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Energy performance of buildings — Methods for expressing energy performance and for energy certification of buildings

Performance énergétique des bâtiments — Méthodes d'expression de la performance énergétique et de certification énergétique des bâtiments

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Contents

Page

Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2. www.iso.org/directives

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The committee responsible for this document is ISO/TC 163, *Thermal performance and energy use in the built environment,* in collaboration with Technical Committee ISO/TC 205, *Building environment design.*

Introduction

This International Standard is prepared by ISO/TC 163, *Thermal performance and energy use in the built environment,* in collaboration with Technical Committee ISO/TC 205, *Building environment design,* and is one of three closely linked documents dealing with definitions and general procedures for the overall building energy performance rating and certification (see also Figure 1):

— ISO/TR 16344, *Energy performance of buildings — Common terms, definitions and symbols for the overall energy performance rating and certification*;

— ISO 16343, *Energy performance of buildings — Methods for expressing energy performance and for energy certification of buildings*;

— ISO 16346, *Energy performance of buildings — Assessment of the overall energy performance*.

ISO/TR 16344 provides a coherent set of terms, definitions, and symbols for concepts and physical quantities related to the overall energy performance of buildings and its components, including definitions of system boundaries, to be used in all International Standards elaborated within ISO on energy performance of buildings.

ISO 16346 defines the general procedures to assess the energy performance of buildings, including technical building systems, different types of ratings, and building boundaries.

Their development greatly benefited from similar CEN documents (viz. CEN/TR 15615, EN 15217, and EN 15603) developed to support the European Energy Performance of Buildings Directive (EPBD).

A revision of the set of CEN standards to support the EPBD is anticipated in the near future. Issuing the ISO documents aims to bring the key subjects of building energy performance assessment to the global international level.

Given the strong demand for these standards at ISO level, it was decided not to delay the advancement of these International Standards and Technical Reports by waiting on these CEN developments. However, it is expected that a future revision of these International Standards and Technical Reports will be carried out in collaboration with CEN under the Vienna Agreement.

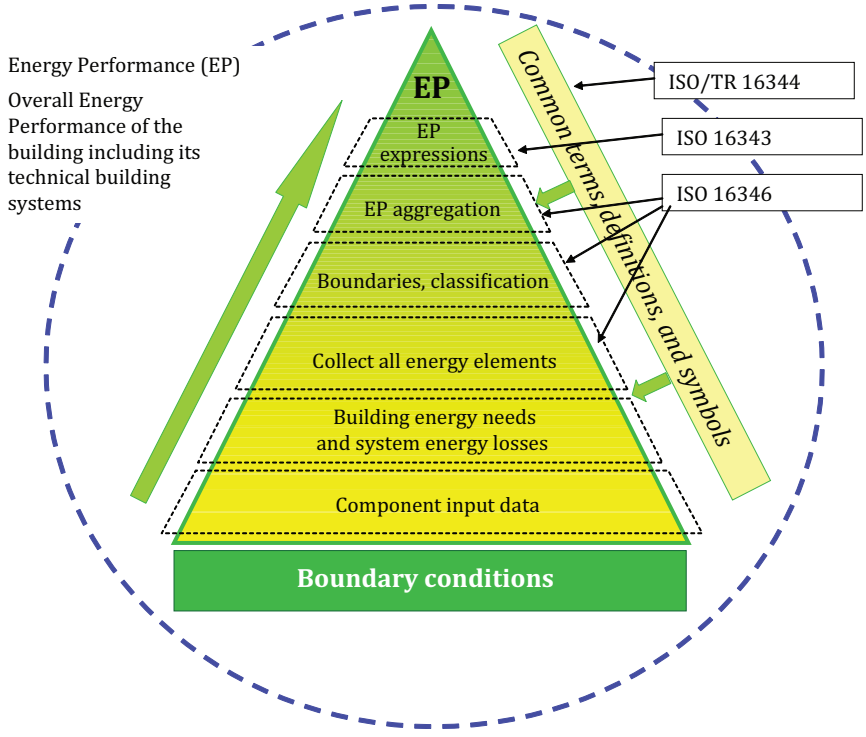

Figure 1 — Flow diagram illustrating the successive elements of the general procedures

Introduction to methods for expressing energy performance and for energy certification of buildings

Expression of the energy performance of buildings is needed to

— enable the establishment of regulations regarding energy performance of buildings, and

— encourage building designers, owners, operators, and users to improve the energy performance of buildings.

This International Standard provides methods to express the energy performance of buildings in a way that serves these purposes. It is based on International Standards that provide methods to calculate or measure energy performance.

