed of mutual covenant or DMC)	Entrance lobby, common corridor, staircase etc. (i.e. the common area interpreted in BEEO)	Building owner	CBSI	BSI not solely serving a unit
	Building owner occupied unit	Building owner	Non-CBSI	BSI solely serving a unit
	Occupier owned unit	Building owner		
		Unit occupier		
Leased unit	Building owner	Unit lessee		
Building without common area (without DMC)	Entrance lobby, common corridor, common staircase etc.	Building owner	CBSI	BSI owned by the building owner (and not solely serving a unit)
	Building owner occupied unit	Building owner	CBSI	BSI owned by the building owner
	Leased unit			
	Leased unit	Unit lessee	Non-CBSI	BSI solely serving a unit and owned by a person who is not the building owner

TG – Compliance Process

Building Blocks in a Complex

- Building owner accounting for management/ownership convenience may choose to carry out the energy audit for all the blocks at the same time, or for each block separately
- Auditing all blocks (with ones having different audit timeframes per BEEO sec 22(2) &/or 22(3)) at the same time – to carry out at the earlier timeframe of the blocks
- Podium and tower counted as 2 nos. blocks (each with separate EA Form, but may be covered by a single EA Report)
- Two towers with common podium counted as 3 nos. blocks (each with separate EA Form and EA Report), and three towers with podium as 4 nos. blocks etc.
- Grouping into one entity for certain but not all blocks – carry out the energy audit at the constituent blocks' earlier timeframe (dictated by latest OA or earliest COCR)
- Phased completion of a building – based on the phases' latest OA (existing building) or earliest COCR (newly constructed building)



TG – Compliance Process

Other Explanations/Remarks



- Prescribed building identification (energy audit applicable) –
 - OA (occupation permit) usage categorization
 - instrument or land record maintained with the Land Registry or Lands Department (in the form of land register, memorial, government lease, conditions of grant/sale/exchange etc.)
- Identification of commercial portion and CBSI
- Not governed –
 - CBSI not solely serving commercial portion, and
 - the building is one that is allowed to have its individual floor usage freely swapped between commercial and residential usages
- Good practice (Addendum no. TG-EAC01) –
 - to include in the energy audit a composite building's "central chilled/heated water plant ≥ 350 kW capacity" that serves both commercial portion and non-commercial portion



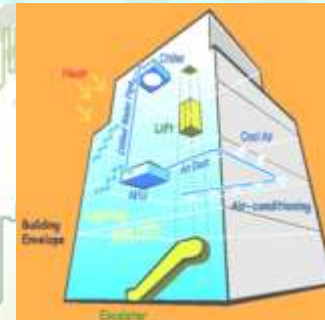
TG – Compliance Process

Other Explanations/Remarks

- EAC recommends completion of energy audit in 6 months after commencement
- Energy audit independent from BEC compliance
- Implementation of energy management opportunities (EMO) – strongly encouraged as good practice but not mandatory
- With EMOs identified & audit report in place, some EMOs will be implemented, if not all
- EUI comparison – a trigger on energy efficiency improvement



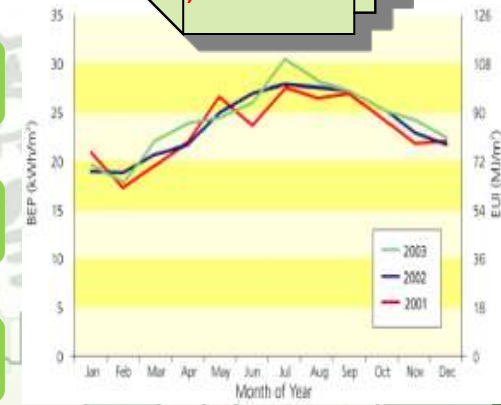
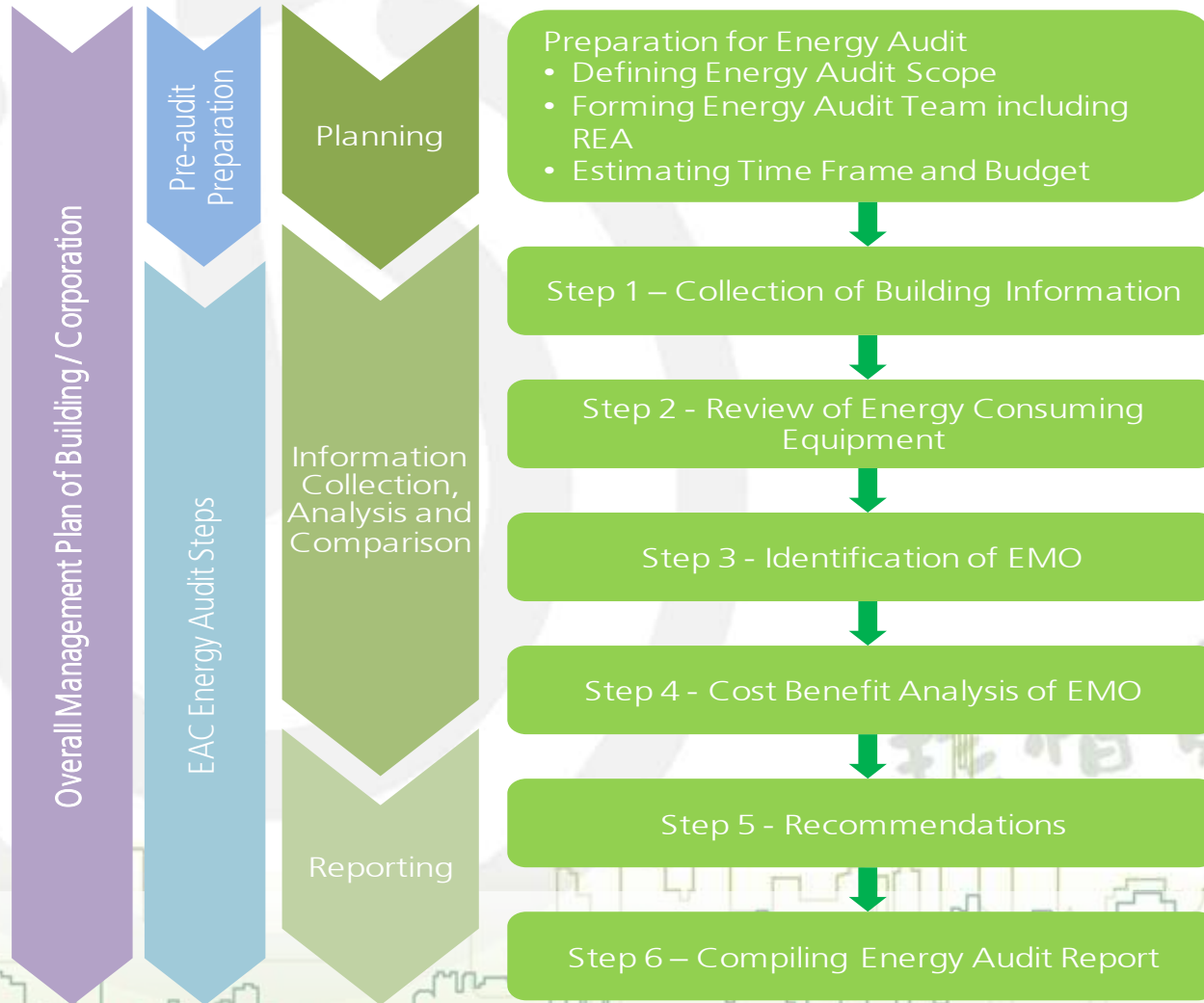
6 months



