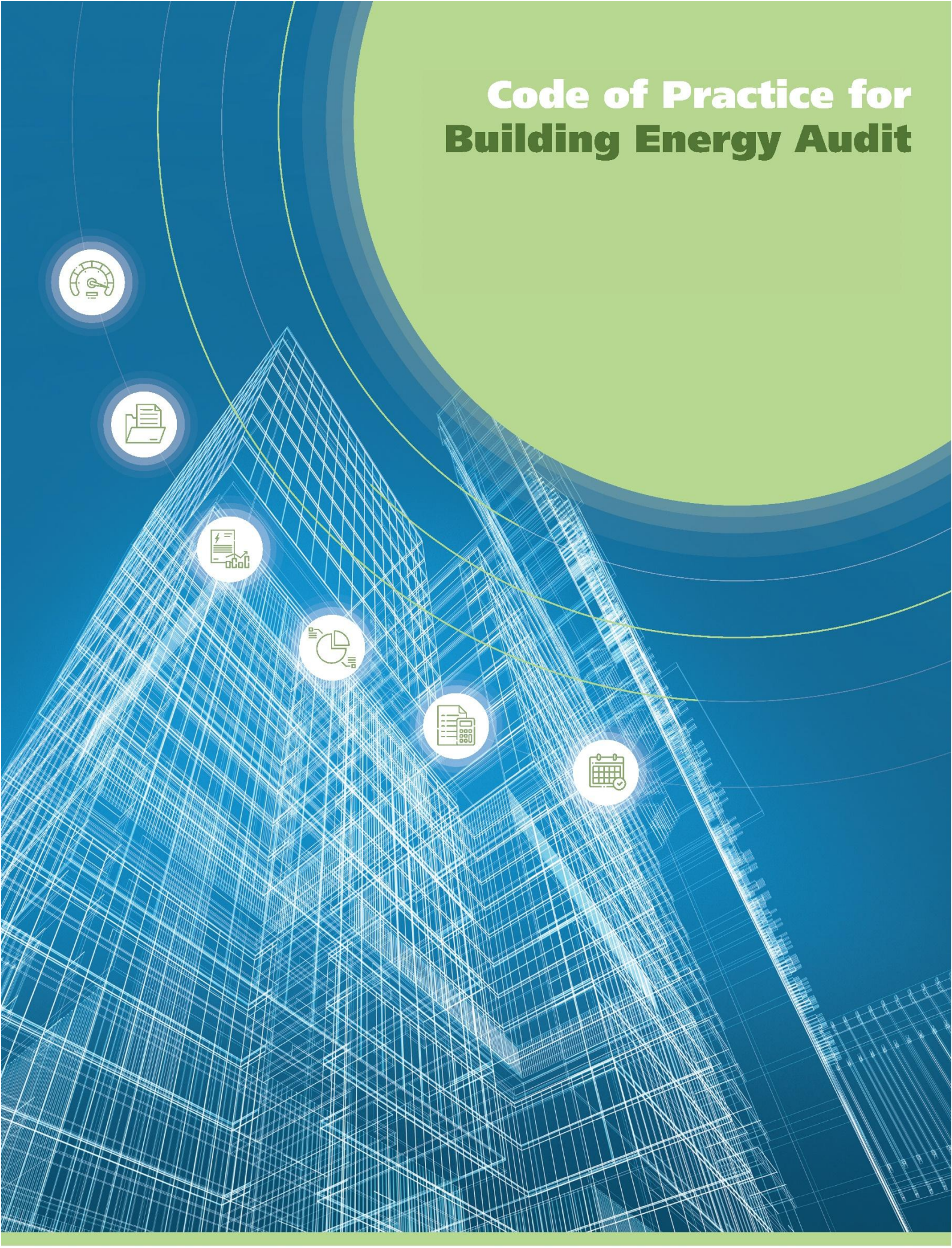
Code of Practice for Building Energy Audit



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EMSD

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Code of Practice for Building Energy Audit

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1. Introduction

1.1 This Code of Practice titled "Code of Practice for Building Energy Audit", hereinafter referred as the "Energy Audit Code" or "EAC", is issued under Part 9 of the Buildings Energy Efficiency Ordinance, Chapter 610 (hereinafter referred as "the Ordinance").

1.2 This EAC sets out the technical guidance and details in respect of the energy audit requirements governing the central building services installations under the Ordinance. Energy audits conducted in accordance with this EAC are deemed to have satisfied the relevant requirements of the Ordinance in the technical aspects.

