

March 2012

ICS 27.010

English version

Energy audits - Part 1: General requirements

Audits énergétiques - Partie 1: Exigences générales

Energieaudits - Teil 1: Allgemeine Anforderungen

This draft European Standard is submitted to CEN members for formal vote. It has been drawn up by the Technical Committee CEN/CLC/JWG 1.

If this draft becomes a European Standard, CEN and CENELEC members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration.

This draft European Standard was established by CEN and CENELEC in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CEN and CENELEC member into its own language and notified to the CEN-CENELEC Management Centre has the same status as the official versions.

CEN and CENELEC members are the national standards bodies and national electrotechnical committees of Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and United Kingdom.

Recipients of this draft are invited to submit, with their comments, notification of any relevant patent rights of which they are aware and to provide supporting documentation.

Warning : This document is not a European Standard. It is distributed for review and comments. It is subject to change without notice and shall not be referred to as a European Standard.



CEN-CENELEC Management Centre:
Avenue Marnix 17, B-1000 Brussels

Contents		Page
Foreword		3
Introduction		4
1 Scope.....		5
2 Normative references		5
3 Terms and definitions.....		5
4 Quality requirements		6
4.1 Energy auditor.....		6
4.1.1 Competency.....		6
4.1.2 Confidentiality		6
4.1.3 Objectivity.....		6
4.1.4 Transparency.....		7
4.2 Energy audit process.....		7
5 Elements of the energy audit process		7
5.1 Preliminary contact.....		7
5.2 Start-up meeting.....		8
5.3 Collecting data		9
5.4 Field work		9
5.4.1 Aim of field work		9
5.4.2 Conduct.....		10
5.4.3 Site visits		10
5.5 Analysis		10
5.6 Report.....		11
5.6.1 General.....		11
5.6.2 Content of report.....		11
5.7 Final meeting		12
Bibliography		14

Foreword

This document (FprEN 16247-1:2012) has been prepared by Technical Committee CEN/CLC/JWG 1 “Energy audits”, the secretariat of which is held by BSI.

This document is currently submitted to the Formal Vote.

This part covers the general requirements common to all energy audits. There are three further parts of EN 16247, currently under development, which will provide additional material to Part 1 for three specific sectors.

The other parts of EN 16247 will be:

- *Energy audits — Part 2: Buildings;*
- *Energy audits — Part 3: Processes;*
- *Energy audits — Part 4: Transport.*

Introduction

An energy audit is an important step for an organisation, whatever its size or type, wanting to improve its energy efficiency, reduce energy consumption and bring related environmental benefits.

This standard defines the attributes of a good quality energy audit. It states the requirements for energy audits and corresponding obligations within the energy auditing process. It recognises that there are differences in approach to energy auditing in terms of scope, aims and thoroughness, but seeks to harmonise common aspects of energy auditing in order to bring more clarity and transparency to the market for energy auditing services. The energy audit process is presented as a simple chronological sequence, but this does not preclude repeated iterations of certain steps.

It applies to commercial, industrial, residential and public-sector organisations, excluding individual private dwellings.

This standard does not deal with the energy audit programme/scheme properties (such as programme administration, training of energy auditors, quality control issues, energy auditors' tools, etc.).

1 Scope

This European standard specifies the requirements, common methodology and deliverables for energy audits. It applies to all forms of establishments and organisations, all forms of energy and uses of energy, excluding individual private dwellings.

This European standard covers the general requirements common to all energy audits. Specific energy audit requirements will complete the general requirements in separate parts dedicated to energy audits for buildings, industrial processes and transportation.

2 Normative references

Not applicable.

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

3.1

energy audit

systematic inspection and analysis of energy use and energy consumption of a site, building, system or organisation with the objective of identifying energy flows and the potential for energy efficiency improvements and reporting them

3.2

energy auditor

individual, group of people or body carrying out an energy audit

NOTE 1 to entry A group or body can include subcontractors.

3.3

adjustment factor

quantifiable parameter affecting energy consumption

EXAMPLE Weather conditions, behaviour related parameters (indoor temperature, light level) working hours, production throughput, etc.

3.4

audited object

building, equipment, system, process, vehicle or service which is the subject of the energy audit

3.5

organisation

person or body who owns, operates, uses or manages the audited object(s)

3.6

energy consumption

quantity of energy applied

[SOURCE: EN ISO 50001:2011, 3.7]

3.7

energy efficiency

ratio or other quantitative relationship between an output of performance, service, goods or energy, and an input of energy

EXAMPLE Conversion efficiency; energy required/energy used; output/input; theoretical energy used to operate/energy used to operate.

NOTE 1 to entry Both input and output need to be clearly specified in quantity and quality, and be measurable.

