



BSI Standards Publication

Energy performance of buildings — Overarching EPB assessment

Part 1: General framework and procedures

National foreword

This British Standard is the UK implementation of EN ISO 52000-1:2017. It is identical to ISO 52000-1:2017. It supersedes BS EN 15603:2008, PD ISO/TR 16344:2012 and BS ISO 16346:2013, which are withdrawn.

The UK participation in its preparation was entrusted to Technical Committee B/540, Energy performance of materials components and buildings.

A list of organizations represented on this committee can be obtained on request to its committee manager.

At the time of publication of this standard, the UK committee advises users that it is preparing a National Annex for inclusion in a subsequent revision of this document.

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COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG

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European foreword

This document (EN ISO 52000-1:2017) has been prepared by Technical Committee CEN/TC 371 "Energy Performance of Buildings project group", the secretariat of which is held by NEN, in collaboration with Technical Committee ISO/TC 163 "Thermal performance and energy use in the built environment".

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by January 2018 and conflicting national standards shall be withdrawn at the latest by January 2018.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CEN shall not be held responsible for identifying any or all such patent rights.

This document supersedes EN 15603:2008.

This document has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association.

According to the CEN-CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, Former Yugoslav Republic of Macedonia, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.

Endorsement notice

The text of ISO 52000-1:2017 has been approved by CEN as EN ISO 52000-1:2017 without any modification.

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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 (see www.iso.org/directives).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation on the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT) see the following URL: www.iso.org/iso/foreword.html.

ISO 52000-1 was prepared by the European Committee for Standardization (CEN) Technical Committee CEN/TC 371, *Energy Performance of Buildings project group*, in collaboration with ISO Technical Committees TC 163, *Thermal performance and energy use in the built environment*, and TC 205, *Building Environment Design*, in accordance with the Agreement on technical cooperation between ISO and CEN (Vienna Agreement).

A list of all parts in the ISO 52000 series can be found on the ISO website.

This document cancels and replaces ISO/TR 16344:2012^[3] and ISO 16346:2013^[2].

Introduction

This document is part of a series aimed at the international harmonization of the methodology for assessing the energy performance of buildings. Throughout, this series is referred to as a “set of EPB standards”.

All EPB standards follow specific rules to ensure overall consistency, unambiguity and transparency.

All EPB standards provide a certain flexibility with regard to the methods, the required input data and references to other EPB standards, by the introduction of a normative template in [Annex A](#) and [Annex B](#) with informative default choices.

For the correct use of this document, a normative template is given in [Annex A](#) to specify these choices. Informative default choices are provided in [Annex B](#).

The main target groups for this document are architects, engineers and regulators.

Use by or for regulators: In case the document is used in the context of national or regional legal requirements, mandatory choices may be given at national or regional level for such specific applications. These choices (either the informative default choices from [Annex B](#) or choices adapted to national/regional needs, but in any case following the template of [Annex A](#)) can be made available as national annex or as separate (e.g. legal) document (national data sheet).

NOTE 1 So in this case:

- the regulators will specify the choices;
- the individual user will apply the document to assess the energy performance of a building, and thereby use the choices made by the regulators.

Topics addressed in this document can be subject to public regulation. Public regulation on the same topics can override the default values in [Annex B](#). Public regulation on the same topics can even, for certain applications, override the use of this document. Legal requirements and choices are in general not published in standards but in legal documents. In order to avoid double publications and difficult updating of double documents, a national annex may refer to the legal texts where national choices have been made by public authorities. Different national annexes or national data sheets are possible, for different applications.

It is expected, if the default values, choices and references to other EPB standards in [Annex B](#) are not followed due to national regulations, policy or traditions, that:

- national or regional authorities prepare data sheets containing the choices and national or regional values, according to the model in [Annex A](#). In this case a national annex (e.g. NA) is recommended, containing a reference to these data sheets;
- or, by default, the national standards body will consider the possibility to add or include a national annex in agreement with the template of [Annex A](#), in accordance to the legal documents that give national or regional values and choices.

Further target groups are parties wanting to motivate their assumptions by classifying the building energy performance for a dedicated building stock.

More information is provided in the Technical Report accompanying this document ISO/TR 52000-2[6].

The framework for overall EPB includes:

- a) common terms, definitions and symbols;
- b) building and assessment boundaries;
- c) building partitioning into space categories;

- d) methodology for calculating the EPB (formulae on energy used, delivered, produced and/or exported at the building site and nearby);
- e) a set of overall formulae and input-output relations, linking the various elements relevant for the assessment of the overall EPB;
- f) general requirements for EPB dealing with partial calculations;
- g) rules for the combination of different spaces into zones;
- h) performance indicators;
- i) methodology for measured energy performance assessment.

[Table 1](#) shows the relative position of this document within the set of EPB standards in the context of the modular structure as set out in ISO 52000-1.

NOTE 2 In ISO/TR 52000-2^[6] the same table can be found, with, for each module, the numbers of the relevant EPB standards and accompanying technical reports that are published or in preparation.

NOTE 3 The modules represent EPB standards, although one EPB standard could cover more than one module and one module could be covered by more than one EPB standard, for instance, a simplified and a detailed method respectively. See also [Tables A.1](#) and [B.1](#).

Table 1 — Position of this document (in casu M1-1 - M1-3, M1-5, M1-7 - M1-10), within the modular structure of the set of EPB standards

	Overarching		Building (as such)		Technical Building Systems									
Sub module	Descriptions		Descriptions		Descriptions	Heat- ing	Cool- ing	Ven- tila- tion	Hu- midifi- cation	Dehu- midifi- cation	Do- mestic hot water	Light ing	Build ing auto mation and control	PV, wind, ..
sub1		M1		M2		M3	M4	M5	M6	M7	M8	M9	M10	M11
1	General	ISO 52000-1	General		General									
2	Common terms and definitions; symbols, units and subscripts	ISO 52000-1	Building en- ergy needs		Needs								a	
3	Applications	ISO 52000-1	(Free) Indoor conditions without systems		Maximum load and power									
4	Ways to ex- press energy performance		Ways to ex- press energy performance		Ways to ex- press energy performance									
5	Building categories and building boundaries	ISO 52000-1	Heat transfer by transmis- sion		Emission and control									
6	Building occupancy and operating conditions		Heat transfer by infiltra- tion and ventilation		Distribution and control									
7	Aggregation of energy services and energy carriers	ISO 52000-1	Internal heat gains		Storage and control									
8	Building zoning	ISO 52000-1	Solar heat gains		Generation and control									
NOTE The shaded modules are not applicable.														

NOTE The shaded modules are not applicable.

Table 1 (continued)

	Overarching		Building (as such)		Technical Building Systems									
Sub module	Descriptions		Descriptions		Descriptions	Heat- ing	Cool- ing	Ven- tila- tion	Hu- midifi- cation	Dehu- midifi- cation	Do- mestic hot water	Light ing	Build ing auto mation and control	PV, wind, ..
sub1		M1		M2		M3	M4	M5	M6	M7	M8	M9	M10	M11
9	Calculated energy per- formance	ISO 52000-1	Building dynamics (thermal mass)		Load dis- patching and operating conditions									
10	Measured energy per- formance	ISO 52000-1	Measured energy per- formance		Measured energy per- formance									
11	Inspection		Inspection		Inspection									
12	Ways to ex- press indoor comfort				BMS									
13	External environment conditions													
14	Economic calculation													
NOTE The shaded modules are not applicable.														

Energy performance of buildings — Overarching EPB assessment —

Part 1: General framework and procedures

1 Scope

This document establishes a systematic, comprehensive and modular structure for assessing the energy performance of new and existing buildings (EPB) in a holistic way.

It is applicable to the assessment of overall energy use of a building, by measurement or calculation, and the calculation of energy performance in terms of primary energy or other energy-related metrics. It takes into account the specific possibilities and limitations for the different applications, such as building design, new buildings ‘as built’, and existing buildings in the use phase as well as renovation.

NOTE [Table 1](#) in the Introduction shows the relative position of this document within the set of EPB standards in the context of the modular structure as set out in this document.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 7345:1987, *Thermal insulation — Physical quantities and definitions*

NOTE Default references to EPB standards other than ISO 52000-1 are identified by the EPB module code number and given in [Annex A](#) (normative template in [Table A.1](#)) and [Annex B](#) (informative default choice in [Table B.1](#)).

EXAMPLE EPB module code number: M5-5, or M5-5.1 (if module M5-5 is subdivided), or M5-5/1 (if reference to a specific clause of the documents covering M5-5).

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 7345:1987 and the following apply.

[Clause 3](#) includes terms that are not used in this document, but that are needed for overall consistency in the EPB standards.

NOTE 1 An alphabetic list of all terms defined in this document is given in [Annex F](#).