1.3 This EAC is developed by the Electrical and Mechanical Services Department (EMSD) in conjunction with various professional institutions, trade associations, academia and government departments.

1.4 This EAC may be updated from time to time by appropriate notices to cope with technological advancement and prevalent trade practices, and the update will be publicized and given in the homepage of the Ordinance (http://www.emsd.gov.hk/beeo).

2. Interpretations

'**air-conditioning**' means the process of cooling, heating, dehumidification, humidification, air distribution or air purification.

'**air-conditioning system**' means the fixed equipment, distribution network and terminals that provide either collectively or individually the processes of cooling, dehumidification, heating, humidification, air distribution or air-purification or any other associated processes to a conditioned space.

'**air handling unit** (AHU)' means an equipment that includes a fan or blower, cooling and/or heating coils, and provisions for air filtering and condensate drain etc.

'**building services installation**' has the same meaning in the Ordinance, which means - (a) an air-conditioning installation; (b) an electrical installation; (c) a lift and escalator installation; or (d) a lighting installation.

'**central building services installation**' has the same meaning in the Ordinance, which means –

(a) a building services installation in a prescribed building that does not solely serve a unit of that building; or

(b) a building services installation in a prescribed building that has no common area except an installation that –

(i) solely serves a unit of that building; and

(ii) is owned by a person who is not the owner of that building.

Examples of central building services installation

Building / Individual installation	Building with designated common area	Building without designated common area
Lighting installation	located in the common area	located anywhere in that building unless it is in an individual unit and is separately owned by the responsible person of the unit who is not the owner of that building
Air-conditioning installation	not separately owned by the responsible person of an individual unit	located anywhere in that building, unless it is separately owned by the responsible person of an individual unit who is not the owner of that building
Electrical installation	on the incoming side of an electricity supplier's electricity meter for an individual unit	located anywhere in that building unless it is on the outgoing side of an electricity supplier's electricity meter for an individual unit with its responsible person not being the owner of that building
Lift and escalator installation	located in the common area, unless solely serving an individual unit	located anywhere in that building, unless it is solely serving an individual unit and is separately owned by the responsible person of that unit who is not the owner of that building

'**chilled/heated water plant**' means a system of chillers/heat pumps, with associated chilled/heated water pumps and if applicable associated condenser water pumps, cooling towers and/or radiators.

'**chiller**' means an air conditioning equipment that includes evaporator, compressor, condenser, and regulator controls, which serves to supply chilled water.

'**conditioned floor area**' means the internal floor area of a conditioned space.

'**conditioned space**' means a space within boundaries maintained to operate at desired temperature through cooling, heating, dehumidification or humidification, using means other than only natural or forced fan ventilation.

'**Director**' means the Director of Electrical and Mechanical Services.

'**energy management opportunities (EMO)**' means the ways to achieve energy efficiency and conservation.

'**energy utilization index** (EUI)', in relation to the total energy consumption of the central building services installations in a building, means dividing total energy consumption for a specific period by the total internal floor area of the building.

'**internal floor area**', in relation to a building, a space or a unit, means the floor area of all enclosed spaces measured to the internal faces of enclosing external and/or party walls.

'**lighting power density** (LPD) (unit : W/m^2)' means the maximum circuit wattage consumed by fixed lighting installations per unit floor area of an illuminated space.
(In equation form, the definition of LPD is given by:

$$\text{LPD} = \frac{\text{Total circuit wattage of the fixed lighting installations}}{\text{Internal floor area of that space}}$$

, where the total circuit wattage should be taken at the full lighting output condition)

'**luminaire**' means a lighting device, which distributes light from a single lamp or a group of lamps; a luminaire should include controlgears if applicable, and all necessary components for fixing and mechanical protection of lamps.

'**space**' in the context of lighting installation means a region in a building that is illuminated by artificial lighting installation and is bounded by a physical floor, a physical ceiling and physical walls.

'**unit**' when not referring to dimensions (of length, area, volume, mass, time, power, energy etc.) has the same meaning in the Ordinance, which in relation to a building, means –

(a) a unit or a part of the building; or

(b) 2 or more units or parts of the building that are –

(i) occupied by the same occupier for the purpose of the same undertaking; and

(ii) interconnected by an internal corridor, internal staircase or other internal access;

but does not include a common area of the building.

