INTERNATIONAL STANDARD

ISO 52000-1

First edition
2017-06

Energy performance of buildings — Overarching EPB assessment —

Part 1: General framework and procedures

Performance énergétique des bâtiments — Évaluation cadre PEB — Partie 1: Cadre général et modes opératoires

Reference number
ISO 52000-1:2017(E)

ISO copyright office
Ch. de Blandonnet 8 • CP 401
CH-1214 Vernier, Geneva, Switzerland
Tel. +41 22 749 01 11
Fax +41 22 749 09 47
copyright@iso.org
www.iso.org

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 (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	Heating	Cooling	Ventilation	Humidification	Dehumidification	Domestic hot water	Lighting	Building automation 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 energy needs		Needs								[a]	
3	Applications	ISO 52000-1	(Free) Indoor conditions without systems		Maximum load and power									
4	Ways to express energy performance		Ways to express energy performance		Ways to express energy performance									
5	Building categories and building boundaries	ISO 52000-1	Heat transfer by transmission		Emission and control									
6	Building occupancy and operating conditions		Heat transfer by infiltration 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.

Table 1 *(continued)*

	Overarching		Building (as such)		Technical Building Systems									
Sub module	Descriptions		Descriptions		Descriptions	Heating	Cooling	Ventilation	Humidification	Dehumidification	Domestic hot water	Lighting	Building automation and control	PV, wind, ..
sub1		M1		M2		M3	M4	M5	M6	M7	M8	M9	M10	M11
9	Calculated energy performance	ISO 52000-1	Building dynamics (thermal mass)		Load dispatching and operating conditions									
10	Measured energy performance	ISO 52000-1	Measured energy performance		Measured energy performance									
11	Inspection		Inspection		Inspection									
12	Ways to express 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 m^2 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 m^2 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
CO_2 emission coefficient
coefficient that describes the amount of CO_2 that is released from doing a certain activity, such as burning one tonne of fuel in a furnace

Note 1 to entry: In general, CO_2 emission coefficients from specific energy consumption (ISO 50001:2011, 3.7) are quantified based on CO_2 emission factors for use of the energy.

Note 2 to entry: CO_2 emission coefficients can differ by year.

Note 3 to entry: The CO_2 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,j,k	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., CO_2 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:

a) Introduce a unique case identifier, to keep track of the case throughout all elements of the EPB assessment;

b) 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);

c) 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	*Ewe*	kWh/an kgCO2/an kgCO2eq/an €/an kWh/m2/an	M1–4
Renewable energy ratio	RER	-	M1–4
Energy available for use outside the building	*Eexp;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	*Ewe;X Ewe;X;z,i*	kWh/an kgCO2/an kgCO2eq/an €/an kWh/m2/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	*Edel;X Edel;X;z,i*	kWh/an	M1–4
NOTE *CAR_NAMEj* 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*	$E_{X,\mathrm{gen},i,\mathrm{in},\mathrm{el},t}$	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*	$W_{X;Y;\mathrm{aux};t}$	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	$E_{\mathrm{pr};\mathrm{el},j;t}$	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	$E_{\mathrm{nEPus};\mathrm{el};t}$	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*	$E_{X;\mathrm{gen},i;\mathrm{in};\mathrm{cr};t}$	E_X_gen_i_in_cr_t	kWh	0…∞	Various	Yes
Energy carrier to generator *i* for building service *X*	$\mathrm{GEN\_CR}_{X;\mathrm{gen},i}$	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	$Q_{X;\mathrm{nd};\mathrm{i}}$	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 $E_{X,\text{gen},i,\text{in,el},t}$ 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 $E_{\text{pr;el,j};t}$ 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 *cr*	$f_{we;del;cr;t}$		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, CO_2 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 Ewe 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 $E_{del;cr,i;meas}$ and $E_{exp;cr,j;meas}$ 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

d) The measured energy performance is calculated according to the principles given in 9.6 and Clause 11, using the measured amounts of delivered and exported energy carriers instead of the calculated ones.

Details on the adaptation of the formulae of 9.6 and Clause 11 for the measured energy performance are given in Annex D.

8.7 Comparison between calculated energy performance and measured energy performance

The comparison between calculated and measured energy performance shall be made on the corresponding metered and calculated delivered and exported energy carrier amounts.

Before comparison,

— either the calculation shall be tailored to reflect the same conditions of climate and use of the building as the measured energy performance.

— or the measured energy performance to be compared shall be standardized for climate and use to reflect the same conditions as the calculated energy performance.

The comparison can also be done by superimposing specific correlations between used power and a variable describing the level of service. The same correlation shall be generated using calculated and measured data and compared.

EXAMPLE A design energy signature could be compared with the measured energy signature. This neutralizes the climate influence and could provide some clues on the use of the building.

These specific comparison techniques are described in the relevant measurement modules MX-10.

NOTE Validation of the measured energy performance against calculated energy performance is, in particular, needed for assessing the cost and energy effectiveness of possible improvement measures.

8.8 Measured energy performance reporting

The report of the measured energy performance shall include the following information:

— the type of assessment (e.g., actual, climate corrected, use corrected, normalized);

— the actual measured delivered and exported energy amounts;

— the corrected measured delivered and exported energy amounts;

— the measured energy performance;

— the result of applicable validation checks;

— information on assumptions and or other relevant facts about the energy measurements.

9 Overall assessment of the energy performance of buildings

9.1 Categorization of building and/or spaces

According to 6.2.2, depending on the choice in Table A.6/Table B.6, one of the building categories from Table A.4/Table B.4 is allocated to the whole building, or one of the space categories of Table A.7/Table B.7 is allocated to each space.

Each space category is characterized by a set of conditions for use for the energy performance assessment (calculated or measured), as specified in the standards covering EPB module M1-6.

9.2 Combination of building services included in EPB in each space

The conditions of use (temperature, humidity, air quality, light, ..) imply which services are assumed to be present (see 6.2.5). The space categories include conditioned, unconditioned or partially conditioned spaces. Each space may contribute itself to the energy use or may have an influence on other spaces (e.g. thermal, solar, daylight, additional energy use).

Consideration shall be given for buildings that are not equipped with all services for which the energy performance shall be assessed (e.g., building without cooling systems when cooling is part of the energy performance calculation). Possible options are:

— "Assumed system": if the type of space is supposed to be thermally conditioned, then the space is considered as thermally conditioned (disregarding the absence of actual heating or cooling provision, so assuming a fictitious system or the same system as in the adjacent spaces).

— "Presence of system: If a heating or cooling sub-system is present, then the space is considered as thermally conditioned (disregarding the supposed use).

NOTE 1 The first option prevents the building getting a better energy performance at the cost of a lower thermal comfort (violation of a level playing field).

NOTE 2 The presence or absence of, e.g., a heat emitting provision (e.g. radiator) is not an adequate criterion: a space could be heated indirectly via adjacent spaces (if there is only a heating system in one space, intended to heat adjacent spaces as well).

This has the following implications for the calculation:

— **Principle "Assumed system":** Provide specification of a default technical system for each missing service.

EXAMPLE 1 A dwelling without heating in bedrooms.

NOTE 3 Sometimes called: "fictitious service". This is a way to avoid violation of a level playing field, in case of under-installation or absence of installation. For instance: heating in a habited attic, cooling in a building without (or with an) insufficient cooling system. In these cases simply not taking the heating or cooling into account would lead to a better energy performance than when the installation is present. Unless compensated by an indication of the lower comfort. See more explanation in ISO/TR 52000-2[6].

— **Principle "Presence of system":** Do not take into account energy use for a specific service if there is no technical building system present for that service. Consequence: a possibly better energy performance for buildings missing some service is accepted (violation of level playing field).

NOTE 4 A possibility is to compensate this by highlighting the discomfort with a complementary discomfort indicator (example: hours of summer discomfort). If specific services are absent or insufficient, a national or regional choice could be needed to create a level playing field. This can be done with the help of the EPB documents related to module M1–6.

— Either the actual conditions of use are taken: leading to less energy use and thus better energy performance, but at the cost of lower comfort or usability, which then has to be reported to avoid misunderstanding the better energy performance value;

— or the standard conditions of use are assumed for the calculation, which means the EPB standards need to facilitate such choice for each service: heating (e.g., insufficiently heated living spaces), cooling (e.g., office spaces with bad summer comfort), lighting (too low lighting levels or visual comfort), domestic hot water (e.g., too slow heating of hot water or too low temperature), etc.

— **Principle "Other principle":** Principle not covered by the above two principles.

The choice between Principle "Assumed system", Principle "Presence of system" or Principle "Other principle" is given in Table A.19 (template), with informative default choice in Table B.19.

This choice may also have an effect on the zoning rules (Clause 10).

In addition, certain thermally unconditioned spaces may, for reasons of simplicity, be assumed to have the same conditions of use as the adjacent thermally conditioned spaces and then joined.

EXAMPLE 2 Attic, staircase, atrium and garage.

NOTE 5 See extensive discussion in ISO/TR 52000-2[6].

Specific rules are provided in the relevant standard under EPB module M2-2.

The choice whether these enclosed spaces are assumed to have the same conditions of use as the adjacent thermally conditioned spaces may have a very strong impact on the calculated energy performance.

Also, the choice whether the size of these spaces, such as the useful floor area, reference floor area or reference volume, is included in the size of the building may have a very strong impact on the numerical indicator for the energy performance.

NOTE 6 Consistency is needed between these successive choices. The rationale behind, and some of the consequences of, these choices are presented in ISO/TR 52000-2[6].

Because of this impact, the choice is not only relevant for calculated energy performance, but also for measured energy performance. Moreover, it may be relevant to know if the energy used in these kind of spaces has to be included in the measured energy performance.

Such a choice may also depend on the national legal infrastructure and building tradition.

It is also possible to choose on the basis of the construction that forms the main thermal barrier: the internal or external construction of the thermally unconditioned space or spaces. However, a decision based purely on these physical data are not evident, especially when air infiltration, glazing, thermal bridges and/or ground floor areas are involved: a detailed assessment of the thermal transmission and ventilation heat transfer properties may be difficult and not efficient.

For some types of spaces it can be legally mandatory to consider these as within the thermal envelope (e.g., a bedroom) or (for other types of spaces) outside the thermal envelope (e.g., a garage or gasoline storage).

9.3 Useful floor area and air volume

For each space (index space, i) the useful (floor) area, $A_{use;space,i}$ is assessed. This is needed to quantify specific conditions for use that are expressed per m^2 of useful floor area (e.g. occupancy) and for the application of the simplifications and the zoning and (re-)allocation rules.

The choices with respect to the type of dimensions to determine the useful floor area are given in Table A.20, with informative default values in Table B.20.

The useful floor area shall be specified in such a way that the sum of the useful floor area of individual spaces is the same as the useful floor area of the thermal zone or service area of these spaces.

EXAMPLE If external dimensions are used, partition walls between spaces could be counted double if the floor area of two adjacent spaces are summed up. A system where external dimensions of a room include half of the partitions is better in this respect.

The useful floor area can also be the basis to determine the reference floor area (see ISO 52003-1).

For each space (index space, i) the air volume, $V_{air;space,i}$, is assessed. This is needed as basis for the air volume per thermal zone, an input for the thermal calculations in relation to ventilation and moisture.

9.4 Normalization to building size

9.4.1 Reference size

Overall and partial energy performance can be normalized to the building size, by relating it to one or more of the relevant metrics for the building size, such as reference volume or reference floor area.

Table A.21 provides the template for the choice or choices of the metric for the reference size with an informative default choice in Table B.21.

Assessing the size of a building or part of a building implies the choice which spaces are considered to be included. This choice is related to the space category. For specific space categories a fraction (between 0 and 1) of the size may be appropriate.