NOTE 2 See ISO/TR 52000-2[6] for explanation on the overarching terms and definitions and how possible conflicts with national or regional (e.g., legal) specifications is avoided.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- IEC Electropedia: available at <http://www.electropedia.org/>
- ISO Online browsing platform: available at <http://www.iso.org/obp>

3.1 Building

3.1.1

assessed object

building, part of a building or portfolio of buildings that is the object of the energy performance assessment

Note 1 to entry: The assessed object comprises all spaces and technical systems which may contribute to or influence the energy performance assessment.

Note 2 to entry: The assessed object may include one or several building units, if these are not individually object of the energy performance assessment.

Note 3 to entry: A distinction may be made between e.g. a designed building, new building after construction, existing building in the use phase and existing building after major renovation.

3.1.2

building

construction as a whole, including the fabric and all technical building systems, where energy may be used to condition the indoor environment, to provide domestic hot water and illumination and other services related to the use of the building

Note 1 to entry: The term refers to the physical building as a whole, or to all parts thereof, that at least include the spaces and technical building systems that are relevant for the energy performance assessment.

Note 2 to entry: Parts of a building can be physically detached, but are on the same building site. For example: a canteen or a guard house or one or more classrooms of a school in a detached part of a building; or an essential space in a dwelling (e.g., bedroom).

3.1.3

building category

unit category

classification of buildings and/or building units related to their main use or their special status, for the purpose of enabling differentiation of the energy performance assessment procedures and/or energy performance requirements

EXAMPLE Buildings officially protected as part of a designated environment or because of their special architectural or historical merit, buildings used as places of worship and for religious activities, residential buildings, (a) single-family houses of different types; (b) apartment blocks; (c) offices; (d) educational buildings; (e) hospitals; (f) hotels and restaurants; (g) sports facilities; (h) wholesale and retail trade services buildings; (i) data centres; (j) other types of energy-consuming buildings.

Note 1 to entry: Building regulations often make a distinction between building categories.

Note 2 to entry: The building category, for instance, may determine if energy performance assessment is mandatory (e.g., not for religious or historic buildings) and which are the minimum energy performance requirements (e.g., for new buildings); in some countries measured energy performance of a building is prescribed for specific categories of buildings (e.g., apartment buildings, large public buildings), etc. Another type of categorization is the distinction between new and existing and renovated buildings.

Note 3 to entry: Many buildings or building units of a given (use) category contain spaces of different (use) categories; for instance an office building may contain a restaurant; see [3.1.14](#) definition of space category.

Note 4 to entry: The allocation of a building category may also have a strong impact on other parts of the building regulations, for instance on safety (e.g., emergency exits, strength of floor) or indoor environmental quality (e.g., minimum ventilation rates).

3.1.4

building element

integral component of the technical building systems or of the fabric of a building

3.1.5**building fabric**

all physical elements of a building, excluding technical building systems

EXAMPLE Roofs, walls, floors, doors, gates and internal partitions.

Note 1 to entry: It includes elements both inside and outside of the thermal envelope, including the thermal envelope itself.

Note 2 to entry: The fabric determines the thermal transmission, the thermal envelope airtightness and (nearly all of) the thermal mass of the building (apart from the thermal mass of furniture and technical building systems). The fabric also makes the building wind and water tight. The building fabric is sometimes described as the building as such, i.e., the building without any technical building system.

3.1.6**building portfolio**

set of buildings and common technical building systems whose energy performance is determined taking into account their mutual interactions

Note 1 to entry: An example of common technical systems is an energy generation system (PV panels, wind turbine, cogeneration unit, boiler, etc.) serving the building portfolio.

3.1.7**building thermal zone****thermal zone**

internal environment with assumed sufficiently uniform thermal conditions to enable a thermal balance calculation according to the procedures in the standard under EPB module M2-2

Note 1 to entry: The EPB standard under module M2-2 is ISO 52016-1.

3.1.8**building unit**

section, floor or apartment within a building which is designed or altered to be used separately from the rest of the building

EXAMPLE A shop in a shopping mall, an apartment in an apartment building or a rentable office space in an office building.

Note 1 to entry: The building unit can be the assessed object.

3.1.9**cooled space**

room or enclosure, which for the purposes of a calculation is assumed to be cooled to a given temperature set-point or set-points

3.1.10**elementary space****space**

room, part of a room or group of adjacent rooms that belong to one thermal zone and one service area of each service, used to administer the boundaries of the thermal zones and service areas and to administer the exchange of data between the service areas and thermal zones

3.1.11**heated space**

room or enclosure which for the purposes of a calculation is assumed to be heated to a given temperature set-point or set-points

[SOURCE: ISO 13675:2013,^[8] 3.1.17; modified]

3.1.12

reference floor area

floor area used as a reference size

Note 1 to entry: See definition of reference size.

3.1.13

reference size

relevant metric to normalize the overall or partial energy performance and energy performance requirements to the size of the building or part of a building and for the comparison against benchmarks

3.1.14

space category

classification of building spaces related to a specific set of use conditions

EXAMPLE Office space, restaurant space, entrance hall, toilet, living space, assembly hall, shop, residential bed room, indoor car park, heated indoor stair case, unheated indoor stair case, etc.

Note 1 to entry: The space category is relevant for the calculation of the energy performance assessment and for defining the reference size.

3.1.15

thermal envelope area

total area of all elements of a building that enclose thermally conditioned spaces through which thermal energy is transferred, directly or indirectly, to or from the external environment

Note 1 to entry: The thermal envelope area depends on whether internal, overall internal or external dimensions are being used.

Note 2 to entry: The thermal envelope area does not include the area to adjacent buildings; see ISO 13789^[9].

Note 3 to entry: The thermal envelope area may play a role in the ways to express the overall and partial energy performance and energy performance requirements and comparison against benchmarks.

[SOURCE: ISO 13789:2017^[9], 3.9 — modified with addition of notes 2 and 3]

3.1.16

thermally conditioned space

heated and/or cooled space

3.1.17

thermally unconditioned space

room or enclosure that is not part of a thermally conditioned space

3.1.18

useful floor area

<for EPB assessment>area of the floor of a building needed as parameter to quantify specific conditions of use that are expressed per unit of floor area and for the application of the simplifications and the zoning and (re-)allocation rules

3.2 Indoor and outdoor conditions

3.2.1

condition of use

requirement and/or restriction for the use of a building space category, related to the services for the energy performance assessment and/or the boundary conditions

EXAMPLE Heating set-point, cooling set-point, minimum amount of ventilation related to air quality, net domestic hot water needs (e.g., per m² floor area or per person), lighting levels, internal heat gains, etc. ; including the distribution over time (operation). Where relevant, the numbers are based on the number of occupants per m² per type of building space.

3.2.2**design condition**

<building operating>description based on a particular environmental element such as indoor air quality, satisfactory lighting, thermal and acoustical comfort, energy efficiency and associated system controls to be used for assessing operation of the building, part of the building and technical building systems

3.2.3**external temperature**

temperature of outdoor air

3.2.4**internal temperature**

weighted average of the air temperature and the mean radiant temperature at the centre of the thermal zone

Note 1 to entry: This is the approximate operative temperature according to ISO 7726.

3.2.5**other building service**

service supplied by energy-consuming appliances

3.2.6**solar irradiance**

power density of radiation incident on a surface, i.e., the quotient of the radiant flux incident on the surface and the area of that surface, or the rate at which radiant energy is incident on a surface, per unit area of that surface

3.2.7**solar irradiation**

incident solar heat per area over a given period

Note 1 to entry: Incident energy per unit area of a surface, found by integration of solar irradiance over a specified time interval, often an hour or a day (ISO 9488^[10]).

3.3 Technical building systems**3.3.1****air conditioning system**

combination of all components required to provide air treatment in which supply air temperature is controlled, possibly in combination with the control of ventilation rate and humidity and air filtration

3.3.2**air conditioning system service area**

group of spaces connected to the same air conditioning system

3.3.3**building service**

service provided by technical building systems and by appliances to provide acceptable indoor environment conditions, domestic hot water, illumination levels and other services related to the use of the building

[SOURCE: ISO 13612-2:2014,^[7] 3.6 — modified]

3.3.4**building service area (service area)**

part of a building consisting of one or more elementary spaces served by a specific technical building system or sub-system

Note 1 to entry: Building service area for a specific heating system circuit, for a specific cooling system circuit, for a specific domestic hot water distribution system, for a specific ventilation system, for a specific air conditioning system, for a specific lighting (artificial light or daylight) configuration.