TG – Engineering Guidelines



Energy Audit Process



TG – Engineering Guidelines



Energy Audit Process

STEP 1

Collection of Building Information (Focus on CBSI)

Technical Characteristics and Operation Characteristics

- equipment inventories - O&M programmes - floor areas
- system schematics, drawings - technical brochures, manuals
- energy bills - operation records

STEP 2

Review of Energy Consuming Equipment (Focus on CBSI)

Review: Compile records, with site inspections and where necessary supplementary information collection

<u>Types and Components</u>	<u>Technical & Operation Characteristics</u>
Air-conditioning - chillers, heat pumps, unitary air-conditioners - AHUs, fans - Pumps - Other equipment	Types, capacity ratings and operating characteristics Control mechanism
Lighting - Luminaires	Power quality
Lifts and escalators	Metering provisions
Other equipment - e.g. motors of plumbing & drainage pumps	Utilization pattern Other notable characteristics affecting energy consumption

Review: Identify and calculate power and energy consumptions

- based on operation records
- based on technical brochures (with adjustments to suit)
- take measurements where necessary to supplement the operation records
- apply external metering where necessary

STEP 3

Identification of EMO

Evaluation and appraisal of findings in STEP 2

Energy performances **VS** Corresponding operating conditions

- Chiller/heat pump (kWh/annum)
- AHU / PAHU (W/litre/s air flow)
- Pump (W/litre/s flow)
- Lighting power density (W/m²)
- Other equipment
- EUI of building

Comparative Normalized Performance Indicators

- Compare with original design
 - Reference to codes, international guidelines, established local practices
- Also assess operation hours for integration with power consumption to arrive at annual energy consumption

↓
Potential EMO

STEP 4

Cost Benefit Analysis of EMO

- Energy saving estimate
- Categorization into Cat I, Cat II and Cat III
- Cat II and Cat III : cost vs energy saving

STEP 5

Recommendations

- Due regard : energy saving and cost benefit
- Make use of O&M activities

STEP 6

Energy Audit Report

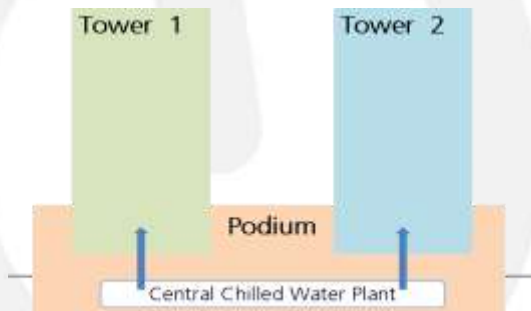
- Executive Summary - Objective and scope
- Equipment / systems operating characteristics
- Potential EMO : energy savings and cost benefit analyses
- Recommendations with due regard to O&M programme

TG – Engineering Guidelines

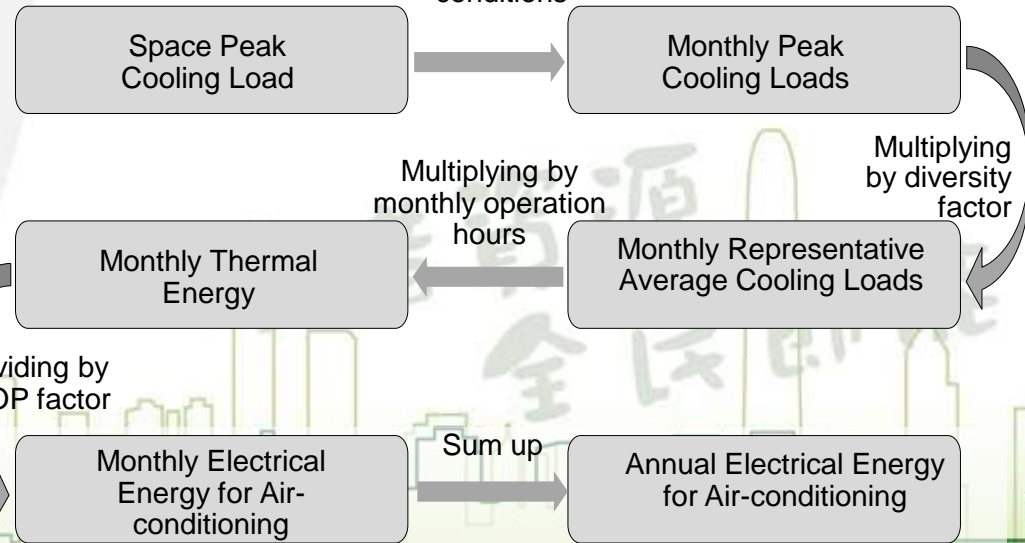


Metering for Shared Service and Estimation of Energy Consumption

- Energy supply to units (commercial) and consumption breakdown
- “Import” and/or “Export” of energy
- Metered data and professional judgement
- Rule-of-thumb – energy per m², cooling capacity, diversity factor
- Building energy simulation



Considering profile of electricity bills / weather conditions



Soft tools
(human / machine interface)
- Set points
- Operating schedules

Operating conditions
- Temperature
- Pressure
- Load demand
etc.