EXAMPLE Basement, attic, indoor parking.

NOTE These kind of choices may have a strong effect on the normalized energy performance. The choices are, therefore, directly related to the assumptions concerning conditions of use for the different building and/or space categories (e.g. for a basement, attic, indoor parking, etc.) and are typically determined at national or regional level; see more information on the impact and the rationale of the possible choices in ISO/TR 52000-2[6].

Table A.22 provides the template for the choice of space categories that are included in the metric for the building size, with an informative default choice in Table B.22. Where applicable, the fraction of the contribution, $f_{\mathrm{ref;cat},i}$. can be specified.

9.4.2 Normalization

This leads to Formula (1) for normalization of a quantity X by the reference size S:

$$Y = \frac{X}{S} = \frac{X}{\sum_i (f_{\mathrm{ref;cat},j} S_{\mathrm{sp},i})} \tag{1}$$

where:

X is the quantity to be normalized;

S is the reference size of the assessed object;

Y is the normalized quantity;

$S_{\mathrm{sp},i}$ is the size of the space i in the assessed object;

$f_{\mathrm{ref;cat},i}$ is the fraction of contribution to the reference size, for the space category j to which space i belongs;

index i covers all spaces in the assessed object.

9.4.3 Reference floor area

One of the choices for the metric of the building size is the reference floor area, which can be based on the useful floor area, A_{use}. Table A.21 provides the template for the choice of reference metric, including the possibility to add extra information on where this can be found. The default choice is in Table B.21.

NOTE 1 Difference between the useful floor area and the reference floor area: the reference floor area is used for normalization of the energy performance. The useful floor area is used for various purposes, such as conditions of use, if conditions of use are given per m^2 of floor area (e.g., hot water use, ventilation needs) or weighting according to floor area, for instance for redistribution in case of zoning (see Clause 10).

NOTE 2 The rationale for the choice is given in the accompanying Technical Report, ISO/TR 52000-2[6].

9.5 Assessment boundary and perimeters

9.5.1 General principles

The assessment boundary is related to the assessed object, as determined in 6.2.1.

Energy performance for a part of the assessed object and/or per service is calculated according to normative Annex E.

Energy can be imported or exported through the assessment boundary. The assessment boundary defines where the actual value of the delivered or exported energy is calculated or measured.

Some of these energy flows can be quantified based on the meters (e.g., gas, electricity, district heating). For active solar, wind or water energy systems the assessment boundary is the output of the solar panels, solar collectors or electric generation devices.

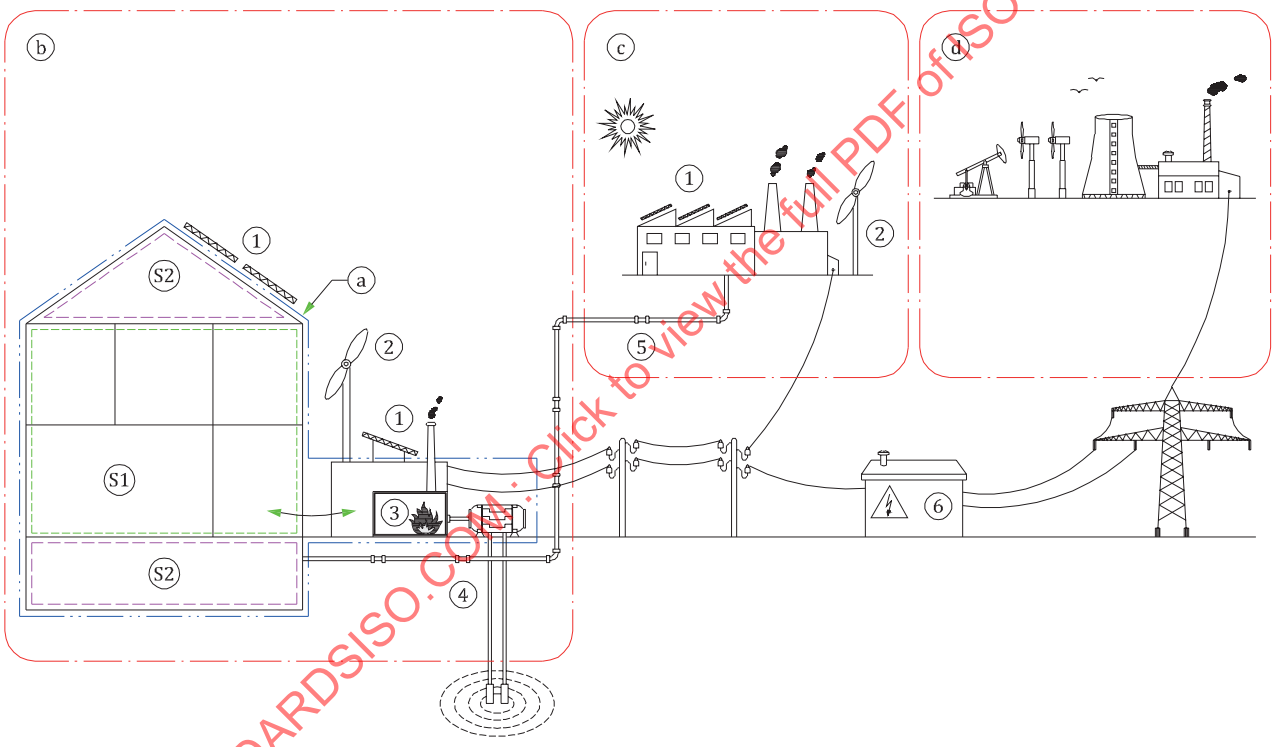
The delivered energies are classified according to the following perimeters (origin or destination):

— on-site;

— nearby;

— distant.

The concept of on-site, nearby and distant is schematically shown in Figure 1.



Key

a	assessment boundary (use energy balance)	1	PV, solar
b	perimeter: on-site	2	wind
c	perimeter: nearby	3	boiler room
d	perimeter: distant	4	heat pump
S1	thermally conditioned space	5	district heating/cooling
S2	space outside thermal envelope	6	substation (low/medium voltage and possible storage)

Figure 1 — Example of a scheme representing the concept of perimeters and assessment boundary

Energy weighting factors (e.g., primary energy, CO_2) are defined for each energy flow delivered or exported through the assessment boundary, taking into account the origin for delivered and the destination for exported energy.

In case of energy produced on-site or nearby, the weighting factors are calculated according to the relevant EPB standards. The template for weighting factors is provided in Table A.16. See Table B.16 for informative default weighting factors.

In case of distant energy, weighting factors are also provided in Table A.16. See Table B.16 for informative default weighting factors.

Inclusion or exclusion of energy contribution according to the perimeter (origin) depends on the calculation objective: e.g. for defining the renewable energy ratio (RER) or to determine the energy performance. See the template in Table A.23 and Table A.24. Informative default choices are given in Table B.23 and B.24.

Assessment boundaries and weighting factors for the building, on-site, nearby and distant shall be established in a way to avoid double counting of renewable energy. Double counting of renewables in the energy supply chain to and from the building shall be prohibited.

9.5.2 Assessment boundary for multiple buildings

The energy exchanged between buildings belonging to the same building portfolio shall be weighted according to step A (e.g., $k_{exp} = 0$).

If the assessed object includes several buildings, served by common technical building systems but for which a separate energy performance is desired, they shall be treated the same way as two or more building units or two or more services.

9.6 Overall energy performance

9.6.1 Weighted overall energy balance

The weighted overall energy performance E_{we} of an assessed object is the balance at the assessment boundary of:

— the weighted delivered energy, required to meet the energy demand of considered uses and to generate the exported energy $E_{we;del}$;

— the weighted exported energy $E_{we;exp}$.

The weighted delivered and the weighted exported energy are based on weighting factors per energy carrier.

The weighted overall energy performance E_{we} is calculated with Formula (2):

$$E_{we} = E_{we;del;an} - E_{we;exp;an} \quad (2)$$

where:

$E_{we,del;an}$ is the annual weighted delivered energy, taking into account only energy carriers delivered from the (origins) perimeters defined according to the template given in Table A.23, as specified in Clause 9 for calculated energy performance and in Clause 8 for measured energy performance. Default perimeters are given in Table B.23;

$E_{we,exp;an}$ is the annual weighted exported energy for energy carrier i, including energy exported to functions at the building site that are not included in the energy performance, as specified for calculated energy performance in Clause 11 and for measured energy performance in Clause 8.

The weighted energy performance can be calculated with any of the following types of weighting:

— primary energy, which can be non-renewable (E_{Pnren}), renewable (E_{Pren}) and total (E_{Ptot}), see 9.6.2;

— greenhouse gas emissions, see 9.6.3;

— additional weighting factors, see 9.6.4;

— costs, see 9.6.5.

NOTE 1 This means that the weighted amount E_{we} is not necessarily an energy: it can be a cost, a heat emission amount, a greenhouse gas emission amount.

In order to allow time dependent weighting factors, the weighting shall be performed in each calculation interval, which is done in Clause 11.

$E_{we,del;an}$ is given by Formula (3):

$$E_{we;del;an} = E_{we;del;nexp;an} + E_{we;del;el;an} \quad (3)$$

where:

$E_{we;del;nexp;an}$ is the annual weighted delivered energy for all energy carriers without energy export calculated according to 11.6.3, Formula (39);

$E_{we;del;el;an}$ is the annual weighted delivered electricity, calculated according to 11.6.2.1, Formula (19);

NOTE 2 If an energy carrier in not exported then $E_{we;exp;nexp;an} = 0$.

9.6.2 Primary energy factors

Different values for the primary energy factors are possible for energy exported, re-delivered or exported to functions at the building site that are not included in the energy performance. The delivered energy and the related primary energy factor can be expressed based on gross or net calorific values (see Table A.13 to Table A.16 and informative default values in Table B.13 to Table B.16).

The choice between net and gross caloric value shall be maintained from the energy performance assessment of (sub-)systems until, and including, the primary energy factors, without mixing net and gross values. See Table A.25 for conversion factors between net and gross calorific values and informative default values in Table B.25).

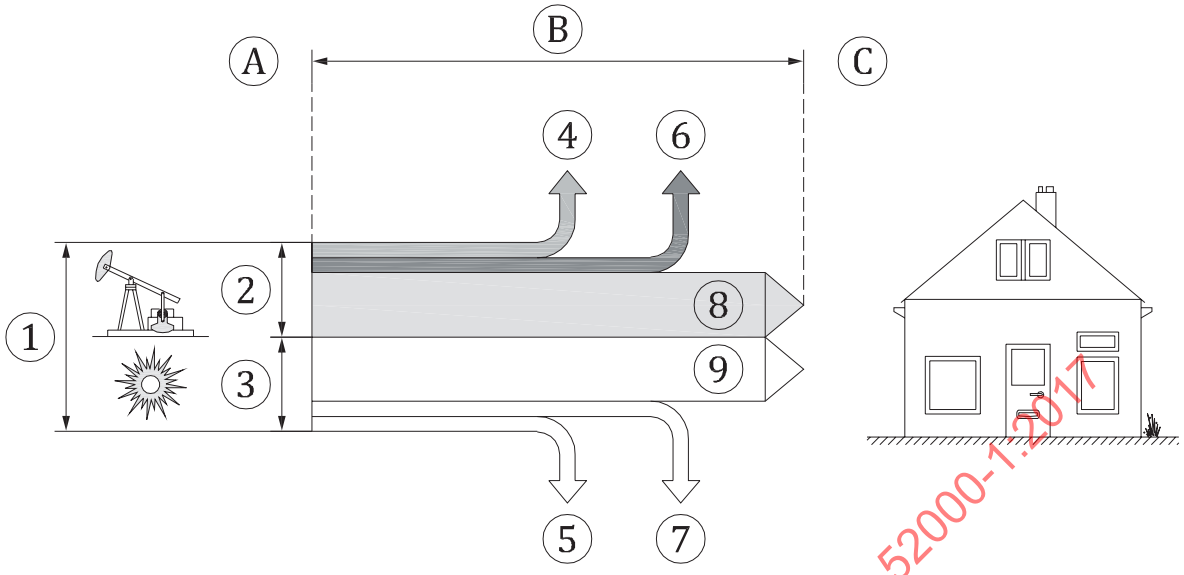
The primary energy factor from delivered and exported energy can be different, also per energy carrier.