3.3.5

cogeneration

combined heat and power

CHP

simultaneous generation in one process of thermal energy and electrical and/or mechanical energy

[SOURCE: EPBD]

3.3.6

cooling system service area

group of spaces connected to the same cooling circuit

3.3.7

domestic hot water system service area

group of spaces connected to the same domestic hot water distribution

3.3.8

heating system service area

group of spaces connected to the same heating circuit

3.3.9

recoverable system thermal loss

part of a system thermal loss which can be recovered to lower either the energy need for heating or cooling or the energy use of the heating or cooling system

Note 1 to entry: This depends on the calculation approach chosen to calculate the recovered gains and losses (detailed or simplified approach, see [11.3](#)).

3.3.10

recovered system thermal loss

part of the recoverable system thermal loss which has been recovered to lower either the energy need for heating or cooling or the energy use of the heating or cooling system

Note 1 to entry: This depends on the calculation approach chosen to calculate the recovered gains and losses (detailed or simplified approach; see [11.3](#)).

[SOURCE: ISO 13675:2013,^[8] 3.1.23]

3.3.11

system thermal loss

thermal loss from a technical building system for heating, cooling, domestic hot water, humidification, dehumidification or ventilation that does not contribute to the useful output of the system

Note 1 to entry: A system loss can become an internal heat gain for the building if it is recoverable.

Note 2 to entry: Thermal energy recovered directly in the sub-system is not considered as a system thermal loss but as heat recovery and directly treated in the related system standard under EPB module M3 to M8.

Note 3 to entry: Heat dissipated by the lighting system or by other services (e.g. appliances of computer equipment) is not part of the system thermal losses, but part of the internal heat gains.

[SOURCE: ISO 13612-2:2014,^[7] 3.41 — modified]

3.3.12

technical building sub-system

part of a technical building system that performs a specific function (e.g. heat generation, heat distribution, heat emission)

3.3.13**technical building system**

technical equipment for heating, cooling, ventilation, humidification, dehumidification, domestic hot water, lighting, building automation and control and electricity production

Note 1 to entry: A technical building system can refer to one or to several building services (e.g., heating, heating and domestic hot water).

Note 2 to entry: A technical building system is composed of different sub-systems.

Note 3 to entry: Electricity production can include cogeneration, wind power and photovoltaic systems.

3.3.14**ventilation system service area**

group of spaces connected to the same ventilation system

3.4 Energy**3.4.1****air conditioning**

form of air treatment in which maximum or minimum temperature is controlled, possibly in combination with the control of ventilation, humidity and air cleanliness

3.4.2**assessment boundary**

boundary where the delivered and exported energy are measured or calculated

3.4.3**auxiliary energy**

electrical energy used by technical building systems to support energy transformation to satisfy energy needs

Note 1 to entry: This includes energy for fans, pumps, electronics, etc. Electrical energy input to a ventilation system for air transport is not considered as auxiliary energy, but as energy use for ventilation.

[SOURCE: ISO 13612-2:2014,^[7] 3.3 — modified]

3.4.4**building automation and control**

products, software and engineering services for automatic controls, monitoring and optimization, human intervention and management to achieve energy-efficient, economical, and safe operation of building services equipment

3.4.5**dehumidification**

process of removing water vapour from air

3.4.6**delivered energy**

energy, expressed per energy carrier, supplied to the technical building systems through the assessment boundary, to satisfy the uses taken into account or to produce the exported energy

Note 1 to entry: Delivered energy can be calculated for defined energy uses or it can be measured.

3.4.7**distant**

<to the building site>not on-site nor nearby

3.4.8**electricity grid**

public electricity network

3.4.9

energy carrier

substance or phenomenon that can be used to produce mechanical work or heat or to operate chemical or physical processes

3.4.10

energy from non-renewable sources

non-renewable energy

energy from a source which is depleted by extraction

Note 1 to entry: an example is energy from fossil fuels.

3.4.11

energy from renewable sources

renewable energy

energy from renewable non-fossil sources, namely wind, solar, aerothermal, geothermal, hydrothermal and ocean energy, hydropower, biomass, landfill gas, sewage treatment plant gas and biogases

3.4.12

energy need for domestic hot water

heat to be delivered to the needed amount of domestic hot water to raise its temperature from the cold network temperature to the prefixed delivery temperature at the delivery point without the losses of the domestic hot water system

3.4.13

energy need for heating or cooling

heat to be delivered to or extracted from a thermally conditioned space to maintain the intended space temperature conditions during a given period of time

3.4.14

energy need for humidification or dehumidification

latent heat in the water vapour to be delivered to or extracted from a thermally conditioned space by a technical building system to maintain a specified minimum or maximum humidity within the space

3.4.15

energy source

source from which useful energy can be extracted or recovered either directly or by means of a conversion or transformation process

EXAMPLE oil or gas fields, coal mines, sun, wind, the ground (geothermal energy), the ocean (wave energy, ocean thermal energy), forests etc.

3.4.16

energy use for lighting

electrical energy input to a lighting system

3.4.17

energy use for other services

energy input to appliances providing services not included in the EPB services

Note 1 to entry: See definition of EPB services.

EXAMPLE Elevators, escalators, home appliances, TV, computers, etc. (if not covered under EPB services).

3.4.18

energy use for space heating or cooling or domestic hot water

energy input to the heating, cooling or domestic hot water system to satisfy the energy need for heating, cooling (including dehumidification) or domestic hot water respectively

3.4.19

energy use for ventilation

electric energy input to a ventilation system for air transport and heat recovery

3.4.20**exported energy**

energy, expressed per energy carrier, supplied by the technical building systems through the assessment boundary

Note 1 to entry: It can be specified by generation types (e.g., combined heat and power, photovoltaic) in order to apply different weighting factors.

Note 2 to entry: Exported energy can be calculated or it can be measured.

3.4.21**gross calorific value**

quantity of heat released by a unit quantity of fuel, when it is burned completely with oxygen at a constant pressure equal to 101 320 Pa, and when the products of combustion are returned to ambient temperature

Note 1 to entry: This quantity includes the latent heat of condensation of any water vapour contained in the fuel and of the water vapour formed by the combustion of any hydrogen contained in the fuel.

3.4.22**humidification**

process of adding water vapour to air to increase humidity

3.4.23**lighting**

process of providing illumination

3.4.24**nearby**

<the building site>on local or district level (e.g., district heating or cooling)

Note 1 to entry: Options are possible (see [Annex A](#)) and informative default options are provided (in [Annex B](#)).

3.4.25**net calorific value**

calorific value that does not include the latent heat of condensation of any water vapour contained in the fuel and of the water vapour formed by the combustion of any hydrogen contained in the fuel

3.4.26**non-renewable energy**

energy taken from a source which is depleted by extraction (e.g. fossil fuels)

Note 1 to entry: Resource that exists in a finite amount that cannot be replenished on a human time scale.

3.4.27**on-site**

premises and the parcel of land on which the building(s) is located and the building itself

Note 1 to entry: On-site is defining a strong link between the energy source (localization and interaction) and the building.

3.4.28**perimeter**

<boundary classification>origin of delivered energy

Note 1 to entry: This document distinguish between “on-site”, “nearby” and “distant” energy sources.

3.4.29**primary energy**

energy that has not been subjected to any conversion or transformation process

Note 1 to entry: Primary energy includes non-renewable energy and renewable energy. If both are taken into account it can be called total primary energy.

3.4.30

space cooling

process of extracting heat from a building space with the aim of reaching and maintaining a given maximum space temperature

3.4.31

space heating

process of heat supply to a building space with the aim of reaching and maintaining a given minimum space temperature

3.4.32

total energy

energy from both renewable and non-renewable sources

Note 1 to entry: Total energy is the sum of renewable and non-renewable energy.

3.4.33

ventilation

process of supplying or removing air by natural or mechanical means to or from a space or building

3.5 Energy performance

3.5.1

actual measured energy

measured energy without any correction for standard climate and use

3.5.2

as built energy performance

energy performance calculated with data for the building after construction (prior to or during operation) and standard use data set

Note 1 to entry: This represents the calculated intrinsic annual energy use of a realized building under standardized conditions. It is particularly relevant for the energy performance certificate and for regulation (verification of compliance with requirements).

3.5.3

calculated energy performance

energy performance based on calculations of the weighted net delivered energy for the EPB services

3.5.4

CO₂ emission coefficient

coefficient that describes the amount of CO₂ that is released from doing a certain activity, such as burning one tonne of fuel in a furnace

Note 1 to entry: In general, CO₂ emission coefficients from specific energy consumption (ISO 50001:2011, 3.7) are quantified based on CO₂ emission factors for use of the energy.

Note 2 to entry: CO₂ emission coefficients can differ by year.

Note 3 to entry: The CO₂ emission coefficient can also include the equivalent emissions of other greenhouse gases (e.g., methane).