Load patterns
- Intensity
- Time of occurrence

TG – Energy Audit Report

Executive Summary - Technical Form EE-EAes (V.1)



Part 1 – Administrative Information & Building Characteristics			
(A) Administrative Information			(EAC Clause 8.1)
Name of Building ^{^1}			
Address of Building			
1) Date of commencement of energy audit :	(dd/mm/yyyy)		
2) Date of completion of energy audit : (not later than 6 months after the energy bill reference month)	(dd/mm/yyyy)		
3) Energy Audit Form validity period - issued on :	(dd/mm/yyyy)	and expired on :	(dd/mm/yyyy)
4) Energy Audit Report reference no. (optional) :			
5) Does the audited building import or export energy from/to other building ?	Building(s) importing energy or to which energy is exported		Import or export
<input type="checkbox"/> Yes <input type="checkbox"/> No	Name(s) of building(s)	Address(es) of building(s)	
If yes, please provide information ^{^34} . (Refer TG-EAC clause 4.4)			

TG – Energy Audit Report

Executive Summary - Technical Form EE-EAes (V.1) (Cont'd)



(B) Building Characteristics

(EAC Clause 8.1)

(I) Building Type, Usage & Operation

(Please tick where applicable and insert N/A for non-applicable items.)

1) Type of building

(a) Please choose the type (tick one item only) of building of the building entity^{^2} audited :

- Commercial building
 Commercial portion of composite (commercial & residential) building
 Commercial portion of composite (commercial & industrial) ^{^3} building

(b) Please indicate the portion of the building entity being common area^{^4} :

	%
--	---

(c) Please indicate the no. of blocks^{^2} of the building entity :

	no. of blocks
--	---------------

Commercial portions – common areas & units

2) Total internal floor area^{^5} of the building entity (m²) :

3) No. of floors ^{^6} of the building entity :

4) Major type of building façade (tick one item) :

- Curtain wall Non-curtain wall

5) Date(s) of issue of occupation approval (dd/mm/yyyy) ^{^7} :

6) Type of central air-conditioning^{^8} provided :

- Cool air Chilled water Condenser water only Not applicable

7) Summary of operation characteristics of categorized major usages of CBSI-served areas :

(Below is a summary of the categorized usages in item 8). Item 8) should be completed first, based on which the following summary information can be provided.) (EXCEL version of Form EE-EAes has the built-in function to automatically add the corresponding % area figures in item 8) and insert in the relevant yellow shaded cells in item 7.)

Operation characteristics	%tage area of total of building entity ^{^9^27E}	%tage AC area of total of building entity ^{^10^27E}	Average weekly operating hours (hrs/week) ^{^11^12}	Daily average no. of occupants ^{^12}
Major usage				
(a) Office				
(b) Shopping & leisure				
(c) Back of house area				
(d) Restaurant				
(e) Car park				N/A
(f) Others ^{^13}				
Total ^{^14^27E}			N/A	
Daily average occupant density (m ² per person) ^{^15^27E}				

TG – Energy Audit Report

Executive Summary - Technical Form EE-EAes (V.1) (Cont'd)



8) Details of operation characteristics of CBSI-served areas grouped under categorized major usages ^{^16}
(with energy consumption on account of the building owner) :

Operation Characteristics CBSI served Categorized major usages		Norm ^{^17} of operation		%tage area of total of building entity	Weekly operating hours/wk ^{^12} [sum up hours of "weekday" and hours of "weekend" to obtain hours of "week total"] ^{^27E}		
		General or 24-hour	AC or non-AC		weekday	weekend	week total
(a)	(i) Commonly used areas ^{^18} on office floors (office tower entrance lobby, lift lobbies, common corridors, common toilets etc.)	General	AC				
		24-hour	Non-AC				
	(ii) Areas specific for office works (general office, private office, meeting rooms, data centres, server rooms, clinics, laboratories, tutorial schools, private toilets etc.)	General	AC				
		24-hour	Non-AC				
(b)	(i) Commonly used areas ^{^18} on shopping & leisure floors (shopping mall entrance lobby, public circulation areas, atrium, visitor toilets, etc.)	General	AC				
		24-hour	Non-AC				
	(ii) Areas specific for shopping & leisure (retail shops, department stores, cinemas, health clubs, private toilets etc.)	General	AC				
		24-hour	Non-AC				
(c)	Back of house areas (plant rooms, cleaner rooms, staircases (outside public circulation areas))	General	AC				
		24-hour	Non-AC				
(d)	Restaurants	General	AC				
		24-hour	Non-AC				
(e)	Car parks	General	AC				
		24-hour	Non-AC				
(f)	Others ^{^13} (if applicable, please specify)	General	AC				
		24-hour	Non-AC				

TG – Energy Audit Report

Executive Summary - Technical Form EE-EAes (V.1) (Cont'd)



(II) Central Building Services Installation ^{^19}

1) Air-conditioning Installation

(a)(i) Chillers, Heat Pumps, Boilers, Other Heating ^{^20^34}

Type of equipment (C/HP/B/O) ^{^21} (C: Chiller, HP: Heat Pump, B: Boiler, O: Other heating)	Cooling (for heat rejection) (AFW/SW/FE) ^{^22}	Compressor (Ce/Se/So/Re) ^{^23}	Refrigerant (R134a/ R123/R407c/R410a/ R12/R11 etc.) ^{^24}	Rated Capacity (kW)	Rated input power (kW)	Quantity	COP (kW / kW) ^{^25}
Each row to cater for all equipment of the same configuration							
Total for cooling ^{^26} , of all chillers / heat pumps							
Total for heating ^{^26} , of all boilers / heat pumps / other heating							