For each delivered or exported energy flow or energy carrier there are three primary energy factors (see Figure 2):

a) Total primary energy factor (P_{tot});

b) Non-renewable primary energy factor (P_{nren});

c) Renewable primary energy factor (P_{ren}).



$$f_{Ptot} = \frac{1}{8+9} \qquad f_{Pnren} = \frac{2}{8+9} \qquad f_{Pren} = \frac{3}{8+9}$$

Key

A	energy source	4	non-renewable infrastructure related energy
B	upstream chain of energy supply	5	renewable infrastructure related energy
C	inside the assessment boundary	6	non-renewable energy to extract, refine, convert and transport
1	total primary energy	7	renewable energy to extract, refine, convert and transport
2	non-renewable primary energy	8	delivered non-renewable energy
3	renewable primary energy	9	delivered renewable energy

Figure 2 — Primary energy factors

The energy overheads of delivery to the point of use are defined in Table A.26 and informative default choices are given in Table B.26.

The template for the values of the primary energy factors is given in Table A.16. Informative default values for primary energy factors are given in Table B.16.

The energy performance of the building, when expressed as primary energy, is either based on total or on non-renewable primary energy factors. See Table A.27. An informative default choice is given in Table B.27.

When expressing a primary energy use, it shall be specified if it is total primary energy, non-renewable primary energy or renewable primary energy.

9.6.3 Greenhouse gas emission factors

The Greenhouse gas emission factors shall be expressed in kg of CO_2 equivalent per kW h and may also include the equivalent emissions of other greenhouse gas emissions like methane, water vapour etc. The conversion factors shall be coherent with the choice of referring to gross calorific value or net calorific value.

They shall include all CO_2eq-emissions associated with the delivered energy used by the building.

The options are given in Table A.26, informative defaults in Table B.26.

9.6.4 Additional weighting factors

Additional factors can be used to favour or penalize some energy carriers.

NOTE This option provides the possibility to use the methodology of this document (e.g., assessment boundary, perimeter, energy balance) for any weighting.

9.6.5 Costs factors

The cost weighting factors shall be in line with M1-14 and shall be expressed in currency unit per kW h.

For fuels, the conversion factors shall be coherent with the choice of referring to gross calorific value or net calorific value.

9.6.6 Weighting factors for exported energy

9.6.6.1 General

There are two complementary types of weighting factors for exported energy. They are based on the evaluation of:

— the resources used to produce the exported energy carrier, that are used for "Step A" evaluation ($f_{Pren;exp;stepA,i;}$) according to 9.6.6.2;

— the resources avoided by the external grid due to the export of the energy carrier, that are used for "Step B" evaluation ($f_{Pren;exp,i;}$) according to 9.6.6.3.

9.6.6.2 Step A: Weighting factors based on the resources used to produce the exported energy

9.6.6.2.1 General

The weighting factors based on the resources used to produce the exported energy may be:

— time dependent;

— for a given energy carrier, there is only one weighting factor for all destinations of exported energy.

They are identified by the subscript "stepA".

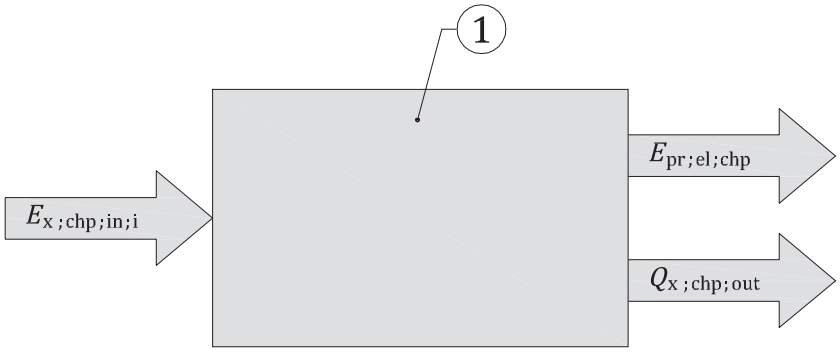
9.6.6.2.2 Photovoltaic/wind electricity

The weighting factor based on the resources used to produce exported photovoltaic and wind electricity $f_{we;exp;el;stepA;PV}$ and $f_{we;exp;el;stepA;wind}$ are the same as the weighting factor for the corresponding delivered energy.

EXAMPLE For PV electricity, the renewable primary energy conversion factor for Step A $f_{Pren;exp;el;stepA;pv}$ is equal to $f_{Pren;del;el;pv}$.

9.6.6.2.3 Cogenerated electricity

The weighting factor based on the resources used to produce exported cogenerated electricity is calculated according to the delivered energy input of the co-generator, using the same allocation method which is used for the heat produced together with the electricity, see Figure 3.



Key

1	cogeneration
$E_{X;chp;in;i}$	energy carrier *cr* input to cogeneration system *i*, for building service *X*
$E_{pr;el;chp}$	electricity produced by the cogeneration system
$Q_{X;chp;out}$	heat produced by the cogeneration system

Figure 3 — Input and output energy flows of a cogeneration system

When a cogeneration system produces both heat $Q_{X;chp;out}$ and electricity $E_{pr;el;chp}$, the Step A primary energy factor $f_{we;exp;el;stepA;t}$ for the cogenerated electricity at calculation interval t is given by Formula (4):

$$f_{we;exp;el;stepA;chp;t} = \frac{E_{we;in;el,t}}{E_{pr;el;chp,t}} \quad (4)$$

where:

$E_{pr;el;chp;t}$ is the electricity produced during calculation interval t.

The fractions of the weighted energy input allocated to the outputs, $E_{we;in;el,t}$ and $E_{we,in;Q,t}$ are given by Formulae (5) and (6):

$$E_{we;in;el,t} = E_{we;in,t} \cdot a_{W,t} \quad (5)$$

and

$$E_{we;in;Q,t} = E_{we;in,t} \cdot a_{Q,t} \quad (6)$$

where:

$a_{W,t}$ and $a_{Q,t}$ are the allocation factors for cogenerated electricity and heat at calculation interval t determined.

$E_{we;in,t}$ is the sum of the weighted energy carrier inputs $E_{X;gen;in;cr,i,t}$ to the cogeneration system at calculation interval t, given by Formula (7):

$$E_{we;in,t} = \sum_i E_{X;chp;in;cr,i;t} \cdot f_{we;del;cr,i;t} \quad (7)$$

NOTE 1 Auxiliary energy for the co-generator is deducted from the generated electricity (e.g., net produced electricity is reported).

This shall be done separately (e.g., independently) for each weighting criteria (for example, for renewable and non-renewable primary energy) with the same allocation factors.

NOTE 2 This procedure can also be used in case of heat export.

9.6.6.2.4 Multiple on-site generation systems providing exported energy

In case of multiple on-site generation system, the average Step A weighting factor $f_{we;el;stepA}$ for electricity is given by Formula (8):

$$f_{we;el;stepA,t} = \frac{\sum_i \left(f_{we;exp;el;stepA;pr,i;t} \cdot E_{exp;el;pr,i;t} \right)}{\sum_i E_{exp;el;pr,i;t}} \quad (8)$$

where:

$E_{exp;el;pr,i}$ is the amount of the electricity produced by generation system i that is exported;

$f_{we;exp;el;-stepA;pr,i}$ is the Step A conversion factor for electricity produced by generation system i, calculated according to 9.6.6.2.2 and 9.6.6.2.3.

The exported amount of the energy produced by each energy generator i $E_{exp;el;pr,i}$ is determined:

— either with priority;

— or without priority;

according to the following procedure.

Each generator type is given an identifier according to the template given in Table A.12. A default set is given in Table B.12.

The priority is specified by associating one generation type identifier to each priority level, starting from level 1 which is the highest. A template is given in Table A.28 and a default priority set is given in Table B.28.

If no priority is required, then the priority levels are given the special identifier “NONE”.

If a priority order is set then the following procedure is followed.

a) Set the amount of produced energy that can be used $E_{EPus;el;left;t,1}$ using Formula (9):

$$E_{EPus;el;left;t,1} = E_{EPus;el;t} \quad (9)$$

b) Start with priority level $i = 1$ and repeat for each priority level until the last:

1) get the energy produced by the generator with priority level i at time interval t $E_{pr;el;lvl,i,t}$

2) calculate the maximum usable energy for the generator with priority level i $E_{pr;el;lvl,i;usmax;t}$ as per Formula (10):

$$E_{pr;el;lvl,i;usmax;t} = \min\left(E_{pr;el;lvl,i;used;t} ; E_{EPus;el;left;t,i} \right) \quad (10)$$

3) calculate the amount of produced energy that can be used at priority level i+1 $E_{EPus;el;left;t,i+1}$ as per Formula (11):

$$E_{EPus;el;left;t,i+1} = E_{EPus;el;left;t,i} - E_{pr;el;lvl,i;usmax;t} \quad (11)$$

4) calculate the actually used energy for the generator with priority level i $E_{pr;el;lvl,i;used;t}$ as per Formula (12):

$$E_{\text{pr;el;lvl},i\text{;used};t} = E_{\text{pr;el;lvl},i\text{;usmax};t} \cdot f_{match;t} \quad (12)$$

5) calculate the exported energy for the generator with priority level i $E_{\text{exp;el;pr},i;t}$ as per Formula (13):

$$E_{\text{exp;el;pr},i;t} = E_{\text{pr;el;lvl},i;t} - E_{\text{pr;el;lvl},i\text{;used};t} \quad (13)$$

If no priority is set (priority identifier = "NONE") then the following procedure is repeated for each type of produced electric energy type i:

a) calculate the fraction $f_{\text{pr;el},i}$ of produced electric energy type I using Formula (14):

$$f_{\text{pr;el},i} = \frac{E_{\text{pr;el};i}}{\sum_k E_{\text{pr;el},k}} \quad (14)$$

b) calculate the actually used energy for produced electric energy type i Epr;el,i;used;t as per Formula (15):

$$E_{\text{pr;el},i\text{;used};t} = E_{\text{pr;el;used;EPus};t} \cdot f_{\text{pr;el};i} \quad (15)$$

c) calculate the exported energy for the generator with priority level i $E_{\text{exp;el;pr},i;t}$ as per Formula (16):

$$E_{\text{exp;el;pr},i;t} = E_{\text{pr;el},i;t} - E_{\text{pr;el},i\text{;used};t} \quad (16)$$

9.6.6.3 Step B: Weighting factors based on the resources avoided by the external grid due to the exported energy

Factors based on the resources avoided by the external grid due to the exported energy may be time dependent. In contrast to Step A, the Step B weighting factors are not identified by any special subscript.

EXAMPLE For electricity, the renewable primary energy conversion factor for Step B is $f_{\text{Pren;exp;el}}$ (renewable part of the resources avoided by the external grid energy). No special subscript given, because this determines the end result, while Step A is an interim step.

Step B weighting factors shall be specified in the format given in Table A.16. Informative default values are given in Table B.16.

9.6.7 Energy flows

The energy flows that are to be taken into account in the energy performance balance calculation shall be identified.

See 11.6.2.