3.5.5

design energy performance

energy performance with design data for the building and standard use and climate data set

Note 1 to entry: This represents the calculated intrinsic annual energy use of a designed building under standardized conditions. It is particularly relevant to obtain a building permit at the design stage.

3.5.6

energy feature
EPB feature

any element, component or property aspect of a building, single or combined, that may have an effect on the energy performance of the assessed object

Note 1 to entry: An EPB feature may relate to a single building element (e.g., the thermal insulation of a wall) or any combination of building elements (e.g., the heating needs, the performance of a heating system, the overall energy performance), up to the entire building.

Note 2 to entry: Every EPB feature can be characterized by several possible EPB indicators. For instance, the thermal insulation of a wall can be quantified by its thermal transmittance, its overall thermal resistance, its temperature factor, etc. For more examples, see ISO 52018-1.

3.5.7

energy performance
overall energy performance

<of an assessed object>calculated or measured amount of (weighted) energy needed to meet the energy demand associated with a typical use of the assessed object, which includes energy used for specific services (EPB services)

Note 1 to entry: See definition of EPB services and definition of assessed object.

Note 2 to entry: Also called overall energy performance, to distinct from partial energy performance.

3.5.8

energy performance certificate

<of an assessed object>certificate, for instance recognized by a country or by a legal person designated by it, which indicates the energy performance of the assessed object, calculated or measured according to one or more specified methodologies

Note 1 to entry: The meaning of the terms “certificate” and “certification” in this document differ from those in ISO/IEC 17000^[9].

3.5.9

energy performance certification
process of providing an energy performance certificate

3.5.10

energy performance indicator
EPB indicator

calculated or measured numerical quantity that characterizes an energy feature of an assessed object

Note 1 to entry: EPB indicators are used for the energy performance rating, the energy performance requirements and/or for the certificate. An EPB indicator can for example be expressed in energy performance per unit of floor area or energy performance divided by the energy performance of a specific benchmark or another reference value.

Note 2 to entry: This covers both overall and partial energy performances.

3.5.11

energy performance requirement

minimum level of the (partial or overall) energy performance that is to be achieved to obtain a right or an advantage, e.g., right to build, lower interest rate, quality label

3.5.12

energy rating
EPB rating

evaluation of the value of an energy performance indicator by comparison against one or more reference values, possibly including a visualization of the position on a continuous or discrete scale

Note 1 to entry: This may concern overall or partial energy performance.

3.5.13

EPB service

building service included in the assessment of the energy performance

Note 1 to entry: See definition of building service. Which services are included is a national or regional choice, specified in [Annex A](#)/[Annex B](#).

EXAMPLE Energy used for heating, cooling, ventilation, humidification, dehumidification, domestic hot water and lighting.

3.5.14

EPB standard

standard that complies with the requirements given in ISO 52000-1 (this document), CEN/TS 16628^[4] and CEN/TS 16629^[5]

Note 1 to entry: These three basic EPB documents were developed under a mandate given to CEN by the European Commission and the European Free Trade Association (Mandate M/480), and support essential requirements of EU Directive 2010/31/EU on the energy performance of buildings (EPBD). Several EPB standards and related documents are developed or revised under the same mandate.

3.5.15

measured energy indicator

energy performance indicator based on measured energy performance

3.5.16

measured energy performance

energy performance based on weighted measured amounts of delivered and exported energy

Note 1 to entry: The measured energy performance is the weighted sum of all energy carriers used by the building, as measured by meters or derived from measured energy by other means. It is a measure of the in-use performance of the building after correction or extrapolation. This is particularly relevant to certification of actual energy performance.

Note 2 to entry: Also known as “operational energy performance”.

3.5.17

non-renewable primary energy factor

non-renewable primary energy for a given energy carrier, including the delivered energy and the considered energy overheads of delivery to the points of use, divided by the delivered energy

3.5.18

numerical indicator of primary energy use

primary energy use per unit of reference floor area

Note 1 to entry: Since primary energy use can be expressed in total primary energy, non-renewable primary energy can be specified in the numerical indicator (e.g., non-renewable primary energy use).

3.5.19

partial energy performance

<of an assessed object>energy performance of one or a combination of building elements or components or other energy features of the assessed object

Note 1 to entry: Other energy features are for instance: energy needs for heating and cooling and air tightness.

3.5.20

reference value

standard legal or calculated value against which an energy indicator is compared

Note 1 to entry: This can be a fixed value for specific types of buildings or for specific energy features, or a variable value (formula or notional reference building) taking into account one or more data from the actual building.

3.5.21**renewable primary energy factor**

renewable primary energy for a given distant or nearby energy carrier, including the delivered energy and the considered energy overheads of delivery to the points of use, divided by the delivered energy

3.5.22**standard energy indicator**

energy performance indicator based on energy performance under a set of standard conditions

Note 1 to entry: Assessed under standard conditions (if calculated) or corrected for deviating conditions (if measured).

3.5.23**standard energy performance**

energy performance using actual data for a building and a standard use and climate data set (if calculated) or corrected for deviating conditions (if measured)

Note 1 to entry: This represents the intrinsic annual energy use of an assessed object, under standardized conditions. It is particularly relevant to certification of standard energy performance.

Note 2 to entry: In case of calculated energy performance it can also be termed “asset energy performance”.

3.5.24**tailored energy performance**

calculated energy performance using actual data for a building and actual climate and occupancy data

3.5.25**total primary energy factor**

sum of renewable and non-renewable primary energy factors for a given energy carrier

3.6 Energy calculation**3.6.1****assessment period**

period of time over which the energy performance is assessed

Note 1 to entry: The assessment period is typically one year. It does not need to be the same as the calculation period or calculation interval.

3.6.2**bin**

statistical temperature class (sometimes a class interval) for the outdoor air temperature, with the class limits expressed in a temperature unit

Note 1 to entry: the bin usually includes non-consecutive interval of times with the same temperature condition.

3.6.3**calculation interval**

discrete time interval for the calculation of the energy performance

EXAMPLE one hour, one month, one heating and/or cooling season, one year, operating modes and bins.

3.6.4**calculation period**

period of time over which a calculation is performed

Note 1 to entry: The calculation period can be divided into a number of calculation intervals.

Note 2 to entry: The calculation period is usually a whole year for domestic hot water and ventilation, and a season for cooling and heating.

Note 3 to entry: The length of the calculation period [e.g., heating or cooling season] may be a result of the calculation or may be imposed for specific applications.

3.6.5

heat gain

heat generated within or entering into the thermally conditioned space from heat sources other than energy intentionally utilized for heating, cooling or domestic hot water preparation

Note 1 to entry: Internal heat gains and solar heat gains. Sinks that extract heat from the building, are examples of heat gains, with a negative sign.

Note 2 to entry: For summer conditions heat gains with a positive sign constitute extra heat load on the space.

3.6.6

heating or cooling season

period of the year during which a significant amount of energy for heating or cooling is needed

Note 1 to entry: The season lengths are used to determine the operation period of technical systems.

3.6.7

internal heat gain

heat provided within the building by occupants (sensible metabolic heat) and by appliances such as lighting, domestic appliances, office equipment, etc., other than energy intentionally provided for heating, cooling or hot water preparation

Note 1 to entry: This includes recoverable system thermal losses, if the detailed approach for the calculation of the recovered system losses is chosen, see [11.3](#).

3.6.8

measurement interval

time between individual measurements

3.6.9

measurement period

interval of time covered by measurement intervals

Note 1 to entry: The measurement period can be a multiple of the assessment period.

3.6.10

solar heat gain

heat provided by solar radiation entering, directly or indirectly (after absorption in building elements), into the building through windows, opaque walls and roofs, or passive solar devices such as sunspaces, transparent insulation and solar walls

Note 1 to entry: Active solar devices such as solar collectors are considered as part of the technical building system.

3.6.11

useful heat gain

part of internal and solar heat gains that contribute to reducing the energy need for heating

4 Symbols, subscripts and abbreviations

Clause 4 includes symbols, subscripts and abbreviations that are not used in this document, but that are needed for overall consistency in the set of EPB standards.

NOTE The set of EPB standards introduces a large number of quantities and their associated symbols. To facilitate the use of these documents, a common set of symbols and subscripts has been defined. The symbols follow established standards on nomenclature such as ISO 7345 and introduce others that are common to the set of EPB standards; in particular a set of subscripts to distinguish between different energy uses, different energy carriers, etc.