(a)(ii) Unitary air-conditioners ^{^20^34}

Type of equipment (R/S/P) ^{^21} (R: Room type, S: Split type, P: Packaged type)	Cooling (for heat rejection) (AFW/SW/FE) ^{^22}	Compressor (Se/So/Re) ^{^23}	VRF ? ^{^24}	Refrigerant (R134a/ R123/R407c/R 410a/R22/R12/ R11 etc.) ^{^24}	Rated Capacity (kW)	Rated input power (kW)	Quantity	COP (kW / kW) ^{^25}
Each row to cater for all equipment of the same configuration								
Total for cooling ^{^26} , of all unitary air-conditioners								
Total for heating ^{^26} , of all unitary air-conditioners								
Percentage (based on total cooling capacity) of all unitary air-conditioners (add up to 100%) :		for office floors		for shopping & leisure floors		for other floors		

TG – Energy Audit Report

Executive Summary - Technical Form EE-EAes (V.1) (Cont'd)



1) Air-conditioning Installation					
(b) Air-conditioning pumps		Pump rated motor power (kW)	Pump rated flow (L/s)	Quantity	Performance (W per L/s)
(i) Chilled water pumps	Primary circuit, sub-total of all pumps ^{^27}				
	Secondary circuit, sub-total of all pumps ^{^27}				
	Total, of all chilled water pumps^{^27A}				
(ii) Condenser water pumps	Fresh water, sub-total of all pumps ^{^27}				
	Sea water, sub-total of all pumps ^{^27}				
	Total, of all condenser water pumps^{^27B}				
(iii) Heated water pumps – total of all heated water pumps ^{^27}					
(c) Heat rejection		Fan rated motor power (kW) ^{^27C}	Rated heat rejection capacity (kW) ^{^27C}	Quantity	Performance (kW / kW) ^{^27C}
Sub-total, of all cooling towers ^{^27C}					
Sub-total, of all radiators ^{^27C}					
Total, of all heat rejection equipment^{^27C}					
(d) Air-conditioning fans		Fan rated motor power (kW)	Fan rated flow (L/s)	Quantity	Performance (W per L/s)
Sub-total, of all AHUs & FCUs (excluding primary air AHU) ^{^27}					
Sub-total, of all primary air AHUs, fresh air and return air fans (for conditioned areas) ^{^27}					
Total, of all air-conditioning fans^{^27D}					
Percentage (based on total fan rated motor power) of all air-conditioning fans (add up to 100%) :		for office floors	for shopping & leisure floors	for other floors	
(e) Chilled / Heated water plant sequencing control		Please indicate if automatic sequencing control is provided :		<input type="checkbox"/> Yes <input type="checkbox"/> No	
(f) Overall representative indoor room temperature set point in summer (°C) :					
(g) Major type of air-side system (CBSI) : (may tick more than one item, if it serves 20% or more of AC area of building entity)		<input type="checkbox"/> Chilled water AHU (VAV/CAV) <input type="checkbox"/> Chilled water FCU <input type="checkbox"/> Unitary air-conditioner <input type="checkbox"/> Not applicable			
(h) Is power supply to air-side system AHU/FCU fans mainly on account of the building owner or tenants ? (please tick only one item) :		<input type="checkbox"/> On account of the building owner <input type="checkbox"/> On account of tenants <input type="checkbox"/> Not applicable			

TG – Energy Audit Report

Executive Summary - Technical Form EE-EAes (V.1) (Cont'd)



2) Central Mechanical Ventilation

	Fan rated motor power (kW)	Fan rated flow (L/s)	Quantity	Performance (W per L/s)
Sub-total, of all exhaust and intake fans for car park ^{^27}				
Sub-total, of all exhaust and intake fans for toilets, pantries, un-conditioned areas etc. ^{^27}				
Total, of all central mechanical ventilation fans^{^27B}				
Total internal floor area of areas served by central mechanical ventilation (m ²) :				
Percentage (based on total rated motor power) of all central mechanical ventilation fans (add up to 100%) :	for office floors		for shopping & leisure floors	

3) Lighting Installation (Lighting power below to be based on rated luminaire wattage, and to include decoration lighting of the building owner but not external lighting)

(a) Sub-total lighting power, of all luminaires with T5 fluorescent lamps (kW)				
(b) Sub-total lighting power, of all luminaires with fluorescent lamps other than T5 (kW)				
(c) Sub-total lighting power, of all luminaires with compact fluorescent lamps (kW)				
(d) Sub-total lighting power, of all luminaires with incandescent lamps (tungsten filament, tungsten halogen etc.) (kW)				
(e) Sub-total lighting power, of all luminaires with discharge lamps (metal halide, high pressure sodium vapour etc.) (kW)				
(f) Sub-total lighting power, of all luminaires with LED (light emitting diode) lamps (kW)				
(g) Sub-total lighting power, of all luminaires with other types of lamps, if any (kW)				
Total lighting power, of all luminaires (kW) [obtained by summing up all figures in (a) to (g)^{^27E}] :				
Total internal floor area of areas having CBSI lighting installation (m ²) :				
Total lighting power density (kW/m²) [obtained by dividing total lighting power by total internal floor area (having CBSI lighting) above^{^27E}] :				
Percentage (based on total lighting power) of all luminaires (add up to 100%)	for office floors		for shopping & leisure floors	

TG – Energy Audit Report

Executive Summary - Technical Form EE-EAes (V.1) (Cont'd)



4) Lift and Escalator Installation

	Rated motor power (kW)	Quantity
Sub-total, of all traction lifts with DC Ward Leonard drive		
Sub-total, of all traction lifts with DC thyristor Leonard drive		
Sub-total, of all traction lifts with AC variable voltage (VV) drive		
Sub-total, of all traction lifts with AC variable frequency (VF) drive		
Sub-total, of all traction lifts with AC VVVF drive		
Sub-total, of all traction lifts with other types of drive		
Sub-total, of all hydraulic lifts		
Sub-total, of all escalators and passenger conveyors		
Total, of all lifts, escalators and passenger conveyors^{^27E}		
Percentage (based on total rated motor power) of all lifts, escalators & passenger conveyors (add up to 100%) :		
	for office floors	for shopping & leisure floors
		for other floors

5) Other Installations^{^28^34}

Total quantity of personal computers and photocopiers, with electricity consumption on account of the building owner :	
Total rated motor power, of all plumbing & drainage pumps (kW)	
Other installations, if applicable (please specify, and insert N/A if not applicable) ^{^28^34}	