'**unitary air-conditioner**' means an air conditioning equipment with one or more factory-made assemblies that includes evaporator, compressor, condenser, cooling or heating coil, air re-circulation fan section, and regulator controls, with single or multiple indoor units, which serves to supply cooled or heated air.

3. Application

3.1 Scope of Application

This EAC is applicable to energy audits carried out for the central building services installations in a building of a category prescribed in Schedule 4 of the Ordinance.

4. Technical Compliance with the Ordinance

4.1 To satisfy the relevant requirements of the Ordinance, an energy audit should be conducted in accordance with this EAC for the central building services installations as a minimum in a building prescribed in Schedule 4 of the Ordinance, save for exclusion or exemption under the Ordinance.

4.2 In the case of building type 2 specified in Schedule 4 of the Ordinance, i.e. a portion of a composite building that is for commercial use, the gross floor area referred in section 21(3) of the Ordinance means the gross floor area of the portion of a composite building that is solely for commercial use. And the energy audit requirement specified in clause 4.1 should only be applicable to the central building services installation solely serving the portion of the composite building that is for commercial use.

4.3 In the case of building type 11 specified in Schedule 4 of the Ordinance, i.e. a portion of an industrial building that is occupied principally as a data centre, central building services installations means building services installations solely serving the portion of an industrial building that is occupied principally as a data centre, except building services installations that is owned by a person who is not the owner of the portion of the building.

4.4 The building owners may, pursuant to section 25 of the Ordinance, apply to the Director in writing for an exemption of the relevant central building services installation from the requirement of carrying out energy audit under section 22(4) of the Ordinance if they consider that it is technically or operationally undesirable to carry out energy audit provided that the total rating of all the circuit protective devices (whichever are nearer the supply side, the circuit protective devices governing the electricity supply of charging facility of electric vehicles can be excluded) solely governing the electricity supply of the relevant central building services installation in a building prescribed in Schedule 4 does not exceed 400A, 3-phase.

4.5 The Energy Audit Form, Energy Audit Report and Data Disclosure Form, accompanied by the documents specified in the Forms, should be submitted to the Director to demonstrate compliance with the energy audit requirements.

5. Objectives of Energy Audit

5.1 An energy audit involves the systematic review of the energy consuming equipment/systems in a building to identify energy management opportunities (EMO), which provides useful information for the building owner to decide on and implement the energy saving measures for environmental consideration and economic benefits.

6. Overview of Energy Audit

6.1 An energy audit commences with the collection and analysis of relevant information that may affect the energy consumption of the building, followed with the reviewing of the collected information, the analyzing of the conditions and performances of existing equipment, systems and installations, and the energy bills, and the comparing with performances at relevant energy efficient modes of operation, and finally the identification of areas of energy inefficiency and the means for improvement.

6.2 Energy audit can achieve energy efficiency and conservation through the implementation of EMO identified in the audit. EMO should be classified into three categories –

(a) Category I – involving housekeeping measures which are improvements with practically no cost investment and no disruption to building operation;

(b) Category II – involving changes in operation measures with relatively low cost investment; and

(c) Category III – Involving relatively higher capital cost investment to attain efficient use of energy.

7. Energy Audit Requirements

7.1 General

In conducting the energy audit, a checking of the energy consuming equipment/systems of the central building services installations should be carried out, followed with an evaluation of their operation characteristics and controlling parameters, leading to the identification of as many EMO as possible and their categorization. The following auditing steps should be followed.

7.2 **Step 1** – Collection of Information

Information on building operation characteristics and technical characteristics of various energy consuming equipment/systems relevant to the central building services installations should be collected. The essential information should include the following -

(a) type, major usage and nominal operating hours of the building;
(b) configuration (number of blocks, number of floors, etc.) and total internal floor area of the building;
(c) approximate portion of the building entity being common area;
(d) date of issue of occupation approval of the building;
(e) types, quantities, rated capacities, rated power consumptions, coefficient of performance (if applicable) and control systems of various building services installations;
(f) total power factor and total harmonic distortion for the electrical installation;
(g) energy bills and energy consumption data of at least 12 consecutive months;
(h) operational data of equipment from available metering facilities and /or building management system; and
(i) EMO implemented within the past 5 years.