9.7 Share of renewable energy

The renewable energy ratio RER is given by Formula (17):

$$\text{RER} = \frac{E_{\text{Pren;RER}}}{E_{\text{Ptot}}} \quad (17)$$

where:

E_{Ptot} is the total primary energy calculated with Formula (2) using total primary conversion factors $f_{Ptot;del;cr,i}$ and $f_{Ptot;exp;cr,i}$., taking into account the perimeters. Table A.24 gives a template for defining the perimeters for the RER, with informative default values in Table B.24;

$E_{Pren;RER}$ is the renewable primary energy calculated with Formula (2), taking into account the perimeters. Table A.24 gives a template for defining the perimeters for the RER, with informative default values in Table B.24.

NOTE Further explanation and worked examples are provided in the accompanying Technical Report, ISO/TR 52000-2[6].

RER is dependent on the chosen perimeter. To be able to compare different calculated values of RER the chosen perimeter should be shown as subscript (e.g., RER_{onst}, RER_{nrby}, RER_{dist}).

Procedures on the energy from renewable energy source related to different technologies (thermal solar systems, heat pumps, etc.) are given in the related sub-system EPB standards.

9.8 Energy performance indicators for technical building systems

For the purpose of transparency and optimising the energy use of technical building systems, partial energy performance indicators of the technical building systems can be set for the energy performance.

For the purpose of optimising the energy use of technical building systems system requirements can be defined for the energy performance.

The system performance indicators shall cover at least the following services, if these are part of the combination of energy services (see 6.2.5/9.2):

— heating systems;

— domestic hot water systems;

— air-conditioning systems;

— cooling systems;

— ventilation systems;

— lighting systems;

— building automation and control systems;

— or a combination of such systems.

For each of these systems (e.g., heating system) or sub-systems (e.g., heat generation, heat distribution) the system performance indicators are calculated in the related system or sub-system standards under EPB modules M3 to M10.

9.9 Calculation methods for energy performance indicators per part of a building and/or service

There are two methods for the detailed calculation procedure for energy performance indicators per part of a building and/or service. The two methods are fully equivalent but require different calculation resources and only one can be used for measured energy performance.

The conventional accounting method starts with the needs and then follows the energy calculations to the weighted energy. For each part of the service or part of the building that is to be rated individually, a separate accounting is kept. This method can be used only for calculated energy performance, not for measured energy performance.

The reverse calculation method starts with the weighted energy and the calculation then goes towards the needs. It is applied after that the overall energy performance calculation has been completed. Then it is calculated which part of this overall energy performance can be allocated to which part of the building and/or service. This method can be used for measured energy performance.

Both methods are given in Annex E.

10 Zoning

10.1 General

Clause 10 is applicable to calculated energy performance.

Assessed objects can be divided into thermal zones and service areas.

Where possible, the assessed object (building or part of the building) is considered as a single thermal zone.

However, the energy performance calculation may require that the assessed object is divided into thermal zones (see 10.2) depending on:

— the differentiation in conditions of use over the spaces in the building;

— the complexity of the building (building physics, building units, etc.);

— the complexity of the technical building systems (control, losses).

Then the thermal balance calculation is performed separately for each thermal zone and not directly for the whole assessed object.

Where possible, the assessed object (building or part of the building) is considered as a single service area for each service (heating, cooling, domestic hot water, ventilation, lighting).

However, for one or more services, the energy performance calculation may require that the assessed object is divided into different service areas (see 10.2), depending on the complexity of the technical building systems.

The division of the building or part of the building into service areas is in principle done separately for each service. In this way, it is avoided that if a more refined division into service areas is needed for one service, this would also be needed for all other services.

EXAMPLE A service area for lighting and a service area for domestic hot water needs can be specified and calculated independently from each other.

The influence of technical building systems on the thermal balance, in the form of dissipated heat or cold, is taken into account per thermal zone.

Where the service area for a service does not coincide with a thermal zone, simple subdivision and aggregation rules are introduced.

The type of assessed object (e.g., new or existing building) and the type of application (e.g., EP certificate or minimum EP requirements), as specified in Table A.3 and Table A.8 (normative template) and Table B.3 and Table B.8 (informative default choices), may also influence the differentiation into thermal zones and service areas.

NOTE 1 For high performing buildings the interest in more precise energy performance assessment could be more important than for existing buildings with bad energy performance.

Each thermal zone or service area covers one or more so called elementary spaces for easy, transparent and unambiguous subdivision and aggregation of certain calculated quantities between service areas and thermal zones (see 10.3). An elementary space is the smallest area that covers one thermal zone and

one service area of each type. These elementary spaces are only used for this purpose. The subdivision and aggregation rules are based on the size (e.g., floor area) of the elementary spaces.

NOTE 2 The metric for the size is open for choice (normative template in Table A.29, informative default choice in Table B.29).

NOTE 3 In principle it would be enough to subdivide a thermal zone in (elementary) spaces independently for each service. However, for the administration and the application of the zoning rules and for the actual calculation (software) this would be more complicated. The only information needed at elementary space level is its size.

The term "zoning" is used for the whole process of subdivision into thermal zones and the subdivision into service areas. The elementary spaces are specified as the final step of the zoning process.

10.2 Thermal zones and service areas

For each relevant input and output quantity of each EPB standard it has to be made unambiguously clear to which thermal zone (Z_{th}) or service area (SA_X) the value applies.

There are different types of service areas, different according to the considered service.

The following service areas listed in Table 9 are distinguished:

Table 9 — The EPB service areas types

Symbol	Service area (type)	Notes (informative)
SA_H	Heating system service area	For the heating systems
SA_C	Cooling system service area	For the cooling systems
SA_V	Ventilation zone service area	For the air flow rates and ventilation systems
SA_W	DHW service area	For the domestic hot water needs and systems
SA_L	Lighting service area	For the daylighting and artificial lighting systems

A thermal zone is a part of the building that consists of a set of elementary spaces that share the same thermal balance.

A service area is a part of the building that consists of a set of elementary spaces that share, for the calculation, a uniform need or are served by one specific part of a technical system or subsystem.

NOTE 1 In simple cases thermal zones and service areas for the different services can be identical. But the division into service areas may be needed for one service and not needed for another service. In that case different service areas for the different services leads to the highest simplicity, both for the gathering of input data and for the actual calculation. See examples below (and see ISO/TR 52000-2[6] for more examples).

NOTE 2 Needs for a service area can be calculated for parts of the building that are not the same as the thermal zones.

The criteria for the subdivision into thermal zones and service areas are provided in 10.4.

A service area may cover rooms, group of rooms, the entire building or parts of rooms. The boundary of a service area does not need to be a material boundary.

NOTE 3 The boundary could be somewhere in the middle of a room or group of rooms and does not necessarily coincide with a wall.

EXAMPLE 1 A lighting service area can end at a specific place in the room or group of rooms where the daylight levels fall below a certain threshold.

The total number of thermal zones cover the whole area of the assessed object. The thermal zoning also applies to unheated spaces.

EXAMPLE 2 A series of unheated garage boxes or storage spaces can be seen as one thermal zone.

For each type of service area, the total number of service areas cover the whole area of the assessed object.

EXAMPLE 3 If part of the assessed object is not serviced or assumed to be serviced by a specific type of service (e.g., no cooling), then this part is labelled as a service area with zero service (e.g., cooling system service area: "No mechanical cooling").

A service area can cover part of a thermal zone or cover (parts of) more than one thermal zone.

10.3 Spaces

For the purpose of the zoning, a space is called an "elementary space" if it belongs to one service area of each service and one thermal zone.

An elementary space is a part of a room, a room or group of adjacent rooms that belongs to one thermal zone and one service area of each service. The elementary space is used for the specification of the thermal zones and service areas. An elementary space cannot partly belong to one thermal zone and partly to another; or partly to one service area and partly to another.

EXAMPLE 1 See Figure 4. Thermal zone 1 covers elementary spaces S1+S2+S3+S4+S5. Heating system service area 1 covers elementary spaces S1+S2+S3. Heating system service area 2 covers elementary spaces S4+S5.

EXAMPLE 2 An elementary space consisting or a series of adjacent office spaces which are in the same thermal zone, the same domestic hot water needs service area, the same ventilation service area, the same heating and cooling system and system parts service areas and the same lighting service area.

EXAMPLE 3 An elementary space consisting or a series of garages in an apartment building that buffer the thermal losses of the thermally conditioned floor above; with electricity use for lighting that could (in specific countries) be included in the energy performance of the building.

The elementary space is also used for the exchange of certain calculated data between the service areas and the thermal zones, using the subdivision and aggregation rules given in 10.5.

In addition, this enables the possibility to assign data to a group of elementary spaces that form a building unit or a specific part of the building.

The elementary space is not used for the actual calculations: the actual calculations are performed per thermal zone (thermal balance calculations) and additionally, per each type of service area (for the systems related calculations).

Therefore, most input, like most physical properties, boundary conditions and conditions of use, are not gathered at the level of the elementary spaces, but at the level of the thermal zones and (additional systems related input) service areas.

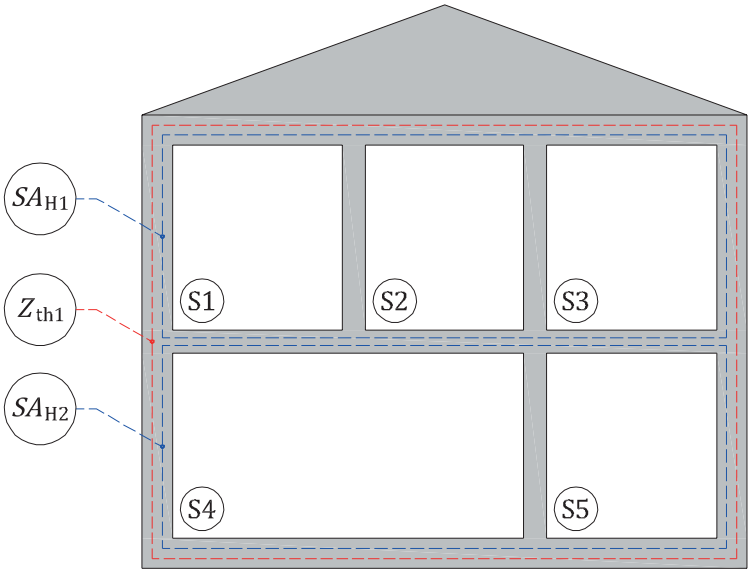
EXAMPLE 4

— The thermal properties and areas of the building elements are gathered per thermal zone and not per elementary space.

— For a domestic hot water zone the DHW needs are gathered per DHW service area and not per elementary space.

— However data from DHW service area calculation such as recoverable losses for heating have to be passed unambiguously to the correct thermal zone(s) and for that purpose assignment rules are given (in 10.5).

— For a lighting service area typical input data are the glazing characteristics (visual transmittance, height above floor and size), plus the depth of the daylight area perpendicular to the daylight openings, as well as the lighting system properties. These data are gathered per lighting service area and not for each elementary space.



Key

Z_{th1} Thermal zone 1; covering elementary spaces S1+S2+S3+S4+S5

SA_{H1} Heating system service area 1 (e.g., radiators); covering elementary spaces S1+S2+S3

SA_{H2} Heating system service area 2 (e.g., floor heating); covering elementary spaces S4+S5

Figure 4 — Example with one thermal zone and two heating system service areas

The boundary of an elementary space does not need to be a material boundary.

EXAMPLE 5 Like for a lighting service area, the boundary could be somewhere in the middle of a room or group of rooms, depending on how far the daylight enters these rooms, and does not necessarily coincide with a wall.

If information is required at the level of a building unit or a part of the building (the "assessed object"), then the boundaries of a group of elementary spaces shall coincide with the boundary of the assessed object.