TG – Energy Audit Report

Executive Summary - Technical Form EE-EAes (V.1) (Cont'd)



Part 2 – Historical Energy Consumption Analysis ^{^29}		(EAC Clause 8.1(g))		
1) Annual electricity consumption of last 36-month (kWh/annum) (EAC Clause 8.1(g)ii))	(kWh/annum)	(kWh/annum)	(kWh/annum)	
	Past 1 st 12-month	Past 2 nd 12-month	Past 3 rd 12-month	
2) Annual consumption of energy ^{^30} other than electricity, of last 36-month (MJ/annum) (EAC Clause 8.1(g)ii))	(MJ/annum)	(MJ/annum)	(MJ/annum)	
	Past 1 st 12-month	Past 2 nd 12-month	Past 3 rd 12-month	
3) Annual total energy consumption, of last 36-month (MJ/annum) (sum of figures in 1) & 2)) ^{^27E} (EAC Clause 8.1(g)ii))	(MJ/annum)	(MJ/annum)	(MJ/annum)	
	Past 1 st 12-month	Past 2 nd 12-month	Past 3 rd 12-month	
4) Annual Energy Utilisation Index (EUI) of last 36-month (MJ/m ² /annum) ^{^27E} (EAC Clause 8.1(g)ii)) (Value in kWh/m ² /annum can be obtained by dividing the MJ/m ² /annum figure by 3.6)	(MJ/m ² /annum)	(MJ/m ² /annum)	(MJ/m ² /annum)	
	Past 1 st 12-month	Past 2 nd 12-month	Past 3 rd 12-month	
5) Monthly EUI of past 1 st 12-month period (MJ/m ² /month) (EAC Clause 8.1(g)iii))	1 st mth	2 nd mth	3 rd mth	4 th mth
	5 th mth	6 th mth	7 th mth	8 th mth
	9 th mth	10 th mth	11 th mth	12 th mth ^{^31}
6) Annual energy consumption breakdown, of past 1 st 12-month period (MJ/annum) (EAC Clause 8.1(g)iv))	Air-conditioning ^{^32}	Lighting	Lift & Escalator	Others ^{^33}
7) Energy supply from CBSI to building's units, as a percentage of the total energy consumption of past 1 st 12-month period (EAC Clause 8.1(h))				(%)
8) Energy bill reference month (month for which the most recent energy bill has been issued by the energy supply utility prior to commencement of energy audit, i.e. the 12 th month of item 5) ending on				(dd/mm/yyyy)

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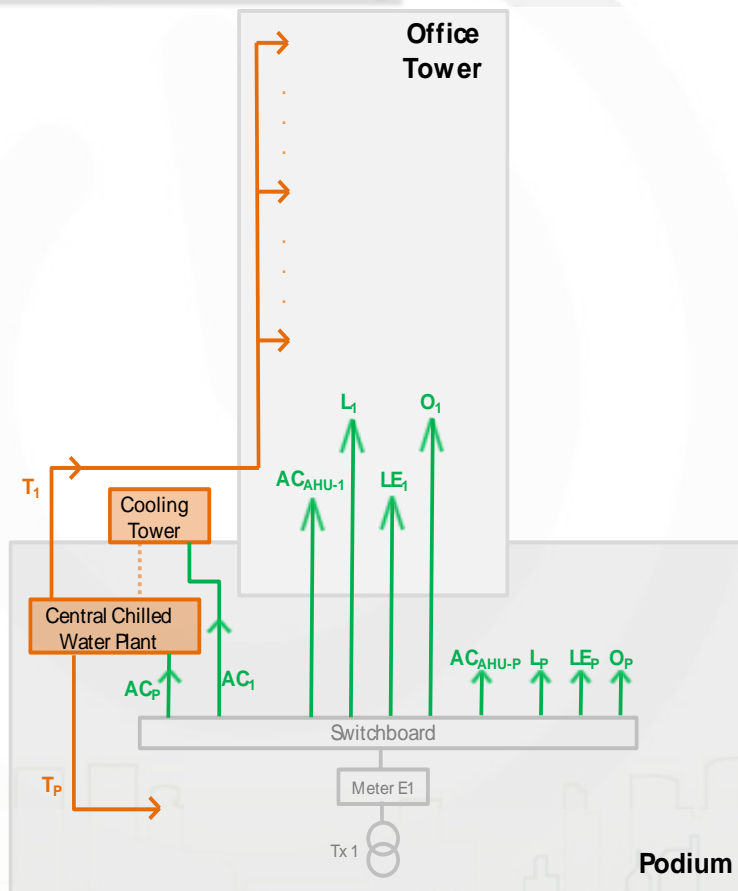


Executive Summary - Technical Form EE-EAes (V.1) (Cont'd)

Part 3 – Energy Management Opportunities (EMO)			Page ___ of ___			
Summary (numbers) of EMO Categorization ^{27E} :			Category I		Category II	Category III
			Lighting	Air-conditioning	Electrical	Lift/Escalator
Ref no.	EMO Category and Type	Description of EMO (EAC Clause 8.1 (Ii)) (Please provide information below)				
Please tick where applicable :			(Please insert additional rows, if necessary)			
	<input type="checkbox"/> I <input type="checkbox"/> II <input type="checkbox"/> III	<input type="checkbox"/> Lighting <input type="checkbox"/> Air-conditioning <input type="checkbox"/> Electrical <input type="checkbox"/> Lift/Escalator <input type="checkbox"/> Others				
	<input type="checkbox"/> I <input type="checkbox"/> II <input type="checkbox"/> III	<input type="checkbox"/> Lighting <input type="checkbox"/> Air-conditioning <input type="checkbox"/> Electrical <input type="checkbox"/> Lift/Escalator <input type="checkbox"/> Others				
	<input type="checkbox"/> I <input type="checkbox"/> II <input type="checkbox"/> III	<input type="checkbox"/> Lighting <input type="checkbox"/> Air-conditioning <input type="checkbox"/> Electrical <input type="checkbox"/> Lift/Escalator <input type="checkbox"/> Others				
	<input type="checkbox"/> I <input type="checkbox"/> II <input type="checkbox"/> III	<input type="checkbox"/> Lighting <input type="checkbox"/> Air-conditioning <input type="checkbox"/> Electrical <input type="checkbox"/> Lift/Escalator <input type="checkbox"/> Others				
	<input type="checkbox"/> I <input type="checkbox"/> II <input type="checkbox"/> III	<input type="checkbox"/> Lighting <input type="checkbox"/> Air-conditioning <input type="checkbox"/> Electrical <input type="checkbox"/> Lift/Escalator <input type="checkbox"/> Others				