[SOURCE: EN ISO 50001:2011, 3.8]

3.8

energy performance

measurable results related to **energy efficiency** (3.7), **energy use** (3.11) and **energy consumption** (3.6)

NOTE 1 to entry In the context of energy management systems, results can be measured against the organisation's energy policy, objectives, targets and other energy performance requirements.

NOTE 2 to entry Energy performance is one component of the performance of the energy management system.

[SOURCE: EN ISO 50001:2011, 3.12]

3.9

energy performance indicator

quantitative value or measure of energy performance, as defined by the organisation

NOTE 1 to entry Could be expressed as a simple metric, ratio or a more complex model.

[SOURCE: EN ISO 50001:2011, 3.13]

3.10

energy efficiency improvement measure

amount of saved energy determined by measuring and/or estimating consumption before and after implementation of one or more energy efficiency improvement measures, whilst ensuring normalisation for factors that affect energy consumption

3.11

energy use

manner or kind of application of energy

EXAMPLE Ventilation; lighting; heating; cooling; transportation; processes; production lines.

[SOURCE: EN ISO 50001:2011, 3.18]

4 Quality requirements

4.1 Energy auditor

4.1.1 Competency

The energy auditor shall be suitably qualified (according to local guidelines and recommendations) and experienced for the type of work being undertaken and the agreed scope, aim and thoroughness.

4.1.2 Confidentiality

The energy auditor shall treat as confidential all information provided by the organisation or disclosed during the energy audit.

4.1.3 Objectivity

The energy auditor shall treat the organisation's interests as paramount, acting in an objective manner.

The energy auditor shall ensure that the competency, confidentiality and objectivity requirements apply to its subcontractors, if any.

4.1.4 Transparency

If the energy auditor has business goals, product and process or marketing involvement that might be in conflict with the energy audit, the Energy auditor has to disclose any conflict of interests in a transparent way.

4.2 Energy audit process

The energy audit process shall be:

- a) appropriate to the agreed scope, aims and thoroughness;
- b) complete: in order to define the audited object and the organisation;
- c) representative: in order to collect reliable and relevant data;
- d) traceable: in order to trace the origin and processing of data;
- e) useful: in order to include a cost effectiveness analysis of the energy saving opportunities identified;
- f) verifiable: in order to allow the organisation to monitor the achievement of the targets of implemented energy efficiency improvement opportunities.

5 Elements of the energy audit process

5.1 Preliminary contact

- a) The energy auditor shall agree with the organisation on:
 - 1) aims, needs and expectations concerning the energy audit;
 - 2) scope and boundaries;

EXAMPLES The whole site and all energy using systems or the boiler plant or the vehicle fleet.
 - 3) degrees of thoroughness required;

EXAMPLES Proportion of apartments in a block to be visited; whether accuracy sufficient for investment decisions is required.
 - 4) timescale to complete the energy audit;
 - 5) criteria for evaluating energy efficiency improvement measures (e.g. pay back period);
 - 6) time commitments and other resources from the organisation;
 - 7) requirement for data to be collected prior to the energy audit commencing and the availability, validity and format of the energy and activity data;
 - 8) foreseeable measurement and/or inspection to be made during the energy audit.
- b) The energy auditor shall request information about:
 - 1) the energy audit context;

EXAMPLE Energy audit related to a government agreement/scheme.

- 2) regulatory or other constraints affecting the scope or other aspects of the proposed energy audit;
 - 3) strategic wider programme (planned projects, outsourcing facilities management);
 - 4) management system (environmental, quality, energy management system or others);
 - 5) changes that may have a bearing on the energy audit and its conclusions;
 - 6) any existing opinions, ideas and restrictions relating to potential energy efficiency improvement measures;
 - 7) expected deliverables and required format of the report;
 - 8) whether a draft of the final report to the organisation should be presented for comment.
- c) The energy auditor shall inform the organisation of any:
- 1) special facilities and equipments required to enable the energy audit to be carried out;
 - 2) commercial or other interest which could influence his or her conclusions or recommendations.

5.2 Start-up meeting

The aim of the start-up meeting is to brief all interested parties about the energy audit objectives, scope, boundaries and depth and agree the practical arrangements for the energy audit.

NOTE 1 The word meeting in this standard includes telephone calls, webinars and other remote interactive discussions.

- a) The energy auditor shall request the organisation to:
- 1) nominate the person ultimately responsible for the energy audit within the organisation
 - 2) nominate a person to liaise with the energy auditor, where necessary supported by other appropriate individuals constituted as a team for the purpose;
 - 3) inform affected personnel and other interested parties about the energy audit and any requirements placed on them in connection with it;
 - 4) ensure the cooperation of the affected parties;
 - 5) disclose any unusual conditions, maintenance work or other activities that will occur during the energy audit.