4.1 Symbols

Symbol	Quantity	Unit
A	area	m ²
b	temperature reduction factor	-
C	heat capacity	J/K ^a
c	specific heat capacity	J/(kg·K) ^a
c	coefficient ^d	various
d	thickness	m
D	diameter	m
E	energy in general ^e	kg, m ³ , (kW·h) ^{a,b}
EP	energy performance indicator	kW·h/(m ² ·a), ^d kg/(m ² ·a), €/ (m ² ·a) ^{a,c}
f	factor (e.g., primary energy factor, ...)	- ^d
H	heat transfer coefficient	W/K
H	calorific value	kW·h/kg
h	surface coefficient of heat transfer	W/(m ² ·K)
I	solar irradiance	W/m ²
k	coefficient	- ^d
K	CO ₂ emission coefficient	kg/(kW·h)
L	length	m
m	mass (e.g., quantity of CO ₂ emissions)	kg
n	air exchange rate	1/h
N	number of items (integer only)	-
O	occupancy	persons
p	pressure	Pa
P	power in general including electrical power	W
Q	quantity of heat	(kW·h) ^a
q	volumetric airflow rate	m ³ /s
q	heat flow density	W/m ²
R	thermal resistance	m ² ·K/W
RER	renewable energy ratio	-
S	elementary space	
S	size	
SA	(system) service area	
T	thermodynamic temperature	K
t	time, period of time	s ^a
U	thermal transmittance	W/(m ² ·K)
V	volume	m ³

^a Hours (h) are used as the unit of time instead of seconds when aggregating heat or energy flow (W) to quantity of heat or energy (kW·h).

^b The unit depends on the type of energy carrier.

^c The unit depends on the indicator chosen.

^d Coefficients have dimensions; factors are dimensionless.

^e Including primary energy and energy carriers; note that for heat the symbol Q and for auxiliary energy and work the symbol W is used.

Symbol	Quantity	Unit
W	(electrical) auxiliary energy	(kW·h) ^a
X	volume fraction	%
X, Y	any property, system, ...	–
Z	(thermal) zone	
Δ	delta (difference) prefix to be combined with symbols	various
η	efficiency (factor)	-
ϑ	Celsius temperature	°C
Ψ	linear thermal transmittance	W/(m·K)
Φ	heat flow rate, thermal power	W
φ	relative humidity	%
χ	point thermal transmittance	W/K
ρ	density	kg/m ³
τ	time constant	s ^a
ε	expenditure factor	

^a Hours (h) are used as the unit of time instead of seconds when aggregating heat or energy flow (W) to quantity of heat or energy (kW·h).

^b The unit depends on the type of energy carrier.

^c The unit depends on the indicator chosen.

^d Coefficients have dimensions; factors are dimensionless.

^e Including primary energy and energy carriers; note that for heat the symbol Q and for auxiliary energy and work the symbol W is used.

4.2 Subscripts

0	base, reference	mn	mean (time or space)
a	air	nd	need
A	other appliances ^a	nEPus	not related to considered building services
an	annual	ngen	without generation
aux	auxiliary	nrbl	non-recoverable
avg	time-average	nrby	nearby
B	building	nren	non-renewable
bin	bin	nrvd	not recovered
bm	biomass	ntdel	net delivered
C	cooling ^a	nused	not used (in the same calculation interval)
calc	calculated	nut	non-utilized
CO ₂	CO ₂ emission	off	off
cr	energy carrier	oil	oil
ctr	control	on	on
CW	cooling and DHW ^a	out	output, outlet
day	daily	P	primary energy
dc	district cooling	per	for a period of time
del	delivered	pk	peak
dh	district heat	Pnren	non-renewable primary energy

^a Type of energy use.

DHU	dehumidification ^a	pol	related to policy
dis	distribution	pr	produced
distant	distant	Ptot	total primary energy
dhum	dehumidification (system)	pv	solar electricity (photovoltaic)
e	external	rbl	recoverable
el	electricity		
em	emission/emitter	red	reduced
env	envelope	ren	renewable energy
EPus	all building services included in the energy performance assessment	rvd	recovered
		saX	service area (X is placeholder for C, H, etc.)
est	estimated	seas	seasonal
exp	exported	sens	sensible
f	floor	set	setpoint
gas	gas	sf	solid fuel
gen	generation	sol	solar
gn	gains	sp	space
grid	from public network (grid)	sto	storage
h	hourly	sys	system
H	heating ^a	T	thermal ^a
HC	heating and cooling ^a	t	calculation interval
HCW	heating, cooling and DHW ^a	tmp	temporary
ht	heat transfer	tot	total
HU	humidification ^a	TOT	total ^a
hum	humidification (system)	tr	transmission heat transfer
HW	heating and DHW ^a	us	use
<i>i,j,k</i>	indexes	use	useful (floor area)
		used	used in the same calculation interval
in	input, inlet	ut	utilized
int	internal or indoor	V	ventilation ^a
L	lighting ^a	ve	ventilation heat transfer
lat	latent	W	domestic hot water (DHW) ^a
lf	liquid fuel	wd	wood
ls	losses	we	weighting
m	monthly	wk	weekly
max	maximum	X	any considered building service
meas	measured	Y	any sub-system
min	minimum	zt	thermal zone
^a Type of energy use.			

4.3 Abbreviations

AHU	air handling unit
BAC	building automation and control
CHP	combined heat and power
DHW	domestic hot water (system)

EP	energy performance
EPB	energy performance of buildings
PV	photo-voltaic
RER	renewable energy ratio

5 Description of the overarching framework and procedures

5.1 Output of the method

The main output of this document is an indicator of the overall energy performance of a building, part of a building (e.g., building unit) or portfolio of buildings.

In addition it gives a breakdown in partial energy performance, e.g., per energy service (heating, lighting, etc.), per building unit, per time interval (hour, month, etc.) and breakdown in energy flows at different perimeters and, e.g., delivered versus exported energy.

5.2 General description of the procedures and routing

This document provides the modular and over-arching framework for the assessment of the energy performance of buildings. It provides a common basis for calculated and measured energy performance, and also for energy performance inspection, at whole building, building units or building element level.

The EPB standards facilitate that the inspection of technical building systems can be used in the building assessment process through a tuned approach for inspection and assessment of the energy performance (see specific EPB standards: M1-11 – M10-11).

Depending on the application, other standards may be needed.

The method to assess the energy performance of buildings has to take into account many parameters:

- Object type: whole building, building unit, part of a building, or building element (building fabric or technical building system);
- Building (and/or space) category (residential, office, etc.);
- Application type: calculated or measured overall energy performance or inspection;
 - Each of these applications can in turn have different goals: check compliance with national or regional energy performance requirements, energy performance certificate;
- Assessment types: design, as built, etc.;
- Energy services: heating, cooling, ventilation, (de-)humidification, domestic hot water, lighting, building automation and control, PV and wind as energy sources, etc.

These parameters may be directly or indirectly related to national or regional regulations. The values of these parameters have to be gathered in the preparation of the energy performance assessment ([Clause 6](#)). After this preparation, the following steps have to be followed for the assessment of the energy performance:

- Determination of the assessment boundary and perimeters (see [9.5](#)).
- Calculation ([Clause 7](#)) or measurement ([Clause 8](#)) of the energy flows at the assessment boundary.
- Weighting of the energy flows according to primary energy factors or other metrics, e.g., CO₂ emission (see [9.6](#)). This is performed with controlling factors to allow inclusion or exclusion of the effect of exported energy and of any compensation between energy carriers.

- Aggregation to the energy performance and the renewable energy contribution (see 9.7).
- For calculated overall energy performance (see the calculation routing in Clause 6, including the zoning of the building or part of a building in Clause 10);
- For calculated energy performance at building or system element level (see 9.8);
- For measured overall energy performance (see Clause 8).

NOTE To provide flexibility, clearly identified options are possible (see Annex A). In order to progress on harmonization, reproducibility and transparency, informative default options are provided (in Annex B). See Introduction.

The main impact on routing through the EPB standards is the choice between calculated or measured energy performance assessment or inspection. Table 2 gives a brief overview of the relevance of each clause for these three main applications.

Table 2 — Relevance of the successive clauses for different applications

Clause	Calculated EP	Measured EP	Inspection
3 Terms and definitions	Yes	Yes	Yes
4 Symbols, units, subscripts and abbreviations	Yes	Yes	Yes
5 Description of the overarching framework and procedures (Routing,) The overarching reference modular structure	Yes	Yes	Yes
6 Preparation steps (type of object, building category and space categories, type of application, type of assessment, building services)	Yes	Yes	Yes
7 Calculated energy performance	Yes	No (except for validation)	No (except for comparison)
8 Measured energy performance	No	Yes	Partly
9 Overall assessment of the energy performance of buildings: Assessment boundaries, energy balance, performance indicator, share of renewable, energy performance indicators for technical building systems)	Yes	Yes	Partly
10 Building zoning	Yes	Partly ^a	Partly ^a
11 Calculation of the overall energy performance, routing and balance (Delivered and exported energy balance, Building thermal needs, Technical building systems, Operating conditions, Climatic and external environment data)	Yes	No (except for validation)	No (except for comparison)
12 Common overarching output	Yes	Yes/ partly ^a	Yes/ partly ^a
13 Quality control	Yes	Yes	Yes/ partly ^a
14 Compliance check	Yes	Yes	Yes/ partly ^a
Annex A, Annex B (Input and method selection data sheet)	Yes	Yes	Yes/ partly ^a
Annex C (Common subscripts)	Yes	Yes	Yes
Annex D (Calculation of measured energy performance)	Yes	Yes	Partly ^a
Annex E (Calculation methods for energy performance indicators per part of a building and/or service)	Yes	Partly ^a	No
^a See ISO/TR 52000-2[6] for further explanation.			