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Major Energy Components of Sample Building



← Electrical Energy

← Thermal Air-conditioning Energy of Central Chilled Water Plant

Annual energy consumption of past 1 st 12-month period	Energy consumption (E_{con})
a) Total air-conditioning (electrical energy)	$AC_p + AC_1 + AC_{AHU-P} + AC_{AHU-1}$ 
b) Total lighting	$L_p + L_1$
c) Total lift and escalator	$LE_p + LE_1$
d) Others	$O_p + O_1$
TOTAL	$\Sigma [a) + b) + c) + d)]$
Energy supply from CBSI to building's units, (as a percentage of the total energy consumption of past 1 st 12-month period)	$\frac{[(T_1 \times 0.9) + (T_p \times 0.7)] / (T_1 + T_p) \times [AC_p + AC_1 + AC_{AHU-P} + AC_{AHU-1}]}{\Sigma [a) + b) + c) + d)]} \times 100 \%$ <p>Remarks : Only thermal energy in the form of chilled water is supplied to tenant units and measurements indicate that 90% of thermal energy T_1 is for tenant units in Office Tower, and 70% of thermal energy T_p is for tenant units in Podium.</p>

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Major Energy Components of Sample Building (Cont'd)



<u>Energy component</u>	<u>Description</u>
AC_p	Electrical energy consumed by the central chilled water plant, including chillers, condensing water pumps, and chilled water pumps (excluding cooling tower)
AC_1	Electrical energy consumed by the cooling tower (mainly for fan motors) of the central chilled water plant [the cooling tower (located on roof of Podium) forms part of the central chilled water plant]
T_p	Thermal air-conditioning energy [@] (generated by the central chilled water plant) serving the spaces in Podium
T_1	Thermal air-conditioning energy [@] (generated by the central chilled water plant) serving the spaces in Office Tower
AC_{AHU-P}	Electrical energy consumed by the AHUs and ventilation fans (mainly for motors of AHU fans and ventilation fans) in Podium
AC_{AHU-1}	Electrical energy consumed by the AHUs and ventilation fans (mainly for motors of AHU fans and ventilation fans) in Office Tower
L_p	Electrical energy consumed by the luminaires in Podium
L_1	Electrical energy consumed by the luminaires in Office Tower
LE_p	Electrical energy consumed by the lifts & escalators mainly serving Podium
LE_1	Electrical energy consumed by the lifts & escalators mainly serving Office Tower (may have landing in Podium)
O_p	Electrical energy consumed by other equipment in Podium
O_1	Electrical energy consumed by other equipment in Office Tower

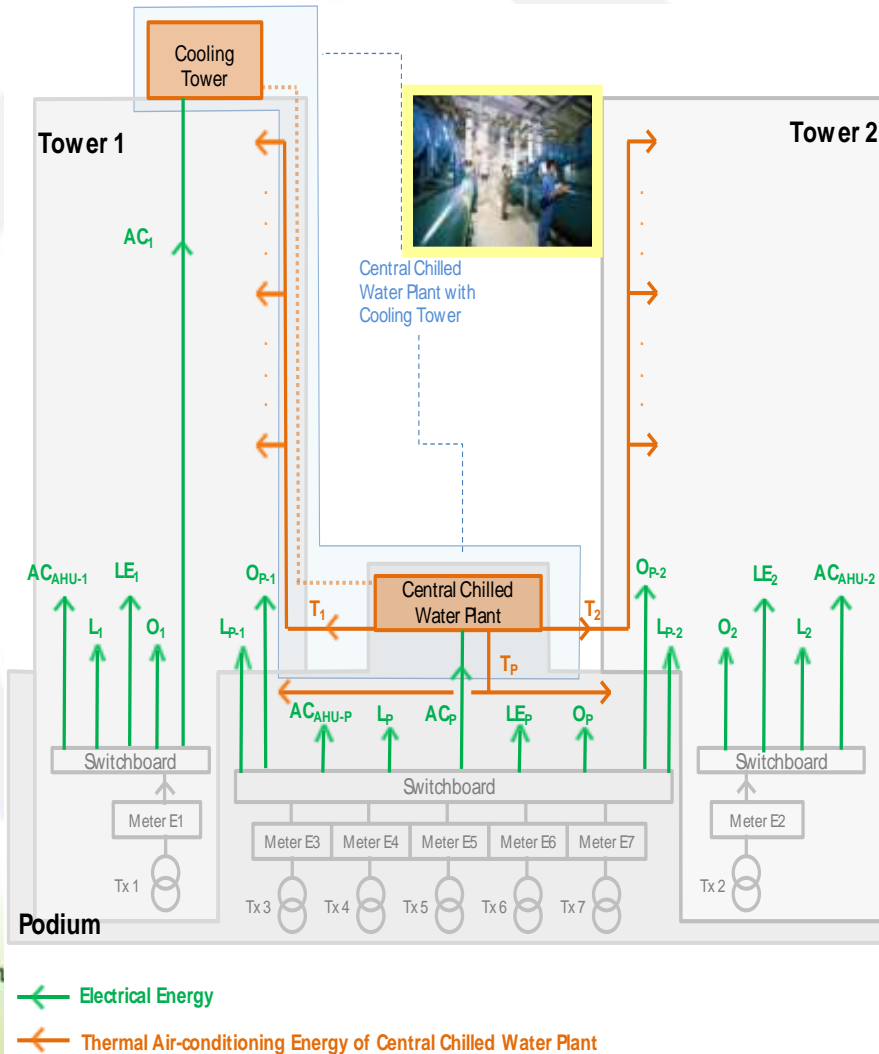
[@] Electrical power (drawn by the plant) multiplied by the plant's coefficient of performance gives the thermal power which when integrated over a year gives the thermal energy

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Major Energy Components of Sample Building Complex