EXAMPLE 6 If in an apartments block with a centralized heating system the heating energy performance is required per building unit, then each building unit has to be considered as an elementary space or combination of elementary spaces.

During the zoning procedure, the specification of the thermal zones and service areas, some basic information is needed at building space level:

— The space category is needed for the conditions of use, being one of the main possible criteria for zoning (see 10.4).

— Other basic information needed for the application of the zoning rules.

NOTE Evidently, it is important that the zoning rules do not require too detailed information at building space level, otherwise the benefit of gathering the input data at the (larger) zone level would be lost.

EXAMPLE 7 A strong difference in percentage of glazing in the façade could be a criterion for subdividing into different thermal zones. This does not require that for each building space separately the size of windows and opaque parts has to be measured in full detail.

When the zoning has been completed, the elementary spaces are also known. For the elementary spaces only the size (e.g., floor area, volume or other selected metric) is needed for the assignment of the calculated results (see 10.5).

10.4 Zoning rules

10.4.1 Principle

The following functional criteria listed in Table 10 are identified to divide the assessed object (the building or part of the building) into thermal zones and service areas:

Table 10 — Zoning functional criteria

Symbol	Description	Possible functional criteria
Z_{th}	Thermal zone	Different conditions of use (thermal, hygric) Difference in thermal balance (e.g., thermal mass, internal gains including system heat losses, glazing to floor area ratio/shading/orientation, ...) Space category boundary Building units
SA_H	Heating system service area	Different types of emitters and emitter control Different distribution networks zones (in practice linked to different operating schedules, in turn linked to different space category) Different heating systems
SA_C	Cooling system service area	Different types of emitters and emitter control Different distribution networks zones (see heating) Different cooling system
SA_V	Ventilation service area	Different conditions of use (ventilation needs related to indoor air quality) Different ventilation and/or subsystem types Different ventilation systems
SA_W	Domestic Hot Water service area	Different conditions of use (domestic hot water needs) Different domestic hot water system or subsystem types Different domestic hot water systems
SA_L	Lighting service area	Different daylighting potential Different conditions of use (lighting needs, "task areas") Different lighting or daylighting system or subsystem types

Additional functional criteria may be identified. In 10.5 these functional criteria are translated into specific criteria.

10.4.2 Specific zoning criteria

The specific zoning criteria for the thermal zones are given in the relevant standard under EPB module M2-2.

The specific zoning criteria or links to specific zoning criteria for the service areas are provided in the relevant system standards under EPB modules M3 – M5 and M8 – M9.

10.5 Assignment rules

10.5.1 Subdivision

For each thermal zone data need to be exchanged with the service areas that cover (part of) the thermal zone and vice versa.

This is done via the elementary spaces. The elementary spaces are used to subdivide and aggregate the data for the exchange.

With the subdivision rules, the data become available at elementary space level, without the need to perform the calculation at the elementary space level, as shown in the example below.

EXAMPLE 1 See Figure 5.

Z_{th1} = S1 + S2 + S3 + S4

Z_{th2} = S5 + S6

SA_{L1} = S1 + S2 + S5

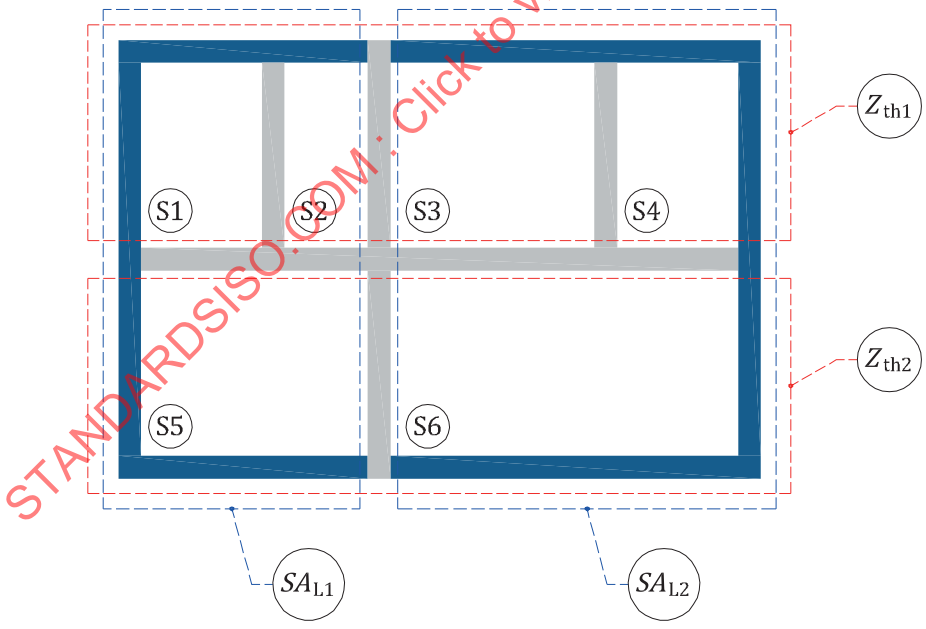
SA_{L2} = S3 + S4 + S6

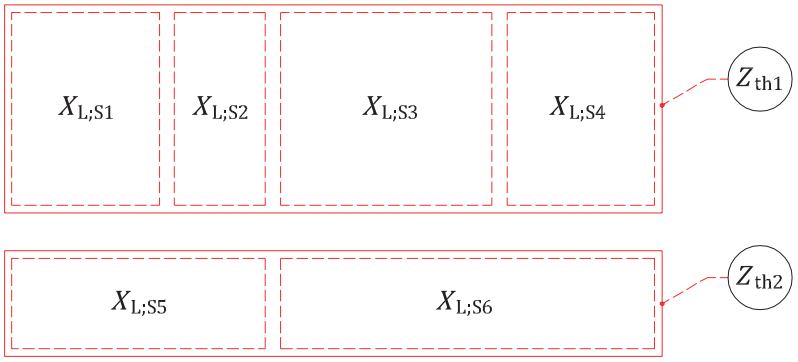
Subdivide result X_{L1} of lighting service area SA_{L1} over the spaces, according to the given generic or specific subdivision rules. This results in $X_{L;S1}$, $X_{L;S2}$ and $X_{L;S5}$

Subdivide result X_{L2} of lighting service area SA_{L2} over the spaces, according to the given generic or specific subdivision rules. This results in $X_{L;S3}$, $X_{L;S4}$ and $X_{L;S6}$

Recombination for the thermal zone Z_{th1}: $X_{L;th1} = X_{L;S1} + X_{L;S2} + X_{L;S3} + X_{L;S4}$ (see 10.5.2)

Recombination for the thermal zone Z_{th2}: $X_{L;th2} = X_{L;S5} + X_{L;S6}$ (see 10.5.2)





Subdivision

Simple rule, see formula (18) for SA_{L1}:

$X_{L;S1} = X_{L1} * S1/(S1+S2+S5)$

$X_{L;S2} = X_{L1} * S2/(S1+S2+S5)$

$X_{L;S5} = X_{L1} * S5/(S1+S2+S5)$

Simple rule, see formula (18) for SA_{L2}:

$X_{L;S3} = X_{L2} * S3/(S3+S4+S6)$

$X_{L;S4} = X_{L2} * S4/(S3+S4+S6)$

$X_{L;S6} = X_{L2} * S6/(S3+S4+S6)$

Recombination

Simple rule:

$X_{L;th1} = X_{L;S1} + X_{L;S2} + X_{L;S3} + X_{L;S4}$

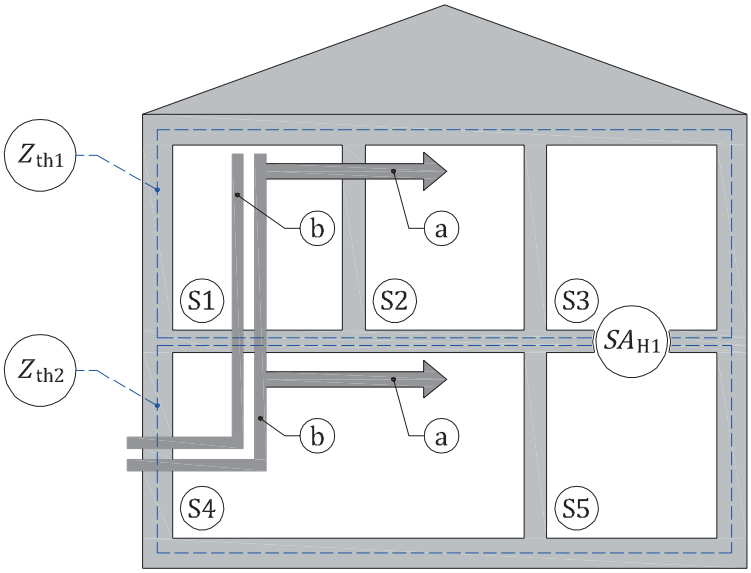
$X_{L;th2} = X_{L;S5} + X_{L;S6}$

Key

Z_{th1}	thermal zone 1 (covering elementary spaces S1+S2+S3+S4)
Z_{th2}	thermal zone 2 (covering elementary spaces S5+S6)
SA_{L1}	lighting system service area 1 (covering elementary space S1+S2+ S5)
SA_{L2}	lighting system service area 2 (covering elementary space S3+S4+S6)
a	recoverable losses
b	distribution system piping

Figure 5 — Example of subdivision and recombination

EXAMPLE 2 One heating system service area and two thermal zones, requiring the allocation of the recoverable system losses to each thermal zone (see Figure 6).



Key

Z_{th1}	thermal zone 1 (covering elementary spaces S1+S2+S3)
Z_{th2}	thermal zone 2 (covering elementary spaces S4+S5)
SA_{H1}	heating system service area 1 (covering elementary space S1+S2+S3+S4+S5)
a	recoverable losses
b	distribution system piping
	situation: two thermal zones (Z_{th1}, Z_{th2}), one distribution piping system; the location of pipe segments in each thermal zone is not known

Figure 6 — Example to illustrate the need for subdivision rules

EXAMPLE 3 If a ventilation duct crosses different (elementary) spaces, it is the indoor environment temperature in each of these spaces that is used for the calculation of the heat transfer through the duct ("heat loss"). If these spaces belong to different thermal zones, the environment temperature is the mean temperature of the thermal zones that are crossed (input from the standard for the thermal balance calculations), weighted by the size of the crossed spaces (or, e.g., weighted by the length of the duct per space). In turn, for the thermal balance in each of the thermal zones, the heat transfer ("heat loss", positive or negative value) to the duct will be collected from the spaces (output from the ventilation standard); the heat loss per space is the fraction of the total duct loss, e.g., weighted by the area of the involved spaces (or, e.g., weighted by the length of the duct per space).

A second purpose is to enable to assign data to a building unit or a specific part of the building, as described in 10.3.

Some EPB standards may have specific assignment rules based on specific properties of the elementary spaces, to enable to perform the calculation at the (larger) thermal zone level, and still benefit from specific information at the elementary space level for the subdivision.

EXAMPLE 4 Specific assignment rules can be used for the type of heating emitter (e.g., radiator or floor heating). With this information the heating needs of a thermal zone can (optionally) be attributed to each elementary space in that zone and linked to different heating emission subsystems.

Subdivision and distribution shall be performed according to a selected weighting factor. The choice of the suitable weighting factor shall be explicit.

Unless otherwise specified, a linear sub-division is performed. If a quantity X shall be sub-divided or distributed to elements i according to the weighting factor Y, it will be as per Formula (18):

$$X_i = X \cdot \frac{Y_i}{\sum_i Y_i} \tag{18}$$

where the weighting factor Y_i is a metric of the element i.

EXAMPLE 5 X is the heating need of a thermal zone; Y is useful floor area; i = 1, 2, … are the elementary spaces in the thermal zone.