The assessment procedures consists of several elements and aspects. It is possible to present these in different ways.

5.3 Selection criteria between the methods

The selection of method or methods is typically done at national or regional level and may depend on object type, building category, application type and assessment type. These choices are provided in [Table A.2](#) (template) with informative default choices given in [Table B.2](#).

NOTE Considerations are given in ISO/TR 52000-2[6].

6 Overarching preparation steps

6.1 General

In preparation of the energy performance assessment, the following parameters have to be identified:

- Object types: see [6.2.1](#);
- Building (and/or space) category: see [6.2.2](#);
- Application types: see [6.2.3](#);
- Assessment types: see [6.2.4](#);
- Energy services: see [6.2.5](#).

Because each of these has a strong impact on the applicability of, or choices within, most of the other EPB standards, the choices are indicated with unique reference identifiers.

These parameters may be directly or indirectly related to national or regional regulations. Therefore normative templates are provided in [Annex A](#), with informative default choices in [Annex B](#). The flexibility offered by the choices in [Annex A](#) enables specific assumptions and possibilities for simple input in relation to new and existing buildings in the same general methodology.

In the next clauses first the lists are specified. Then, for the specific assessment case, the applicable type or category from these lists is identified.

6.2 List of types and categories

6.2.1 Type of object

The object to be assessed is a building, part of a building or portfolio of buildings, located on a single building site.

The building site can contain one or more buildings. Different buildings on a single site can be detached or connected, or even located widely apart.

The different types of object (with Identifier: EPB_OBJECT_TYPE) are given in [Table A.3](#) (template). Informative default object types are given in [Table B.3](#).

EXAMPLE 1 Whole building or part of the building or building unit, new or existing building, large public building. Residential or non-residential buildings could require different choice of assessment method (e.g., measured versus calculated).

NOTE 1 See explanation in the accompanying technical report, ISO/TR 52000-2[6].

NOTE 2 It is possible that the building category (see [6.2.2](#)) and/or type of application (see [6.2.3](#)) could have to be identified in parallel, because the building category and/or type of application could have an impact on the object.

EXAMPLE 2 Connected by a corridor, hall or indoor parking.

NOTE 3 In a national data sheet, specific rules can be given for the limitation of the object to be assessed in case of more than one building or connected building. This is dealt with in [Clause 9](#), because it could depend on the type of application.

6.2.2 Building category and space categories

The different categories of the assessed object with respect to the main use shall be identified, because of the possible impact on the next steps in the procedures.

The list of categories (with Identifier: BLDNGCAT_TYPE) is given in [Table A.4](#) (template). A list of informative default category types are given in [Table B.4](#).

NOTE 1 Normally the allocation of a building category has legal implications, e.g., related to specific building regulations.

NOTE 2 Explanation and examples are given in the accompanying technical report (ISO/TR 52000-2^[6]).

EXAMPLE 1 Residential building, holiday home, office building, mixed building, etc.

EXAMPLE 2 Possible impact, for instance: depending on (national) rules: separate assessment of the residential part of a building with mixed use categories; or of a building unit in an apartment building.

A list of building categories that are not included in the EPB assessment is given in [Table A.5](#), with informative defaults in [Table B.5](#).

Options for whether or not different space categories may occur within a building category is given in [Table A.6](#) (with informative default choice in [Table B.6](#)).

NOTE 3 The categorization of spaces defines the conditions of use for the energy performance assessment (calculation or measurement). The conditions of use can have an impact on which services are to be included in the assessment.

The list of space categories (with Identifier: SPACECAT_TYPE) is given in [Table A.7](#) (template). A list of informative default space category types are given in [Table B.7](#). The list of space categories is identical to the list of building categories.

6.2.3 Type of application

The type of application shall be identified. The possible applications include checking compliance with energy performance requirements, energy performance certification and energy performance inspection.

NOTE At any given stage in the procedures, until and including the zoning ([Clause 10](#)), it is possible that it has to be concluded that the initial identification of the type of building or part of a building was inadequate or incomplete and has to be redone. For example if an adjacent part of a building was initially ignored, but further on appears that it shares a technical building system with spaces included in the energy performance assessment.

The application types (with Identifier: EPB_APPLIC_TYPE) are given in [Table A.8](#) (template). Informative default application types are given in [Table B.8](#).

6.2.4 Types of assessment

The type or types of EPB assessment shall be specified and, depending on the application and/or building category, for which application and building categories.

The EPB assessment includes the building services as specified in [6.2.5](#) and applies to assumed (standard) operating conditions. If the measured EPB assessment (see [Clause 8](#)) is not corrected to cover the same building services and assumed conditions, these two types of EPB assessment cannot be compared.

NOTE In practice the correction is not trivial, see ISO/TR 52000-2^[6].

The typical applications of the different EPB assessment types are summarized in [Table 3](#).

Table 3 — EPB assessment types

Type	Subtype	Input data			Type of application
		Use	Climate	Building	
Calculated (asset)	Design	Standard	Standard	Design	Building permit, certificate under conditions
	As built	Standard	Standard	Actual	Energy performance certificate, regulation
	Actual	Actual	Actual	Actual	Validation
	Tailored	Depending on purpose			Optimization, validation, retrofit planning, energy audit
Measured (operational)	Actual ^a	Actual	Actual	Actual	Monitoring
	Climate corrected	Actual	Corrected to standard	Actual	Monitoring, or energy audit
	Use corrected	Corrected to standard	Actual	Actual	Monitoring
	Standard	Corrected to standard	Corrected to standard	Actual	Energy performance certificate, regulation
^a This is not energy performance, because essential corrections are missing.					

The assessment type or types (with Identifier: EPB_ASSESS_TYPE) are given in [Table A.9](#) (template). Informative default assessment types are given in [Table B.9](#). The type may be different for different object types or building categories.

6.2.5 Building services

The type of combination of services (with Identifier: EPB_LISTSERVICES_TYPE) that shall be taken into account in the assessment of the energy performance are given in [Table A.10](#) (template). Informative default mixes of services types are given in [Table B.10](#).

NOTE For some building services it is less common to be take them into account for the energy performance of the building, (e.g., energy use for appliances, cooking, mechanical escalators, and elevators).

The combination may be different for different building or space categories (e.g., residential versus non-residential). The details of each type of combination are given in [9.2](#) and the choice between different principles is introduced: whether the presence of a system for a specific service is decisive when taking into account the energy use, or whether the required conditions of use are decisive (to ensure a level playing field).

6.3 Identification of types and categories for a specific case

6.3.1 General

For the considered assessed object:

- Introduce a unique case identifier, to keep track of the case throughout all elements of the EPB assessment;
- Identify the object to be assessed according to the list of object types given in [Table A.3](#) (with informative default types in [Table B.3](#));
- Identify the building category according to the list of category types given in [Table A.4](#) (with informative default list in [Table B.4](#));

- d) If different space categories are allowed (see [Table A.6](#), with informative default choice in [Table B.6](#)):
- Identify for each space (or group of spaces) in the considered assessed object the space category from the list of space categories listed in [Table A.7](#) (with informative default choice in [Table B.7](#)).

NOTE It is possible that the identification of space categories could have to be reviewed during the further process of assessing the thermal envelope and simplifications, presented in [Clause 9](#).

- Otherwise the space category is equal to the building category.
- e) Identify the type of application according to the list of application types given in [Table A.8](#) (with informative default types in [Table B.8](#));
- f) Identify the type of assessment according to the list of assessment types given in [Table A.9](#) (with informative default types in [Table B.9](#));
- g) Identify the type of combination of services according to the combination of services types given in [Table A.10](#) (with informative default types in [Table B.10](#)).

6.3.2 Output data

The identified types and categories may also have an effect on the choices in other EPB standards. These are, therefore, important properties to be used as input data in the other EPB standards, where relevant. [Table 4](#) below gives the overarching preparation steps.