➤ Input to Form EE-EAes – **NET Energy Consumption**



Annual energy consumption of past 1 st 12-mth	Energy consumption (E_{con})	Energy import (E_{im})	Energy export (E_{ex})	Net energy consumption ($E_{con} + E_{im} - E_{ex}$)
a) Total air-conditioning	$AC_P + AC_{AHU-P}$	$AC_1 \times [T_p / (T_1 + T_2 + T_p)]$	$AC_P \times [(T_1 + T_2) / (T_1 + T_2 + T_p)]$	$AC_P + AC_{AHU-P} + AC_1 \times [T_p / (T_1 + T_2 + T_p)] - AC_P \times [(T_1 + T_2) / (T_1 + T_2 + T_p)] = (AC_P + AC_1) \times [T_p / (T_1 + T_2 + T_p)] + AC_{AHU-P}$
b) Total lighting	$L_p + L_{p-1} + L_{p-2}$	nil	$L_{p-1} + L_{p-2}$	L_p
c) Total lift & escalator	LE_p	nil	nil	LE_p
d) Others	$O_p + O_{p-1} + O_{p-2}$	nil	$O_{p-1} + O_{p-2}$	O_p
TOTAL	$\sum [a) + b) + c) + d)]$	$\sum [a) + b) + c) + d)]$	$\sum [a) + b) + c) + d)]$	$\sum [a) + b) + c) + d)]$

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Other Explanations/Remarks



- Input to Form EE-EAes (V.1) – **NET Energy Consumption**
- Remarks in Form EE-EAes (V.1)
- EUI Internal Floor Area - to include commercial units
- EUI Energy – to include consumption on account of building owner and exclude consumption not on account of building owner
- Measurements at representative instants and at appropriate intervals
- Form EE-EAes.xls (V.2) forthcoming submission of hard copy & CD

Executive Summary of Energy Audit Report for Energy Audit Code (EAC)
(Please refer to Section 8, Code of Practice for Building Energy Audit)

Form EE-EAes

Remark (applicable to (A) of Part 1) :-

*1 Care should be exercised in naming the building entity in the case of a building complex. The concept of "building entity" is outlined in clause 4.3 of TG-EAC. The name of building here should reflect the "entity". For example, if the entity audited is the podium only of a building complex in the name of "xxx Centre", the name to be inserted may be "xxx Centre (podium)". Likewise if the entity covers both the podium and say Tower 1 of the complex "xxx Centre", the name may be "xxx Centre (podium and Tower 1)".

Remarks (applicable to (B) (i) of Part 1) :-

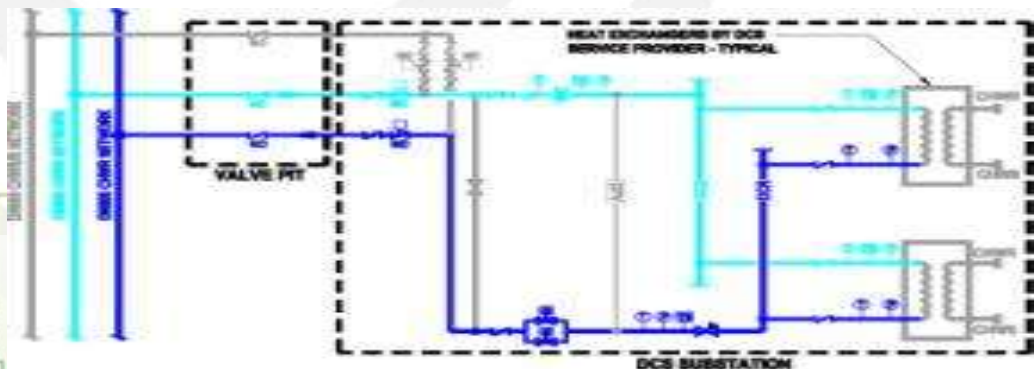
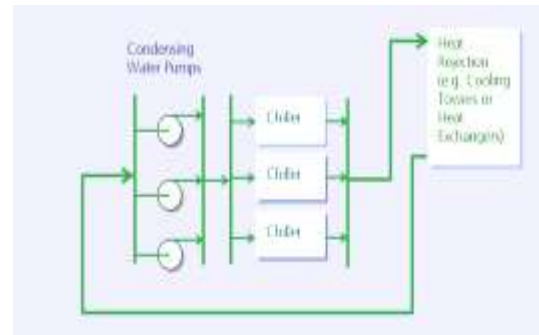
- *2 The concept of "building entity" and "building block" is outlined in clause 4.3 of TG-EAC.
- *3 Refers to "industrial office building" so approved by the Building Authority as under the category.
- *4 Please indicate the portion as a "stage" to the total area of the building entity, based on internal floor areaTM. "Common area" in item 1)(b) refers to the common area interpreted in the Ordinance. See also clause 3.1.3 in the TG-EAC. Under the Ordinance, there are buildings with common area and buildings with no common area. Please insert "0" for building with no common area.
- *5 Please refer to the interpretation in the EAC. "Total internal floor area" in item 2) should include all areas irrespective of norm of operation, and should not include roof, gardening area and balcony.
- *6 For an entity with two or more towers, insert the no. of floors of the tallest block in the entity. In case of an entity formed by both podium and tower, insert the summation of the no. of floors of the podium and that of the tower.
- *7 For a building complex with building blocks having different OAs, please insert the different OA dates and the indicative block designation.
- *8 May tick more than one item. The provision refers to one that constitutes not less than 10% of the energy consumption of the central building services installation (CBSI). The provision refers to the provision of chilled water via the central chilled water plant, or the provision of cool air via AHU/FCU or unitary air-conditioner, or the provision of condenser water only via cooling tower or sea water pump, with electricity or energy on account of the building owner (and not the tenant). For CBSI AHU/FCU supplying cool air, the provision of AC should be regarded as "cool air" and not "chilled water". Please tick "Not applicable" should there be no such provision or the provision constitutes less than 10% of the CBSI energy consumption.
- *9 Please add up the figures in the relevant cells in the column "Stage area of total of building entity" in 8) (a) to (f) to obtain the total ; add up the figures in all the eight cells in 8)(a)(i)&(ii) to give the total in 7)(a); likewise add up the figures in all the eight cells in 8)(b)(i)&(ii) to give the total in 7)(b); add up the figures in all the four cells in 8)(c) to give the total in 7)(c), and perform similar for 7)(d), 7)(e), and 7)(f). (EXCEL version of Form EE-EAes has the built-in function to automatically add the corresponding % area figures in item 8) and insert in the relevant yellow shaded cells in item 7).)
- *10 Please perform the same as in *9, except add up only the cells having "AC" as "Norm of operation". (EXCEL version of Form EE-EAes has the built-in function to automatically add the corresponding % area figures in item 8) and insert in the relevant yellow shaded cells in item 7).)
- *11 Please provide in each cell an average figure that best represents for the major usage the no. of weekly operating hours based on the relevant figures in items 8)(a) to 8)(f).
- *12 Please insert "NA" where the information is unavailable.
- *13 Please confine to usage with criteria significantly affecting energy consumption of the CBSI, and give descriptions of the usage e.g. large lecture theatre or exhibition hall (occasionally used (contributing to lower energy consumption, or frequently used contributing to higher energy consumption), data centre with heavy energy demand on the CBSI (contributing to higher energy consumption), large call centre with 24-hour operation, skating rink demanding additional refrigeration energy, large plant room (for providing chilled water to tenant units or for energy export to outside the building entity) areas etc. (Please attach separate sheets if space provided is not sufficient.)
- *14 For "Stage area" please add up the figures in 7)(a) to (f) above to obtain the total. Perform the same for "Stage AC area" to obtain the total. (EXCEL version of Form EE-EAes has built-in the addition function.)
- *15 Please divide the area figure in item 2) by the total daily average no. of occupants to obtain the occupant density.
- *16 Please group CBSI-served areas under categorized major usages (common in HQ) as listed in items 8) (a) to (f), and to indicate for each of the major usages their respective %stage area coverage of the building entity, their norms of operation (general or 24-hr & AC or non-AC), and their weekly operating hours. The %stage area coverage of a major usage is to be based on the total internal floor area of the building entity (obtained by dividing the floor area coverage of the usage by the figure in item 2). Areas with energy not contributing to the energy consumption of CBSI e.g. tenant units having both lighting energy and air-conditioning energy on account of the tenants need not be included, whereas tenant units supplied with chilled water from the central chilled water plant should be included. Should a usage listed in items 8)(a) to 8)(f) not be applicable, please insert N/A in the relevant cells; e.g. should there be no car park, please insert N/A in all the cells in 8)(e).