The general subdivision rules and links to specific subdivision rules are given in Table A.29 (template) and Table B.29 (informative default rules or links).

10.5.2 Recombination

For each thermal zone or service area, the data which were assigned to each elementary space in 10.5.1 shall be aggregated again to obtain the resulting data at the thermal zone or service area level.

10.6 Zoning procedure

The required division of the assessed object into elementary spaces is obtained applying one after another the zoning criteria specified in 10.4, for the division into thermal zones and, per service, for the division into service areas.

The starting point of the procedure is having the whole building considered as one single thermal zone and one single service area for each service.

For the successive criteria, it is verified if any of the thermal zones defined with the previous criteria shall be further divided into smaller zones. After all criteria have been applied the minimum number of required thermal zones is defined.

For each service and for the successive criteria, it is verified if any of the service areas defined with the previous criteria shall be further divided into smaller areas. After all criteria have been applied the minimum number of required service areas is defined.

11 Calculation of the energy performance, routing and energy balance

11.1 General

Clause 11 is explicitly intended for calculated energy performance. However, elements of these procedures can be used in case of measured energy performance.

NOTE 1 For instance if hourly data are available (smart meters), and/or if PV is measured separately, etc.

The calculation direction goes from the needs to the source (e.g., from the building energy needs to the primary energy).

Electrical energy (for lighting, ventilation, auxiliary) and thermal energy (for heating, cooling, humidification, dehumidification, domestic hot water) are considered separately inside the assessment boundaries.

Cooling quantities shall be positive when heat is extracted from the space and/or system. In the drawings the real direction of heat shall be indicated.

NOTE 2 See ISO/TR 52000-2[6] for more explanation.

11.2 Overall calculation procedure (steps)

The overall calculation procedure consists of the following calculation steps:

a) Define for the building category or, if differentiated, for each space category, the internal conditions of use (temperature, humidity, occupancy, internal heat gains, time schedule thereof) according to the relevant clauses of standards relating to EPB module M1-6.

b) Define the external conditions (climatic data) according to the relevant clauses of standards relating to EPB module M1-13 (see 11.5).

c) Partition the building in zones, if needed. The zoning may be different for the thermal energy need calculation and for technical building systems. See Clause 10.

d) For each calculation interval, calculate the energy needs for heating, cooling and (de)humidification and domestic hot water. For each of the technical building systems related to the EPB services, calculate the energy use, including auxiliary energy, the contribution of renewable energy sources and the recoverable thermal losses (see 11.3). Take into account the impact of building automation and control (see 11.4).

e) Repeat the loop for the individual calculation interval if interactions between the different processes, including the effect of recoverable heat losses (see 11.3), are not taken into account by either simplification (e.g., correction factors within the sub-system) or by introducing (postponing) the interaction to the next calculation interval. The repetition can range from a single repetition to a full iteration.

NOTE In case the interaction is postponed to the next calculation interval, precautions are needed to avoid oscillating output at successive calculation intervals, which occurs in case of interactions or interventions with a strong impact. For instance if a window is opened to enhance free cooling. If this has a strong impact on the thermal balance, the cooling effect can be too large, resulting in immediate closing of the window the next hour (or even leading to heating needs), etc.

f) Calculate PV, wind, CHP and other electricity on-site production according to the relevant clauses of standards relating to EPB module M11-8.

g) Calculate delivered and exported energy components for each calculation interval according to 11.6.2.4.

h) For each calculation interval, weight delivered and exported energy as primary energy or any other indicator (see 9.6) according to 11.6, taking into account options such as inclusion or not of exported energy into the energy performance of the building.

i) Sum individual step results and get the energy performance for the calculation period according to 11.6 and 9.6.1.

j) Calculate the delivered or weighted energy per service or per part of a building according to Annex F.

k) Calculate partial performance indicators such as sub-system efficiencies, load factors, fractional contribution of thermal solar systems.

l) Provide a calculation report according to Clause 12.

11.3 Calculation principles of the recovered gains and losses

11.3.1 General

The interactions between the different energy services (such as heating, cooling, and lighting) are taken into account by the calculation of heat gains and recoverable system losses which can have a positive or negative impact on the energy performance of the building.

The starting points for each heating and/or cooling calculation are the building needs. The heat gains and specific recoverable thermal losses (solar heat gains, metabolic heat gains, etc.) that are included in the building needs are, for each building or space category, given in the relevant clauses of the standards relating to EPB module M1-6.

Two approaches are allowed for taking into account the other recoverable thermal losses (such as fan dissipation, pipe and duct heat or cold losses, dissipation of luminaires) which are not included in the building energy needs at the starting point: a detailed approach, described in 11.3.2, and a simplified approach, described in 11.3.3.

The choice may be different for different technical building (sub-)systems and shall be specified in Annex A of each relevant sub-system standard, with informative default choices in Annex B, e.g., as function of building or system type and location in the building.

NOTE Although the choices between detailed and simplified approach are made in different EPB standards, overall consistency in the choices for the whole EPB set of standards is important in order to have a balanced overall accuracy.

11.3.2 Detailed approach

In the detailed approach, the totality of the effects of the heat sink and sources in the building and the technical building systems that are recoverable for space conditioning, are considered in the calculation of the thermal energy needs.

The technical building thermal systems losses depend on the energy input (the energy need), which itself depends on the recovered system thermal losses. For the calculation, the losses can be recovered either instantly (within the same calculation interval) or with a delay (within the next calculation time interval). The overall calculation steps are described in 11.2.

The following procedure is followed to take into account recoverable heat losses in the following calculation interval:

a) Take the recoverable thermal system losses from the previous calculation interval and add them to other heat sources (e.g., solar and internal heat gains, recoverable thermal losses from lighting and/or other technical building systems like domestic hot water) in the calculation of the needs for heating and cooling;

b) Calculate the thermal energy needs for heating and cooling;

c) Perform a sub-system calculation according to M3–M7 series and determine the recoverable thermal system losses;

d) Store the recoverable thermal system losses for the next calculation interval.

NOTE 1 If the recoverable losses are large relative to needs, the 'next calculation interval calculation' can lead to instability of the calculation (oscillating output).

For both approaches the amount of recovered loss can be extracted from the calculation results as follows:

a) Do an annual calculation according to one of the two methods with the recoverable losses;

b) Do an annual calculation according to one of the two methods without the recoverable losses.

The difference between the two calculations in terms of required technical systems output are the recovered thermal system losses.

NOTE 2 The recovered thermal system losses can be negative, e.g., in case of heat losses leading to increased cooling needs simplified approach.

11.3.3 Simplified approach

In the simplified approach the recovered system heat losses, obtained by multiplying the recoverable thermal system losses by a recovery factor, are directly subtracted from the loss of each technical building (sub-)system considered. This avoids iterations.

The calculation procedure is the following:

— do the sub-system calculations according to the relevant standards under EPB modules M3 to M10 and determine the recoverable system thermal losses;

— calculate the recovered thermal system losses by multiplying the recoverable system thermal losses by a conventional recovery factor;

— subtract the recovered thermal system losses:

  — from the total thermal system losses if losses are recovered for the same building service;

  — from building needs if losses are recovered for a different building service (e.g., domestic hot water losses recovered for heating).

NOTE 1 Recovery factors could, e.g., be calculated according to the monthly heat balance factor from M2–2.

NOTE 2 For complex systems a detailed approach is preferable.

NOTE 3 Heat recovery in systems (e.g., preheating of the combustion air, or recovery from exhaust air) is treated in the relevant system standards under EPB modules M3 to M8.

11.4 Effect of building automation and control (BAC) and technical building management (TBM)

The contribution of BAC (including TBM) to the building energy performance is considered in the calculation procedure as the impact of all installed BAC functions on the building energy performance.

It deals with three characteristics:

— control accuracy (mainly used in (heat/cold) emission and control modules M3-5, M4-5, M5-5);

— BAC functions (mainly used in modules M3-5 until M3-9, M4-5 until M4-9, M5-5 until M5-9, M9-5, M9-9);

— BAC strategies (mainly used for M10-12).

The contribution of each BAC function is taken into account by one of the following five approaches: time approach; set-point approach; direct approach; operating mode approach; and correction coefficient approach.

NOTE The application of one of the first two approaches — the time approach or the set-point approach – leads, in general, to a modification of the time programs and set-points, both coming from the module which defines the user profile (M1–6 Building Occupancy and operating conditions). This modification is done in the calculation step a) of the overall calculation procedure (see 11.2). The application of the other three approaches — direct approach, operating mode approach and correction coefficient approach — affects mainly the calculation at the calculation intervals, i.e. the calculation step e). It may also require some pre-calculation in the calculation step a) until d).

Which approach is applied and how it is exactly done, is described in the standard which is devoted to the EPB module which treats the BAC function. For BAC functions which are treated in one of the standards for EPB modules M3-5 until M3-9, M4-5 until M4-9, M5-5 until M5-9, M9-5, M9-9, M10-5 until M10-9, all five approaches are possible, for BAC functions which are treated in M10-12 the first two approaches are generally applied.

11.5 Climatic and external environment data

Common standard climatic data shall be used in all the relevant EPB standards.

The time series of values shall be representative for the application (e.g., calculation of heating and cooling needs, lighting, solar collector, PV, wind power). As a consequence, these values may differentiate between design conditions (maximum load assessment) and typical conditions (energy assessment).

Common climatic data and pre-processing rules are given in the standard under EPB module M1-13.

NOTE Actual climatic and use data can also be used for tailored rating.

11.6 Overall energy performance

11.6.1 General

The overarching Formula (2) to calculate the energy performance of an assessed object is provided in 9.6.1.

In the following, the parameters needed for this calculation (weighted delivered and/or exported energy) are specified:

— for electricity and any other energy carriers with exportation, $E_{we;del;el;an}$ and $E_{we;exp;el;an}$ are calculated according to 11.6.2.

— for other carriers that are not exported, $E_{we;del;nexp;an}$ is calculated according to 11.6.3.

11.6.2 Electricity and other energy carriers with exportation

11.6.2.1 General energy balance calculation

The weighted energy balance takes into account separately the following parts of on-site produced electricity $E_{pr;el}$:

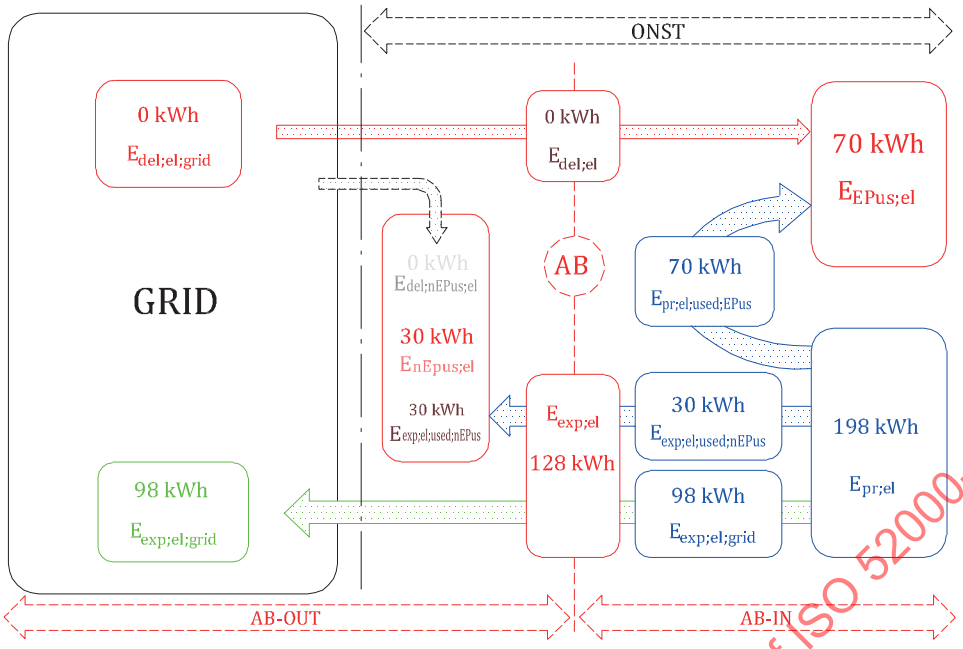
a) $E_{pr;el;used;EPus}$ that is used for EPB building services at the same calculation interval t;

b) $E_{exp;el;used;nEPus}$ that is exported and used for non-EPB building services at the same calculation interval t;

c) $E_{exp;el;grid}$ that is exported and will never be used for building services (only exported).