This International Standard is intended to be used by

— developers of a procedure for building energy certification,

— building authorities setting minimum requirements on the energy performance, and

— building designers, building owners, building operators, and building users to assess the performance of a planned or existing building and ways to improve it and to express this performance.

Energy performance of buildings — Methods for expressing energy performance and for energy certification of buildings

1 Scope

This International Standard sets out ways of expressing the energy performance in an energy performance certificate of a building (including the technical building systems) and ways of expressing energy performance requirements. This includes an overall numerical energy performance indicator and classes against benchmarks.

This International Standard additionally includes numerical indicators at system or component level.

This International Standard defines the different types of rating (such as calculated, measured, design, and tailored rating) and the energy uses to take into account (such as heating, cooling, domestic hot water, ventilation, and lighting).

This International Standard defines

a) overall indicators to express the energy performance of whole buildings, including heating, ventilation, air conditioning, domestic hot water, and lighting systems (this includes different possible indicators),

b) ways to express energy requirements for the design of new buildings or renovation of existing buildings,

c) procedures to define reference values, and

d) ways to design a procedure for building energy certification.

Furthermore, it provides a (calculation) link between delivered energy and the energy performance indicators for buildings. Since a building generally uses more than one fuel (e.g. gas and electricity), the different energy sources are collected per energyware. The overall rating is based on a weighted sum of delivered energywares. The weightings can be related to, for instance, primary energy or CO_2 emissions to provide the end result of the calculation of energy performance.

It also provides calculation procedures to assess the energy performance on the basis of measured energy use, including ways to convert the measured values to values under standardized conditions (environment, user).

Finally, it defines the system boundaries needed to make a distinction between building energy needs, technical building systems, energy supply systems on site, and distant energy supply systems.

This International Standard can be applied to a group of buildings if they are on the same lot, if they are serviced by the same technical systems, and if no more than one of them has a conditioned area of more than 1 000 m^2.

This International Standard provides different options at different levels. When this International Standard is used to set up national or regional methods for expressing energy performance and/or for energy certification of buildings, the choices between the options shall not be made by the individual user but by authorized national or regional bodies.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 7345, *Thermal insulation — Physical quantities and definitions*

ISO 16346, *Energy performance of buildings — Assessment of the overall energy performance*

ISO/TR 16344, *Energy performance of buildings — Common terms, definitions and symbols for the overall energy performance rating and certification*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 7345 and ISO/TR 16344 apply.

NOTE These terms and definitions are applicable to energy calculations according to this International Standard, and to International Standards that are based on this one, to provide input to or use output from this International Standard.

4 Symbols and abbreviations

4.1 Introduction

The International Standards dealing with energy performance of buildings introduce a large number of quantities and their associated symbols.

To facilitate the use of the standards, a common set of symbols and subscripts have been defined, as given in ISO/TR 16344. The symbols follow established standards on nomenclature such as ISO 7345 and introduce others that are common to the set of International Standards needed to assess the energy performance of buildings, in particular, a set of subscripts to distinguish between different energy uses, different energy carriers, etc.

The symbols given in ISO/TR 16344 concern only data passed from one standard (or standard part) to another.

4.2 Principal symbols

Table 1 provides the specific symbols for this International Standard that are not covered in ISO/TR 16344.

Table 1 — Specific symbols and units for this International Standard

Symbol	Quantity	Unit
A_C	conditioned area	m^2
A_E	thermal envelope area	m^2
R	Reference	*)

4.3 Subscripts

Table 2 provides the specific subscripts for this International Standard that are not covered in ISO/TR 16344.

Table 2 — Specific subscripts for this International Standard

R	requirement of regulation
C	conditioned
S	building stock
E	envelope

5 Procedure for building energy certification

5.1 General

Clause 5 includes the following:

a) content of the procedure for building energy certification;

b) content of an energy certificate;

c) options in selecting the overall energy performance indicator EP which is used for the procedure for building energy certification;

d) description of a performance scale;

e) description of types of recommendations to be included in the energy certificate.

In addition to Clause 5, Annexes C and D provide a way to describe a procedure for building energy certification, an informative procedure for buildings classification, and three examples of an energy certificate format.

5.2 Content of procedure for building energy certification

When the procedure for building energy certification is set up according to this International Standard, information on the choices done shall be documented according to the format provided in Annex B.

The national party or other responsible body setting up a procedure for building energy certification may state that its procedures are in accordance to this International Standard if the documentation according to Annex B has been completed and the completed Annex B is published as national or equivalent annex to this International Standard.

NOTE The purpose of the national annex is to achieve transparency on the differences in (national or regional) procedures for building energy certification.