Table 4 — Output data, overarching preparation steps

Description	Identifier	Unit	Intended destination module
Assessment case	CASE_IDENTIFIER	n/a	all
Object type (more than one choice possible)	EPB_OBJECT_TYPE	n/a	all
Building category	BLDNGCAT_TYPE	n/a	all
Space category for each space or group of spaces (if different from building category)	SPACECAT_TYPE	n/a	all
Application type	EPB_APPLIC_TYPE	n/a	all
Assessment type	EPB_ASSESS_TYPE	n/a	all
Type of combination of services	EPB_LISTSERVICES_TYPE	n/a	all

7 Calculated energy performance of buildings

7.1 Output data

The output data of this method are listed in [Table 5](#).

Table 5 — Output data

Description	Symbol	Unit	Intended destination module
Total yearly output data			
Weighted energy performance	E_{we}	kWh/an kgCO ₂ /an kgCO ₂ eq/an €/an kWh/m ² /an	M1-4
Renewable energy ratio	RER	-	M1-4
Energy available for use outside the building	$E_{exp;el;avl;an}$	kWh/an	M1-4
Yearly output data per service or per building zone			
Weighted energy performance per service or per zone or per service and zone	$E_{we;X} E_{we;X;z,i}$	kWh/an kgCO ₂ /an kgCO ₂ eq/an €/an kWh/m ² /an	M1-4
Renewable energy ratio per service	RER _X	-	M1-4
Delivered energy per service or per zone or per service and per zone	$E_{del;X} E_{del;X;z,i}$	kWh/an	M1-4
NOTE CAR_NAME_j is the name of energy carrier j.			

Obtaining the output data per service and per building zone requires the calculation procedures described under [Annex E](#), performance indicators per part of a building and per service.

7.2 Calculation intervals and calculation period

7.2.1 Calculation interval

The calculation intervals applicable for the methods under the modular structure are indicated in the individual EPB standards. The possible calculation intervals are:

- hourly;
- monthly;
- seasonal;
- yearly;
- bin.

The calculation interval shall be consistent throughout the whole calculation. Provisions to combine different calculation intervals are given in the relevant modules.

7.2.2 Calculation period

The length of the heating or cooling season is defined by the operation time of the respective technical systems. It may differ from the time resulting from the energy needs calculation.

NOTE 1 The length of the season could be shorter than in the needs calculation, suppressing off-season needs, or longer, causing system losses during times without needs.

In case of restrictions on the length of the heating or cooling period to be taken into account in the calculations, these restrictions have to be conveyed through all relevant EPB standards.

Such restrictions have to be taken into account in the relevant system standards, under EPB modules M3-1 – M7-1 calculation of the system energy use. The choice for such restrictions is provided in [Annex A](#) (normative template) and [Annex B](#) (informative default choice) in these standards.

NOTE 2 These restrictions could, e.g., be due to national or regional regulations.

7.3 Input data

7.3.1 Product data

This document does not require any product data.

7.3.2 System design data

This document does not require any system design data.

7.3.3 Operating conditions data

7.3.3.1 General

Operating conditions data of the technical (sub-)systems needed for this calculation procedure are listed in [Table 6](#).

Table 6 — List of operating conditions of the technical (sub-)systems input data

Name	Symbol	Software name	Unit	Range	Origin	Varying
Electricity input to the generator i for building service X (or combination of services) during calculation interval t	$E_{X,gen,i,in,el,t}$	E_X_gen_i_in_el_t	kWh	0...∞	Various	Yes
Auxiliary energy input to sub-system Y for building service X (or combination of services) during calculation interval t	$W_{X,Y,aux,t}$	W_X_Y_aux_t	kWh	0...∞	Various	Yes
Electricity use type	EL_USE	EL_USE		LIST	Various	No
On-site electric energy produced by sub-system j (e.g., combined heat and power, photovoltaic or wind power) during the calculation interval	$E_{pr,el,j,t}$	E_pr_el_j_t	kWh	0...∞	Various	Yes
Electricity production type	EL_PROD	EL_PROD	n.a.	LIST	Various	No
Electric energy used in the building for non-EPB uses	$E_{nEPus,el,t}$	E_nEPus_el_t	kWh	0...∞	Various	Yes
Energy carrier cr input to the generator i for building service X during calculation time-step t	$E_{X,gen,i,in;cr,t}$	E_X_gen_i_in_cr_t	kWh	0...∞	Various	Yes
Energy carrier to generator i for building service X	$GEN_CR_{X,gen,i}$	GEN_CRX_gen_i		LIST	Various	No
Additional data required for the calculation of energy performance indicators per part of a building						
Energy need per part of a building	$Q_{X,nd,i}$	QX_nd_i	kWh	0...∞	Various	Yes

Table 6 (continued)

Name	Symbol	Software name	Unit	Range	Origin	Varying
Default weight per part of a building	$X_{\text{def};i}$	Xdef_i	kWh	0...∞	Various	Yes
Energy input to technical sub-systems	$Q_{X;Y;\text{in}}$	QX_Y_in	kWh	0...∞	Various	Yes
Energy output of technical sub-systems	$Q_{X;Y;\text{out}}$	QX_Y_out	kWh	0...∞	Various	Yes

7.3.3.2 Electricity input to generators

The electricity input $E_{X;\text{gen},i;\text{in},\text{el},t}$ is only the main input to a generation device. It is a two-dimensional array:

- one value for each calculation interval t ;
- one value for each generator X,i (one or more generators per each service).

NOTE Typically this is the input to electric heat pumps, chillers and blowers of ventilation systems. There could be one generator per service, one generator for more services or more generators for one service.

7.3.3.3 Auxiliary energy input

The auxiliary energy input $W_{X;Y;\text{aux},t}$ to sub-system Y for building service X (or combination of services) during calculation interval t is a two-dimensional array:

- one value for each calculation interval t ;
- one value for each sub-system Y for service X (there are several sub-systems Y per each service X).

7.3.3.4 Electricity use type

The type of electric energy use is identified by a couple of one-dimensional arrays of case identifiers:

- one array with one value for each electricity input to generator i of service X , see [7.3.3.2](#).
- one array with one value for each auxiliary energy input to sub-system Y for service X , see [7.3.3.3](#).

NOTE 1 This information is used if you want to take into account the type of use (e.g., to restrict the possibility to cover selected uses depending on the type source).

NOTE 2 If this specification is not used, then the default value is assumed.

A template for the specification of electric energy use type is given in [Table A.11](#). Default identifiers are given in [Table B.11](#).

7.3.3.5 On-site produced electricity

The electric energy $E_{\text{pr};\text{el},j;t}$ produced by on-site generator j (e.g. combined heat and power, photovoltaic or wind power) during the calculation interval is a two-dimensional array:

- one value for each calculation interval t ;
- one value for each electricity generation device j .

7.3.3.6 Electricity production type

The type of electric energy production is specified by a one-dimensional array of case identifiers with one value for each electricity production j .

A template for the specification of electric energy generation type is given in [Table A.12](#). Default identifiers are given in [Table B.12](#).

7.3.3.7 Electricity use for non EPB uses

The electric energy used in the building for non-EPB uses $E_{nEPUs;el;t}$ is electricity used on-site for uses such as appliances, commercial activities, elevators (until they are outside EPB scope).

The electric energy used in the building for non-EPB uses $E_{nEPUs;el;t}$ is an optional item. If it is not explicitly indicated, it is assumed to be zero.

It is a one-dimensional array; there is one value per each calculation time-step.

NOTE The generic identifier for this use is EL_USE_NEPB.

7.3.3.8 Delivered energy other than electricity

The energy carrier cr input $E_{X;gen,i;in;cr;t}$ to the generator i for building service X during calculation time-step t is a two-dimensional array:

- one value for each calculation interval t ;
- one value for each electricity generation device j .

Any main electricity input is accounted separately, See $E_{X;gen,i,in,el,t}$ above.

7.3.3.9 Energy carrier specification

The energy carrier GEN_CRX;gen,i to generator i for building service X is a one-dimensional array of case identifiers: one value for each generator i of each service X .

NOTE This information is used to select the relevant weighting factors.

7.3.3.10 Energy use per part of a building

The energy use per part of a building $Q_{X,nd,i}$ is the energy need calculated for the thermal zone i or service area i .

7.3.3.11 Default weight per part of a building

The default weight per part of a building is a property of the thermal zone i or service area i which is used to allocate any common energy amount between thermal zones or service area when the needs are all zero (stand-by operation). See [E.2.3.2](#).

7.3.3.12 Energy input to technical sub-systems

The energy input to a technical sub-systems $Q_{X,Y}$ is the energy entering into a sub-system following the energy flow direction.

EXAMPLE $Q_{H;gen,in}$ is the energy input to a heating generation device such as the fuel input to a boiler.

7.3.3.13 Energy output of technical sub-systems

The energy output of a technical sub-systems $Q_{X,Y,out}$ is the energy leaving the sub-system following the energy flow direction.