NOTE 1 $E_{exp;el;used;nEPus}$ is taken into account only if on-site electric energy use for non-EPB uses has been defined and included in the calculation (e.g., only if $E_{nEPus;el}$ is defined and ≠ 0, which is an option).

The reference diagram of the electric energy balance is shown in Figure 7.



Key

AB	assessment boundary
AB-IN	inside the assessment boundary
AB-OUT	outside the assessment boundary
GRID	grid
Epr,el,t	electricity produced on-site and inside the assessment boundary in the calculation interval *t*
EEPus,el,t	electricity used by technical systems for EPB services in the calculation interval *t*
EnEPus,el,t	electricity used in the building for non EPB services in the calculation interval *t*
Epr,el,used,EPus,t	part of produced electricity Epr,el,t used by technical systems for EPB services in the calculation interval *t*; its value is the minimum of Epr,el,t and EEPus,el,t
Eexp,el,t	part of the produced electricity Epr,el,t in excess of that used by technical systems for EPB services in the calculation interval *t*; Eexp,el,t exits the assessment boundary during the calculation interval *t*
Eexp,el,used,nEPus,t	part of the exported electricity Eexp,el,t that is used for non-EPB services in the building in the calculation interval *t*
Edel,el,t	energy delivered by the grid during calculation interval *t*
Eexp,el,grid,t	electric energy that is exported to the grid
Edel,el,grid,t	energy delivered by the grid during calculation interval *t*

Figure 7 — Reference diagram for the energy balance

NOTE 2 For simplicity, the delivered energy needed to generate $E_{pr;el}$ is not shown in Figure 7. The contribution to the energy performance of the generation of $E_{pr;el;t}$ is taken into account in the calculation about the energy carrier used to generate $E_{pr;el;t}$ (solar radiation, fuel to cogenerator, etc.) which is done in 11.6.3.

NOTE 3 The simultaneity of $E_{pr;el}$ and $E_{EPus;el}$ is better captured with hourly calculation intervals. For monthly intervals it does not take into account the difference, e.g., between production during the day and use of electricity during the night. The matching factor has been introduced in item d) of 11.6.2.4 [see Formulae (31) and (32)] to correct this difference according to the duration of the calculation interval.

The contribution to the annual weighted energy performance of delivered electricity $E_{we;del;el;an}$ is given by Formula (19):

$$E_{we;del;el;an} = \sum_{t} E_{del;el,t} \cdot f_{we;del;el;t} \quad (19)$$

where:

$E_{del;el;t}$ is the delivered electric energy in each calculation interval t, calculated according to the procedure given in step h) of 11.6.2.4;

$f_{we;del;el;t}$ is the time dependent weighting factor of delivered electricity, given in 9.6.2 to 9.6.5.

The contribution of exported electricity to the annual weighted energy performance $E_{we;exp;el;an}$ is given by Formula (20):

$$E_{we;exp;el;an} = E_{we;exp;el;an;A} + k_{exp} \cdot \sum_{i} E_{we;exp;el;an;AB} \quad (20)$$

where:

$E_{we;exp;el;an;A}$ is the weighted exported electricity calculated using factors that reflect the resources used to generate the exported electricity, calculated according to 11.6.2.2, including only the types of sources that are accepted according to the template in Table A.30, with informative default choices given in Table B.30;

$E_{we;exp;el;an;AB}$ is the difference between the weighted exported energy calculated using factors that reflect the avoided resources off-site the building and the weighted exported energy using factors that reflect the resources used to generate the exported energy, calculated according to 11.6.2.3;

k_{exp} is a factor that is used to control which part of the exported energy is included in the energy performance of the building. See Table A.17; the informative default value is given in Table B.17.

NOTE 4 if k_{exp} is set equal to 0, the exported energy (neither the resources for production, nor the avoided resources in the grid) is not included in the energy performance of the building (see ISO/TR 52000-2[6] for an illustration of this).

NOTE 5 Nearby and/or nearby and distant energy sources are included or not included, depending on choices made in 9.6.1. The index y (onst, nrby, dist) has been omitted from the formulae here.

The electricity available for use outside the building $E_{exp;el;avl;an}$ that has not been taken into account in the energy performance of the building is given by Formula (21):

$$E_{exp;el;avl;an} = E_{exp;el;an;A} \cdot \left(1 - k_{exp}\right) \quad (21)$$

The weighted energy resources (renewable and/or non-renewable) that have been used to make this electricity available for use outside the building $E_{we;exp;el;avl;an}$ (and which have not been taken into account in the energy performance of the building) is given by Formula (22):

$$E_{we;exp;el;avl;an} = E_{we;exp;el;an;A} \cdot \left(1 - k_{exp}\right) \quad (22)$$

This part of the exported weighted energy is not part of the energy performance of the building and can be reported as available outside the building. But because the resources used to produce this exported electricity may contain a non-renewable weighted energy part, these used resources (renewable and/or non-renewable) shall be reported as well.

11.6.2.2 Weighted exported energy using factors that reflect exported energy generation (Step "A")

The weighted exported energy $E_{we;exp;el;an;A}$ calculated using factors that reflect resources used to generate the exported energy is given by Formula (23):

$$E_{we;exp;el;an;A} = E_{we;exp;el;used;nEPus;an;A} + E_{we;exp;el;grid;an;A} \quad (23)$$

The contribution to the annual weighted exported energy of electricity that is used for non EPB building services in the building $E_{we,exp,el,used,nEPus,an;A}$ is given by Formula (24):

$$E_{we;exp;el;used;nEPus;an;A} = \sum_t E_{exp;el;used;nEPus;t} \cdot f_{we;exp;el;stepA;t} \quad (24)$$

where:

$E_{exp;el;used;nEPus;t}$ is the electricity that is used for non EPB uses in the building services in each calculation interval t;

$f_{we;exp;el;stepA;t}$ is the time dependent weighting factor for exported electricity related to the resources used to generate it, defined in 9.6.6.2.

The contribution to the annual weighted exported energy of the grid exported electric energy Ewe,exp,el,grid,an is given by Formula (25):

$$E_{we;exp;el;grid;an;A} = \sum_t E_{exp;el;grid;t} \cdot f_{we;exp;el;stepA;t} \quad (25)$$

where:

$E_{exp;el;grid;t}$ is the grid exported electricity in each calculation interval t, calculated according to the procedure given in 11.6.2.4.

NOTE These contributions to the weighted energy performance of the exported energy components are equal to the delivered energy used to generate them. Therefore they cancel the corresponding part of the weighted delivered energy and the resulting energy performance does not include the effect of exported energy.

11.6.2.3 Effect of exported energy on weighted energy performance ("Step B"),

The effect on the energy performance of the difference between the resources used to produce the exported electricity and the avoided resources due to the exported energy, $E_{we;exp:el;an;AB}$, is given by Formula (26):

$$E_{we;exp;el;an;AB} = E_{we;exp;el;used;nEPus;an;AB} + E_{we;exp;el;grid;an;AB} \quad (26)$$

The contribution of electricity that is used for non-EPB building services in the building $E_{we,exp,el,used,nEPus;an;AB}$ is given by Formula (27):

$$E_{we;exp;el;used;nEPus;an;AB} = \sum_t \left(E_{exp;el;used;nEPus,t} \cdot \left(f_{we;exp;el;used;nEPus,t} - f_{we;exp;el;stepA,t} \right) \right) \quad (27)$$

where:

$f_{we;exp;el;used;nEPus,t}$ is the time dependent weighting factor for exported electricity for non-EPB uses in the building.

The contribution of the grid exported electric energy $E_{we;exp;el;grid;an;AB}$ is given by Formula (28):

$$E_{we;exp;el;grid;an;AB} = \sum_t \left(E_{exp;el;grid,t} \cdot \left(f_{we;exp;el;grid,t} - f_{we;exp;el;stepA,t} \right) \right) \quad (28)$$

where:

$f_{we;exp;el;grid;t}$ is the time dependent weighting factor of grid exported electricity.

11.6.2.4 Calculation procedure of delivered and exported electric energy components

The delivered and exported electricity and their components are calculated according to the following procedure:

a) For each calculation interval t, calculate electricity uses for the considered EPB building services $E_{EPus;el;t}$ (e.g., sum of all generation inputs and auxiliary electricity uses) according to Formula (29):

$$E_{EPus;el;t} = \sum_{X,i} E_{X:gen,i;in;el;t} + \sum_{X,Y} W_{X,Y;aux;t} \quad (29)$$

where:

$E_{X,gen,i,in,el,t}$ is the electricity input to the generator i for building service X (or combination of services) during calculation interval t;

$W_{X;Y;aux;t}$ is the auxiliary electricity input to sub-system Y for building service X (or combination of services) during calculation interval t.

It can be decided nationally that some of the electrical uses may not be satisfied by some types of on-site energy production (for economic reasons, not to give an advantage to auto consumption, etc.).

The electrical uses that cannot be satisfied by defined on-site energy production are specified with a table according to the template given in Table A.31. A default table is given in Table B.31.

The electrical uses that cannot to be satisfied by on-site electricity production are withdrawn from the electricity uses to calculate the exported energy and are covered by delivered electricity.

NOTE 1 The possibility to limit the exported energy (e.g., by k_{exp}) is still given.

b) For each calculation interval t, calculate electricity uses for non-EPB building services $E_{nEPus,el,t}$ during the calculation interval t according to the relevant standards.

c) For each calculation interval t, calculate on-site electric energy production Epr,el,t according to Formula (30):

$$E_{pr;el;t} = \sum_j E_{pr:el,j;t} \quad (30)$$

where:

Epr;el,j;t is the on-site electric energy produced by sub-system j (e.g., combined heat and power, photovoltaic or wind power) during the calculation interval.

d) For each calculation interval t, calculate the produced electricity used for EPB building services within the same calculation interval Epr,el,used,EPus,t with Formula (31):

$$E_{pr;el;used;EPus;t} = f_{match;t} \cdot \min\left(E_{EPus;el;t} ; E_{pr;el;t} \right) \quad (31)$$

where:

$f_{match,t}$ is a statistical reduction factor that takes into account the time mismatch between production and use of electricity.

For an hourly calculation interval it is assumed that $f_{match} = 1$.

For other time-steps, f_{match} is given by Formula (32):

$$f_{match,t} = f\left(\frac{E_{pr;el;t}}{E_{EPus;el;t}}\right) \quad (32)$$

This function depends on the duration of the calculation interval and takes into account the type and use of the building. It shall be specified according to the format given in Table A.32. A default table is given in Table B.32.

e) For each calculation interval t, calculate the exported electric energy $E_{exp,el,t}$ with Formula (33):

$$E_{exp;el;t} = E_{pr;el;t} - E_{pr;el;used;EPus;t} \quad (33)$$

f) For each calculation interval t, calculate exported electric energy used for non-EPB uses in the building $E_{exp;el;used;nEPus;t}$ with Formula (34):

$$E_{exp;el;used;nEPus;t} = \min\left(E_{nEPus;el;t}; E_{exp;el;t}\right) \quad (34)$$

where:

$E_{nEPus;el;t}$ is the electric energy used in the building for non-EPB uses.