The following shall be included in a procedure for building energy certification.

a) BUILDING FUNCTIONS: Description of the function or functions of the building or part of the building to which the procedure applies. The main functions of buildings considered are: single family houses, apartment blocks, offices, education buildings, hospitals, hotels and restaurants, sport facilities, wholesale and retail trade service buildings, and other types.

b) APPLICATION: Specification of the cases where the procedure for building energy certification applies:

— for sale, rent, new building design or after construction, display in a public building, etc;

— for checking compliance with minimum energy performance requirements or not.

c) TYPE OF RATING: Specification of the type of rating or ratings used, as specified in 5.4, for each application [calculated (design, standard, or tailored) and/or measured; compliance check or not] and for which building function(s) it applies. In case of design rating, this includes under what conditions the design rating can be considered as or converted to a calculated energy rating for the actually realized building. In case of measured energy rating, this includes specification of which

information on the actual conditions in the building is to be recorded (if any) and whether or not corrections shall be made to correct for deviating periods, weather, and/or indoor conditions.

d) OVERALL NUMERICAL INDICATOR: Specification of what the overall numerical indicator represents, as specified in 6.1, and specifically, which energy services are included and if renewable energy produced on site is part of delivered energy or not.

e) NORMALIZATION: Specification of how the overall numerical indicator is normalized, as specified in 6.4.

f) ENERGY PERFORMANCE REQUIREMENTS: Specification of how the energy performance requirements are expressed, as specified in 7.1, including the way requirements for buildings with different functions are defined, as specified in 7.2, the way the impact of certain parameters is modified, as specified in 7.3, the way the requirements are expressed in case of renovations of and extensions to existing buildings, as specified in 7.4, and the specifications in case of the application of the notional (reference) building approach as described in Annex F.

g) REFERENCE VALUES: Specification of the definition of the reference values and the procedure to define the values, as specified in Clause 8, including the way the impact of certain parameters is modified, as specified in 8.1.

h) OTHER (COMPONENT) INFORMATION: Specification of other information on the energy performance of main building and system components required on the certificate (if any).

i) ADDITIONAL INDICATORS: Specifications and assessment procedures on additional indicators required on the certificate (if any, see 6.1).

j) RECOMMENDATIONS: Procedures to assess the recommendations for cost-effective improvements, as defined in 5.6, and for which applications these are required on the certificate.

k) ENERGY PERFORMANCE CLASSES OR SCALING: Setup and procedures to assess the energy performance class presented on a scale or other scaling (to be specified), as defined in 5.5.

EXAMPLES Examples of energy certificate classes or other scaling options are given in Annex D.

l) ADDITIONAL CONTENT: Specific additional content on the certificate to identify the characteristics of the building.

EXAMPLES Conditioned area, number of conditioned floors, year or period of construction, and year or period of the last major refurbishment.

m) ADDITIONAL INFORMATION: Specification of any other additional information required on the certificate (if any).

n) COMPLETION OF THE CERTIFICATE: General procedures for the completion of the administrative and technical data required on the certificate, as specified in 5.3.

o) FORMAT OF THE CERTIFICATE: Format of the certificate and which content is to be given in the certificate itself and which is to be given in an accompanying report.

EXAMPLES Examples of energy certificate formats are given in Annex D.

p) CENTRAL DATABASE: If this is part of the certification procedures, the purpose of this procedure is to ensure that the data obtained from the energy certificates describing the building stock are stored in an organized way and in a central place (one database).

5.3 Content of the energy performance certificate

The following administrative and technical data shall be provided according to the setup of the procedure for building energy certification as specified in 5.2.

a) **Administrative data**:

1) reference to a specific procedure for building energy certification, including its date;

2) name of person responsible for issuing the energy certificate;

3) address of the building where the energy certificate was issued to;

4) date when the energy certificate was issued and its limit of validity;

b) **Technical data**:

1) one overall indicator representing the energy performance, as specified in 5.2 under d);

2) type of rating(s) used, as specified in 5.2 under c), adding the following note depending on the type of rating:

In case of type:	**Note:**
Calculated energy rating	
Design rating	based on design data
Standard rating	based on standard conditions
Tailored rating	based on actual data
Measured energy rating	based on actual conditions

3) reference values as specified in 5.2 under g);

4) if the certificate is based on design energy rating, the requested additional content as specified in 5.2 under c);

5) if the certificate is based on measured energy rating, the requested additional content as specified in 5.2 under c);

6) specific other information on the energy performance of main building and system components, as specified in 5.2 under h);

7) specific additional indicators, as specified in 5.2 under i);

8) recommendations for cost-effective improvements, as specified in 5.2 under j);

9) energy performance class or other scaling presented on a scale, as specified in 5.2 under k);

10) specific additional content on the certificate to identify the characteristics of the building, as specified in 5.2 under l).