Where the energy auditor is not an individual, a member of the energy auditing team shall be nominated as lead energy auditor.

NOTE 2 Some of these requirements may already have been addressed at an earlier stage.

- b) The energy auditor shall agree with the organisation on:
- 1) arrangements for access for the energy auditor;
 - 2) safety and security rules;
 - 3) resources and data to be provided;

- 4) non-disclosure agreements (e.g. tenants in a building);
- 5) proposed schedule of visits with priorities for each;
- 6) requirements for special measurements;
- 7) procedures to be followed for installation of measuring equipment, if needed.

The energy auditor shall describe the processes, means and schedule of the energy audit and the possible need for additional metering equipment.

5.3 Collecting data

The energy auditor shall, in cooperation with the organisation, collect the following (where available):

- a) list of energy using systems, processes and equipment;
- b) detailed characteristics of the audited object(s) including known adjustment factors and how the organisation believes they influence energy consumption;
- c) historical data;
 - 1) energy consumption;
 - 2) adjustment factors;
 - 3) relevant related measurements;
- d) operational history and past events that could have affected energy consumption in the period covered by the data collected;
- e) design, operation and maintenance documents;
- f) energy audits or previous studies related to energy and energy efficiency;
- g) current and projected tariff, or a reference tariff to be used for the protection of commercial confidence;
- h) other relevant economic data;
- i) the status of the energy management system.

5.4 Field work

5.4.1 Aim of field work

The energy auditor shall:

- a) inspect the object(s) to be audited;
- b) evaluate the energy use of the audit object(s) according to the aim, scope and thoroughness of the energy audit;
- c) understand the operating routines, user behaviour, and their impact on energy consumption and efficiency;
- d) generate preliminary ideas for energy efficiency improvement opportunities;

- e) list areas and processes for which additional quantitative data is needed for later analysis.

5.4.2 Conduct

The energy auditor shall:

- a) ensure that measurements and observations are made in a reliable fashion and in situations which are representative of normal operation and, where relevant, under appropriate weather conditions; it is accepted that it may be beneficial to make observations and measurements outside normal working hours, during shut-down periods, or when no climatic load is expected;
- b) promptly inform the organisation of any unexpected difficulties encountered during the work.

5.4.3 Site visits

The energy auditor shall ask the organisation to:

- a) nominate one or more individuals to act as guide and escort for the energy auditor's personnel during site visits as required; these individuals shall have necessary competences and authority to carry out direct operations on processes and equipment if required;
- b) give the energy auditor access to drawings, manuals and other technical documentation relevant to the installation together with the results of any commissioning tests that have been carried out.

5.5 Analysis

During this phase, the energy auditor shall establish the existing energy performance situation of the audited object.

- a) The existing energy performance situation becomes a reference against which improvements can be measured. It shall include:
 - 1) a breakdown of the energy consumption by use and source;
 - 2) energy flows and an energy balance of the audited object;
 - 3) pattern of energy demand through time;
 - 4) relationships between energy consumption and adjustment factors;
 - 5) one or more energy performance indicators suitable to evaluate the audited object.

Based on the existing energy performance situation of the audited object, the energy auditor shall identify energy efficiency improvement opportunities.

- b) The energy auditor shall evaluate the impact of each energy efficiency improvement opportunity on the existing energy performance situation based on:
 - 1) the financial savings enabled by the energy efficiency improvement measures;
 - 2) the necessary investments;
 - 3) the return on investment or any other economical criteria agreed with the organisation;
 - 4) the other possible non-energy gains (such as productivity or maintenance);

- 5) the comparison in terms of both cost and energy consumption between alternative energy efficiency improvement measures;
- 6) technical interactions between multiple actions.

Energy saving actions shall be ranked upon the agreed criteria.

- c) In those cases where it is appropriate to the agreed scope aim and thoroughness of the energy audit, the energy auditor shall complement these results with:
 - 1) requirements for additional data;
 - 2) the definition of need for further analysis.
- d) The energy auditor shall:
 - 1) evaluate the reliability of data provided and highlight defaults or abnormalities;
 - 2) use transparent and technically appropriate calculation methods;
 - 3) document the methods used and any assumption made.
 - 4) subject the results of the analysis to appropriate quality and validity checks
 - 5) consider any regulatory or other constraints of the potential energy efficiency improvement opportunities.