EXAMPLE $Q_{H;gen,out}$ is the heat output from heating generation device, such as the heat delivered by a boiler to storage or distribution.

7.3.4 Constants and physical data

This document does not require any constant or physical data.

Tables A.13 through A.15 set a template to specify densities and calorific values of fuels. Default values for selected fuels are given in Tables B.13 through B.15.

7.3.5 Other data

This calculation procedure requires the definition of a number of parameters for the weighting of the delivered energy carriers. They are listed in Table 7.

Table 7 — List of calculation parameters

Name	Symbol	Software name	Unit	Range	Origin	Varying ^a
Operating conditions data						
Weighting factor for delivered energy carrier <i>cr</i>	$f_{we;del;cr;t}$		various	0...∞	Local	Yes/No
Weighting factor of grid exported electricity	$f_{we;exp;el;grid;t}$		various	0...∞	Local	Yes/No
Weighting factor for exported electricity for non-EPB uses in the building	$f_{we;exp;el;used;nEPUs,t}$		various	0...∞	Local	Yes/No
Exported energy evaluation factor	k_{exp}			0...1	Local	NO
^a "Varying": value may vary over time: different values per time interval, for instance: hourly values or monthly values (not constant values over the year).						

The possible types of weighting factors (include primary energy, costs, CO₂ emissions, etc.) are identified in 9.6.6.

A template to specify these calculation parameters is given in Annex A, Tables A.16 and A.17.

Default values are given in Annex B, Tables B.16 and B.17 for constant weighting factors. The calculation procedure also supports varying weighting factors.

7.4 Description of the calculation procedure

The outputs of the calculation procedure are the weighted energy performance E_{we} and other energy performance indicators. Optionally, the output can be detailed per service or per part of a building (e.g. building unit).

The calculation path is the following:

- performing the overarching preparation steps, as described in Clause 6;
- assessing the details, boundaries and conditions of the building or building part, as described in 9.1–9.5;
- following all calculation steps as described in 9.6 and Clause 11, including:
 - identifying (calculating) the components of delivered and exported energy, taking into account the timing of energy delivery and export, as described in 11.6;
 - weighting the delivered and exported energy, as also described in 11.6;
- extracting partial performance indicators, e.g. allocating the energy performance to parts of the building or to services, as described in Annex E;
- reporting, as described in Clause 12.

Options are provided to obtain the desired meaning of the energy performance indicators. Options are specified giving a value to calculation parameters like k_{exp} and the weighting factors.

8 Measured overall energy performance and comparison with calculations

8.1 General

This method is only applicable to existing buildings in the use phase.

The measured energy performance is calculated in the same way as the calculated energy performance using the measured delivered and exported energy amounts $E_{\text{del};cr,i;\text{meas}}$ and $E_{\text{exp};cr,j;\text{meas}}$ instead of the corresponding calculated amounts.

The procedures to measure and standardize the delivered, produced and exported energy amounts for the considered services are given in the modules M3-10 through M11-10.

NOTE It is possible that measured energy performance will not provide data with the same resolution as calculated energy performance.

8.2 Output of the method

The output of the measured energy performance is in principle the same as the output from the calculated energy performance given in [Table 5](#), with the following restrictions:

- the history of the energy delivery and export is seldom known. Only seasonal or yearly amounts are usually known;
- the renewable energy ratio cannot be determined if the contribution of renewable sources cannot be measured;

EXAMPLE The contribution of thermal solar is seldom measured directly.

- the availability of measured energy data for specific services and/or building zones depends on the number and quality of installed metering devices.

NOTE 1 Some calculation procedures allow identification of the partial energy performance for specific services without a dedicated meter.

Obtaining the output data per service and per building zone requires the calculation procedures described under [E.3](#).

NOTE 2 Only the reverse calculation approach given in [E.3](#) can be used for measured energy performance.

8.3 Measurement intervals and measurement period

The assessment period (time span over which the energy performance is evaluated) is the same as for the calculated energy performance.

The measurement interval is the time span between readings of meters or use of known amounts of energy. If there are several energy carriers and/or energy uses, measurement intervals can be asynchronous.

The measurement period is the interval of time covered by measurement intervals. In order to average out the effect of climate and/or user behaviour, the required measurement period may be a multiple of the calculation period.

Validation criteria specify the required number of measurement intervals and the minimum required duration of the measurement period.

Detailed specification of the required measurement intervals and periods as well as validation criteria are given in the specific modules.

8.4 Input data

8.4.1 Product data

This calculation procedure does not require any product data.

8.4.2 System design data

This calculation procedure does not require any system design data.

8.4.3 Operating conditions data

The operating conditions data of the technical (sub-)systems needed for the measured energy performance are the same as for the calculated energy performance but the input is given per metered energy flow instead of per generator and/or per sub-system. See [Table 8](#).

Table 8 — List of operating conditions of the technical (sub-)systems input data

Name	Symbol	Software name	Unit	Range	Origin	Varying
Measured electricity delivered for service(s) X	$E_{del;el;X;meas}$	E_DEL_EL_X_MEAS	kWh	0...∞	Various	Yes
Electricity use type	EL_USE	EL_USE	n.a.	LIST	Various	No
Measured exported electricity	$E_{exp;el;meas}$	E_EXP_EL_MEAS	kWh	0...∞	Various	Yes
Measured on-site electric energy produced by sub-system j	$E_{pr;el;j;meas}$	E_PR_EL,J_MEAS	kWh	0...∞	Various	Yes
Electricity production type i	EL_PROD,i	EL_PROD,I	n.a.	LIST	Various	No
Measured electric energy used in the building for non-EPB uses	$E_{nEPUs;el;meas}$	E_NEPUS_EL_MEAS	kWh	0...∞	Various	Yes
Measured delivered energy carrier cr,i for building service(s) X	$E_{del;cr;i;X;meas}$	E_DEL_CR_I_X_MEAS	kWh	0...∞	Various	Yes
Delivered energy carrier i type	MEAS_CR,i	MEAS_CR_I	n.a.	LIST	Various	No
Additional data required for the calculation of energy performance indicators per part of a building.						
Measured energy use per part of a building z,i	$Q_{X;z,i;meas}$	QX_Z_MEAS	kWh	0...∞	Various	Yes
Default weight per part of a building	$X_{def;i}$	XDEF_I	kWh	0...∞	Various	Yes

Operating conditions data for measured energy performance are determined according to modules:

- M3-10 for heating;
- M4-10 for domestic hot water;
- M4-10 for cooling;
- M5-10 for ventilation;
- M9-10 for lighting;
- M10-10 for building automation and control;
- M11-10 for electricity production.

8.4.4 Constants and physical data

This document does not require any constant or physical data.

8.4.5 Other data

Other data (weighting factors) are the same as for the calculated energy performance, given in [9.6](#).

8.5 Measurement procedures

Procedures for the measurement and correction of delivered and exported energy amounts are given in modules MX-10 of the set of EPB

The measured energy amount needs corrections and/or extrapolations for the following reasons:

- Energy services: correct measured energy for services that are not included in the energy performance (See [Table A.18/ Table B.18](#)).

NOTE 1 For instance, this could concern lighting in residential buildings and appliances.

- Estimation of the amounts of fuel used if these are not automatically metered.

NOTE 2 E.g., weighting of the amount and humidity of wood, amount of coal or oil.

- Assessment period: interpolation or extrapolation to a full year, taking into account the different seasonal patterns for different services and renewable energy sources.

NOTE 3 Different seasonal patterns could include: heating, cooling, domestic hot water and lighting and seasonal pattern of, e.g., solar or wind power. This requires an estimation of the relative amounts and seasonal patterns if these energy flows are not known separately.

- Weather: correction from the actual to the standard weather, taking into account the differences in impact of weather on the successive services and on renewable energy sources.
- Occupancy and operation: correction from actual to standard occupancy pattern and conditions of use.

NOTE 4 Corrections and extrapolations to convert the measured energy use to a reasonably accurate energy use under standard environment and operational conditions for the energy performance assessment could require a tailored approach and expert knowledge.

8.6 Calculation of the energy performance based on measured energy

The assessment path is the following:

- a) The energy performance assessment based on measured energy starts with performing the overarching preparation steps, as described in [Clause 6](#). This includes a comparison between the desired energy performance information (e.g., which services to rate and/or which parts of the building and/or which factors shall be neutralized). Any envisaged measured energy performance rating should be taken into account during the design phase of technical systems in new buildings.

NOTE This step, performed on an existing buildings with no special provisions for metering, will provide limitations to the achievable results or the specification for the installation of additional metering devices.

- b) Where relevant, and in connection with the previous step, the details, boundaries and conditions of the assessed object are assessed, as described in [9.1](#) through [9.5](#).
- c) The delivered and exported energy amounts are obtained according to the procedures given in the specific modules