7.3 **Step 2** – Analysis of Energy Consumption

7.3.1 Study the information collected and conduct site inspections / measurement for an appreciation of the applicable energy consuming equipment and systems of the central building services installations. Based on the findings in the study and inspections, compile records of the characteristics of the energy consuming equipment and systems including -

(a) total annual energy consumption of the equipment and systems with at least 12 consecutive months data;
(b) breakdown of total annual energy consumption among the major installations /systems; and
(c) energy utilization index (EUI) per annum (kWh/m^2/annum).

7.3.2 The net energy consumption by charging facility of electric vehicles can be deducted in compiling the total annual energy consumption if separate metering facility is provided for the charging facility.

7.3.3 Should the operation records (such as data from metering facilities, etc.) are not fully available for evaluation of energy consumption or the breakdown, calculations by using partial records /data, in-situ measurements at representative instants and system

/equipment ratings with reasonable assumptions is acceptable. The methodology should be properly recorded in the energy audit report.

7.4 Step 3 – Identification of EMO

7.4.1 Base on the findings in clause 7.3 and site inspection to the building, EMO of various building services installations and /or the sub-systems under different categories (i.e. Category I, Category II and Category III) should be identified and recorded in energy audit report.

7.5 Step 4 - Cost Benefit Analysis of EMO

7.5.1 For each EMO identified, an estimate should be made on the energy saving that can be achieved if the EMO is implemented. For Cat II and Cat III EMO in which capital cost is involved, a cost benefit analysis should be carried out, giving an estimate of the cost for the EMO against its estimated energy saving.

7.5.2 Estimation of energy saving and payback for each EMO should take into consideration the following in respect with that particular EMO related equipment –

(a) service life; and
(b) degradation on energy efficiency of EMO related equipment during the payback period.

7.5.3 Specify the energy prices for evaluating the cost benefit due to the energy saving.

7.6 Step 5 – Compiling Energy Audit Report

7.6.1 The energy audit report should outline the background information of the building and its building services installations, description of operating characteristics of equipment/systems audited, findings in the audit, EMO identified, estimation of potential energy saving of EMO and cost benefit analyses of EMO.

7.6.2 The following information should be included in the energy audit report –

(a) Background of the energy audit, including –
  (i) dates of commencement and completion of energy audit;
  (ii) date of completion of last energy audit (if applicable);
  (iii) date of site inspection(s) conducted by REA;
  (iv) name and address of the building;
  (v) name, contact information and registration number of Registered Energy Assessor who has carried out the energy audit; and

(vi) name and contact information of owner /owner's representative of the building.

(b) Characteristics of the building, including –
  (i) type of building;
  (ii) major usage and nominal operating hours;
  (iii) number of blocks and number of floors;
  (iv) total internal floor area;
  (v) approximate portion of the building entity being common area;
  (vi) date of issue of occupation approval.

(c) Characteristics of major building services installations, including –
  (i) general descriptions, types, quantities, rated capacities, rated power consumptions, coefficient of performance (if applicable) and control systems of air-conditioning system/equipment covering chiller, cooling tower, heat pump, VRF system, unitary air-conditioner, air-conditioning pump and fan of rated power consumption at 5kW or above;
  (ii) general descriptions, types and control systems of lighting installation;
  (iii) general descriptions, types and capacities of renewable energy installation;
  (iv) general descriptions, types, quantities, rated power consumptions and control systems of lifts, escalators and passenger conveyor;
  (v) general descriptions, types, quantities, rated power consumptions, and control systems of other equipment of rated power consumption at 5kW or above; and
  (vi) power quality of electrical installation.

(d) Analysis of annual energy consumption, including –
  (i) total annual energy consumption of the central building services installations with at least 12 consecutive months data;
  (ii) breakdown of total annual energy consumption among the major building services installations;
  (iii) energy utilization index (EUI) per annum (kWh/m^2/annum) and
  (iv) comparison of EUI with figure in previous energy audit (if available).

(e) Energy management opportunities
  (i) list of EMO implemented within the past 5 years;
  (ii) list of EMO identified in the energy audit, with classifications of EMO into categories I, II or III; and
  (iii) cost benefit analysis for the identified EMO.

7.6.3 The energy audit report should be completed using a template issued by the EMSD.

8. Energy Audit Form

The Energy Audit Form is a specified form under the Ordinance. The EUI per annum evaluated in the energy audit should be indicated in the Energy Audit Form for public inspection.

9. Data Disclosure Form

The Data Disclosure Form is a specified form under the Ordinance. The EMSD may release to the public the technical information contained in the Data Disclosure Form submitted.

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