5.4 Overall energy performance rating types

The procedure for building energy certification shall specify the chosen type or types of rating, as listed in 5.2 under c), and for which application and building functions.

The types of rating are defined in 5.3 of ISO 16346.

— A) Calculated energy rating, with the following subdivisions:

  — A1) Design rating: rating applied to a planned building;

  — A2) Standard rating: rating based on standard input data for climate, use, surroundings, and occupant-related input data;

  — A3) Tailored rating: rating calculated with climate, occupancy, and surroundings data adapted to the actual building and to the purpose of the calculation.

— B) Measured energy rating: rating based on measurement of all energy carriers delivered to the building and exported by the building and corrected for non-standard conditions, as specified in Clause 8 of ISO 16346.

If the choice depends on the application and function of the building, this shall be described in the procedure as part of 5.2 point c).

NOTE Which energy services are included or not is dealt with under 6.1.

Rationale for making the choice:

The selection of the relevant rating type shall take into account the following points.

The procedure for building energy certification shall describe how these points have been taken into account as part of 5.2 point c):

— For new buildings, the measured energy indicator is not available.

— The utilities which collect data on energy consumption may not be authorized to disclose them for privacy reasons.

— A measured energy indicator will no longer be valid following a change of building occupier or of the pattern of use of the building. For existing buildings which are rented or sold, the way the building is managed could change and the measured energy indicator could change as a result.

— Defining a standard calculated energy indicator includes the collection of data on the building (insulation, heating system, etc.) which will be useful in giving advice on the improvement of its energy performance.

— In existing public buildings where there is no change in ownership, the measured energy indicator can be a measure of the quality of the management and can be used to motivate building operators and users.

— When the energy certificate is displayed in an existing public building, the operational indicator can be a measure of the quality of the management and can be used to motivate building operators and users.

— For managers of buildings, a measured energy indicator can be easily obtained from data often stored in their information systems (energy bills, areas, etc.).

— Measured energy indicator and standard calculated energy indicator do not necessarily include the same energy uses.

— For new buildings, a design indicator may be the only practical means of assigning an indicator.

The typical application of the different rating types is summarized in Table 3.

Table 3 — Types of ratings

	Name	Input data			Type of application
		Use	Climate	Building	
Calculated	Design	Standard	Standard	Design	Building permit, certificate under conditions
	Standard	Standard	Standard	Actual	Energy performance certificate, regulation
	Tailored	Depending on purpose		Actual	Optimization, validation, retrofit planning
Measured	Operational	Actual	Actual	Actual	Energy performance certificate, regulation

NOTE When applicable, the presentation of both indicators enables differentiation between the calculated intrinsic potential of the building represented by the standard calculated energy indicator and the impact of building management and actual properties of the building and its installations (including control), the effects of which are included in the measured energy indicator.

5.5 Performance scale

The procedures for building energy certification shall specify the setup and the procedures to assess the performance scale as part of 5.2 point k).

In addition to the numerical indicator EP, the energy certificate contains energy efficiency classes or another scaling.

If sufficient information is not available to define the boundaries of classes for a given type of building, the use of classes or another scaling may be postponed until sufficient data becomes available.

The energy class for a given building shall be based on the value of the energy performance indicator.

A procedure to neutralize or reduce the impact of certain parameters on the energy class can be used by modifying some parameters used in the calculation of EP as described in 7.3.

Unless differently defined by the developer of the procedure for building energy certification, the following applies as specified in 5.2 under k).

— The performance scale shall range from A (buildings of highest energy performance) to G (buildings of lowest energy performance).

— The energy performance regulation reference, R_r, shall be placed at the boundary between classes B and C.

— The building stock reference, R_s, shall be placed at the boundary between classes D and E.

— A building with a net delivered energy equal to 0 shall be placed at the top of class A.

— Subclasses can be defined in order to subdivide the classes, e.g. class A can be split between A*, A**, A***.

The procedure for building energy certification shall describe the limits of each class, to be specified in 5.2 under k).

NOTE 1 Annex C (informative) provides a procedure for building classification.

NOTE 2 This means that for a given country or region and a given building type, most buildings completed from 2006 onwards should be in classes A and B, approximately 50 % of the building stock will be in classes between A and D, and approximately 50 % of the building stock will be in classes E, F, and G.

NOTE 3 Annex D (informative) provides example descriptions of an energy certificate.