5.6 Report

5.6.1 General

When reporting the results of the energy audit, the energy auditor shall:

- a) ensure that the energy audit requirements agreed with the organisation have been met;
- b) check the quality of the report before submission to the organisation;
- c) summarise relevant measurements made during the energy audit, commenting on:
 - 1) consistency and quality of data;
 - 2) rationale for the measurements and how they contribute to analysis;
 - 3) difficulties encountered in data collection and field work;
- d) state whether the results of the analysis are on the basis of calculations, simulations or estimates;
- e) summarise the analyses detailing any assumptions;
- f) state the limits of accuracy of estimates of savings and costs;
- g) report the ranking of the energy efficiency improvement opportunities.

5.6.2 Content of report

The exact content of the report shall be appropriate for the scope, aim and thoroughness of the energy audit.

The report of the energy audit shall contain:

- a) Executive summary:
 - 1) ranking of energy efficiency improvement opportunities;
 - 2) suggested implementation programme.
- b) Background:
 - 1) general information of audited organisation, energy auditor and energy audit methodology;
 - 2) context of the energy audit;
 - 3) description of audited object(s);
 - 4) relevant standards and regulations.
- c) Energy audit:
 - 1) energy audit description, scope, aim and thoroughness, timeframe and boundaries;
 - 2) information on data collection;
 - i) metering setup (current situation);
 - ii) statement about which data was used (and which is measured and which is estimated);
 - iii) copy of key data used and calibration certificates where appropriate;
 - 3) analysis of energy consumption;
 - 4) criteria for ranking energy efficiency improvement measures.
- d) Energy efficiency improvement opportunities:
 - 1) proposed actions, recommendations, plan and implementation schedule;
 - 2) assumptions used in calculating savings and the resulting accuracy of the recommendations;
 - 3) information about applicable grants and subsidies;
 - 4) appropriate economic analysis;
 - 5) potential interactions with other proposed recommendations;
 - 6) measurement and verification methods to be used for post-implementation assessment of the recommended opportunities.
- e) Conclusions.

5.7 Final meeting

At the final meeting the energy auditor shall:

- a) hand over the report on the energy audit;
- b) present the results of the energy audit in a way that facilitates decision making by the organisation;
- c) be able to explain the results.

The need for follow-up shall be discussed and concluded.

Bibliography

General standards

ISO 80000-1, *Quantities and units — Part 1: General*

IEC 60027 (all parts), *Letter symbols to be used in electrical technology*

Energy management standards

EN ISO 50001:2011, *Energy management systems — Requirements with guidance for use (ISO 50001)*

EN 15900, *Energy efficiency services — Definitions and requirements*

CEN/CLC/TR 16103, *Energy management and energy efficiency — Glossary of terms*

Specific standards

General

UNE 216501, *Energy audit — Requirements (October 2009)*

Buildings

CEN/TR 15615:2008, *Explanation of the general relationship between various European standards and the Energy Performance of Buildings Directive (EPBD) Directive — Umbrella Document (Annex C – definitions)*

EN 15378, *Heating systems in buildings — Inspection of boilers and heating systems*

EN 15459, *Energy performance of buildings — Economic evaluation procedure for energy systems in buildings*

EN 15232, *Energy performance of buildings — Impact of Building Automation, Controls and Building Management*

EN ISO 13790:2008, *Energy performance of buildings — Calculation of energy use for space heating and cooling (ISO 13790)*

EN 15316 (all parts), *Heating systems in buildings — Method for calculation of system energy requirements and system efficiencies*

EN 15217, *Energy performance of buildings — Methods for expressing energy performance and for energy certification of buildings*

EN 15265, *Energy performance of buildings — Calculation of energy needs for space heating and cooling using dynamic methods — General criteria and validation procedures*

EN 15603, *Energy performance of buildings — Overall energy use and definition of energy ratings*

NF P03-310, *Thermal analysis and energy balances for new housing*

Industry

AFNOR BP X30-120, *Energy diagnosis within industry (English version)*

European Union Directives

Directive 2006/32/EC of the European Parliament and of the Council of 5 April 2006 on energy end-use efficiency and energy services

Directive 2002/91/EC of the European Parliament and of the Council of 16 December 2002 on the energy performance of buildings

Directive 2005/32/EC of the European Parliament and of the Council of 6 July 2005 establishing a framework for the setting of ecodesign requirements for energy-using products

Directive 2004/8/EC of the European Parliament and of the Council of 11 February 2004 on the promotion of cogeneration based on a useful heat demand in the internal energy market

Council Directive 96/61/EC of 24 September 1996 concerning integrated pollution prevention and control

European Commission reference documents on Best Available Technologies (BREF BAT) with codes:

ENE – Energy Efficiency (Note: includes EA and Energy management)

ECM – Economics and Cross Media Effects

MON – General Principles of Monitoring

available at <http://eippcb.jrc.es> website