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Other Explanations/Remarks (Cont'd)



- Plant side (chiller, pump, PAHU) – building owner accountable
- Terminal side – building owner or units' responsible persons accountable
- Collaboration of owners/REAs of building blocks
- Condenser water from sea water pump house – pump energy as energy import to consuming building
- Chilled water from district cooling plant - cooling energy as energy import to a consuming building
- Template for Additional Information



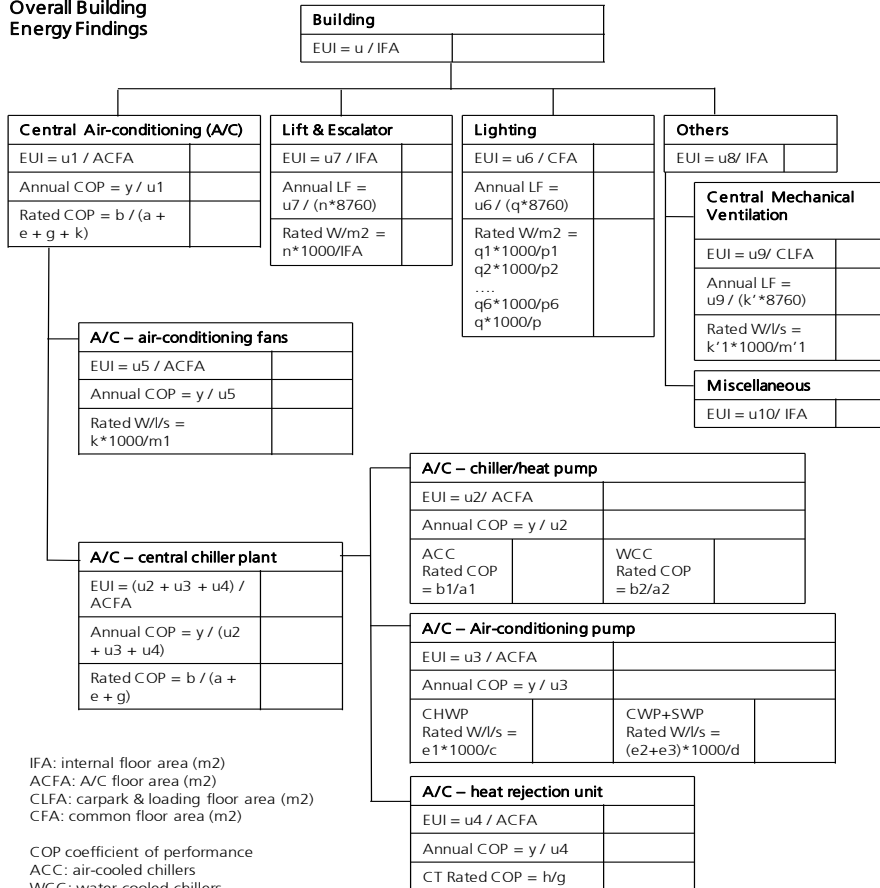


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Other Explanations/Remarks (Cont'd)

Template for Additional Information

Overall Building Energy Findings



IFA: internal floor area (m2)
ACFA: A/C floor area (m2)
CLFA: carpark & loading floor area (m2)
CFA: common floor area (m2)

COP coefficient of performance
ACC: air-cooled chillers
WCC: water cooled chillers
CHWP: chilled water pumps
CWP: condensing water pumps
SWP: seawater pumps
CT: cooling towers

EUI: Electricity utilization index (kWh/m2/annum)
LF: load factor/utilization factor

Thank You

Energy Efficiency Office
能源效益事務處

Enquiry : 3757 6156

Email : mbec@emsd.gov.hk

Address : 3 Kai Shing Street, Kowloon

Website : <http://www.beeo.emsd.gov.hk/>