NOTE 2 Non-EPB uses are not considered in the energy performance if they are set to 0 ($E_{nEPus;el;t} = 0$).

g) For each calculation interval t, calculate the energy exported to the grid $E_{exp;el;grid;t}$ during the calculation interval t with Formula (35):

$$E_{exp;el;grid;t} = E_{exp;el;t} - E_{exp;el;used;nEPus;t} \quad (35)$$

Calculate the annual exported electricity to the grid $E_{exp;el;grid;an}$ with Formula (36):

$$E_{exp;el;grid;an} = \sum_t E_{exp;el;grid;t} \quad (36)$$

h) For each calculation interval t, calculate the delivered electric energy Edel;el;t with Formula (37):

$$E_{del;el;t} = E_{EPus;el;t} - E_{pr;el;used;EPus;t} \quad (37)$$

Calculate annual delivered electricity for EPB services $E_{del;el;an}$, according to Formula (38):

$$E_{del;el;an} = \sum_t E_{del;el,t} \quad (38)$$

11.6.3 Energy carriers without exportation

The annual weighted delivered energy, $E_{we;del;nexp;an}$ for all energy carriers cr,i without energy export is calculated as per Formula (39):

$$E_{we;del;nexp;an} = \sum_t \left(\sum_j \left(E_{del;cr,j,t} \cdot f_{we;del;cr,j,t} \right) \right) \quad (39)$$

where:

$f_{we;del;cr,j,t}$ is the (time dependent) weighting factor for the delivered energy carrier *cr,j*;

$E_{del;cr,j,t}$ is the amount of the delivered energy carrier *cr,j* during calculation time-step *t*.

The amount of the delivered energy carrier *cr,j* during calculation time-step *t* $E_{del;cr,j,t}$ is given by Formula (40):

$$E_{del;cr,j,t} = \sum_{X,i} \left(E_{X;gen,i;in;cr,j;t} \right) \quad (40)$$

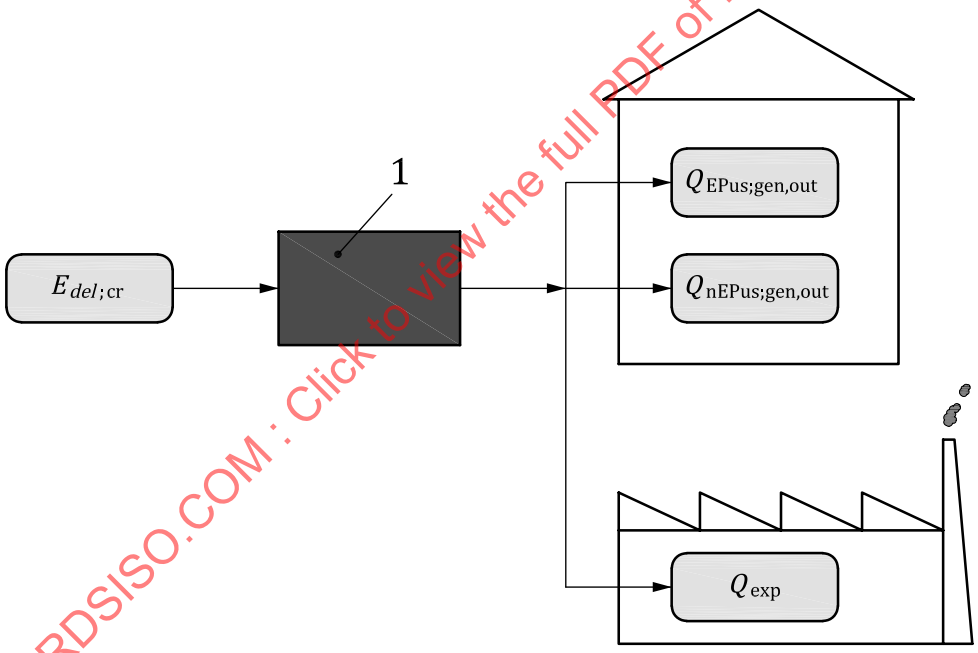
where:

$E_{X;gen,i;in;cr,j;t}$ is the energy carrier *cr,j* input of to any generator *i* for any service *X*.

If a non-electric energy carrier is also exported, then the formulae in 11.6.2 shall be used.

11.6.4 Exported heat produced on-site and not included in thermal use of the building

The effect of non-EPB thermal use or of thermal energy export is excluded from the energy performance calculation (see Figure 8) with the following procedure.



Key

1 generator

Figure 8 — Reference diagram for thermal energy export

For each energy carrier or input to the generator (or the set of generators) $E_{del;cr,i}$, in (kW h), generating heat for other uses than considered building services:

— Calculate the generator(s) input $E_{del;cr}$ taking into account all loads $Q_{EPus;gen;out}$ and $Q_{nEPus;gen;out}$ and Q_{exp}, where:

$Q_{EPus;gen;out}$ is the heat generated for the considered on-site EPB building services;

$Q_{nEPus;gen;out}$ is the heat generated for other on-site uses than the considered EPB building services;

Q_{exp} is the heat exported.

EXAMPLE On-site, non-EPB use: swimming pool heating with the same generator as for heating.

— Calculate the share of each energy carrier $E_{del;cr,i;H}$, in (kW h), to be taken into account in the EPB calculation with Formula (41):

$$E_{del;cr,i;EP} = E_{del;cr,i} \cdot \frac{Q_{EPus;gen;out} + Q_{nEPus;gen;out}}{Q_{EPus;gen;out} + Q_{nEPus;gen;out} + Q_{exp}} \quad (41)$$

If a common on-site generation device produces electricity (or other energy carrier like biogas), the allocation to the on-site energy using technical system shall be done:

— according to the criteria to be specified according to the template in Annex A, with default choices given in Annex B:

  — electricity use;

  — serviced area;

  — other criteria;

— with a priority to be specified according to the template in Annex A, with default choices given in Annex B:

  — first calculate global site grid interaction, then allocate on-site produce and used electricity (or other carrier);

  — first allocate on-site produce and used electricity (or other carrier) then calculate grid interaction of the individual technical system.

NOTE See Annex G for an informative calculation procedure.

12 Common overarching output

12.1 General

Clause 12 defines the content of a report on assessment of energy use of an assessed object according to this document. The content of a certificate is defined in M1-4.

NOTE 1 Information on nearly Zero-Energy Building (NZEB) is given in Annex H.

NOTE 2 Clause 12 defines the contents of a calculation report for the purpose of understanding the calculation performed. This is no requirement to any report for an EPC or an application for a building permit.

The executive summary of the calculation report shall include the following information:

— reference to this document (ISO 52000-1:2017);

— purpose of the energy performance assessment;

— description of the building and its location, its activities, equipment and occupancy;

— type of energy performance assessment.

At least the following information shall be included:

NOTE 3 More reporting depends on national requirements and other documents at the national level.

Climate parameters used for the calculated energy performance or as known – average external temperature, solar irradiance, etc. for the measured energy performance.

Input values for the calculated energy performance:

— content of the report according to the relevant EPB standards;

— assumptions used to compute the energy use for domestic hot water and lighting.

Output values from the calculated energy performance:

— energy use for heating, cooling, ventilation, domestic hot water and lighting, together with their confidence intervals (when available);

— monthly energy need for heating and for cooling, mean monthly indoor and outdoor temperatures and global solar radiation on a horizontal plane, transmission and ventilation heat transfer and solar and internal gains.

NOTE 4 A bar diagram showing these main terms of the monthly energy balance is helpful to obtain a quick impression of the relative influence of each of these main factors.

In case of hourly calculations: hourly delivered energy for each energy carrier as a function of outdoor temperature.

NOTE 5 A plot of, e.g., weekly averaged delivered energy against outdoor temperature is helpful to obtain a quick impression of the important influential factors and to enable quick comparison with similar plots that are frequently used in real buildings as indication on the energy quality. See ISO/TR 52000-2,[6] also for more examples to obtain insight in the relative impact of the various elements in the energy performance.

Measured energy performance, for each energy carrier:

— assessment time period;

— method used to assess the energy use;

— amount used, in units used when assessing it (e.g., litres, cubic meters, kilograms, (kW h));

— methods used for extrapolation and weather correction, if any;

— the delivered and exported energy of each energy carrier in (kW h) or multiples of them, together with their confidence intervals (when available).

Validated energy performance:

— report on the measured energy performance with confidence intervals;

— assumptions used to fit the tailored energy performance to the measured energy performance;

— result of the calculated energy performance including confidence intervals;

— if required, validated standard calculated energy performance including confidence intervals.

12.2 Tabulated overview of the amounts of energy per energy carrier and energy service

Table 11 gives an overview of the overall energy performance and the composition per energy carrier and energy service. It shows all the possible output, but that does not mean that all these should be relevant and available for any specific building (e.g., a building can be without any cooling system). But if the output is available, this is the structure for it.

Also included in the table is the energy needs for heating and cooling, plus the renewable energy produced on-site.

The table shall be completed in case of calculated energy performance. In case of measured energy performance only the available information shall be reported.

To obtain the values, if relevant, values have to be summed over calculation or measurement zones and systems.

NOTE See worked example in ISO/TR 52000-2[6].

The report may include tables with complementary indicators such as:

— contributions of active thermal solar, free heating, free cooling and other special techniques to the energy performance of the building;

— on-site renewable energy production;

— contribution of nearby and distant renewable energy.

Table 12 gives the detailed evaluation of the exported energy, according to the choice of the parameter k_{exp}.

Table 13 gives the detailed composition of the RER depending on the choices on renewable energy accounting. It can be used to show which components of renewable energy were taken into account in determining the RER.

Table 11 — Overview of the total energy performance and the composition per energy carrier and building service

Service	Energy-need (building level) (kW h/an)	Generation output (building level) (kW h/an)	Energy use per energy carrier (kW h/an)		Weighted energy performance (Unit [a]/an)					
			Carrier		Step A			Final result		
			name	Amount	$E_{we,1;A}$ [c]	... [c]	$E_{we,i;A}$ [c]	$E_{we,1}$ [c]	... [c]	$E_{we,i}$ [c]
Heating	$Q_{H;nd}$	$Q_{H;gen;out}$ or $Q_{H;ngen;in}$	Electricity [d]	$E_{H;el}$	$E_{we,1;H;el;A}$		$E_{we,i;H;el;A}$	$E_{we,1;H;el}$		$E_{we,i;H;el}$
			Carrier *j* [b]	$E_{H;cr,i}$	$E_{we,1;H;cr,j;A}$		$E_{we,i;H;cr,j;A}$	$E_{we,1;H;cr,j}$		$E_{we,i;H;cr,j}$
			Total		$E_{we,1;H;A}$		$E_{we,i;H;A}$	$E_{we,1;H}$		$E_{we,i;H}$
Cooling	$Q_{C;nd}$	$Q_{C;gen;out}$ or $Q_{C;ngen;in}$	Electricity [d]	$E_{C;el}$	$E_{we,1;C;el;A}$		$E_{we,i;C;el;A}$	$E_{we,1;C;el}$		$E_{we,i;C;el}$
			Carrier *j* [b]	$E_{C;cr,i}$	$E_{we,1;C;cr,j;A}$		$E_{we,i;C;cr,j;A}$	$E_{we,1;C;cr,j}$		$E_{we,i;C;cr,j}$
			total		$E_{we,1;C;A}$		$E_{we,i;C;A}$	$E_{we,1;C}$		$E_{we,i;C}$
Ventilation			Electricity [d]	$E_{V;el}$	$E_{we,1;V;el;A}$		$E_{we,i;V;el;A}$	$E_{we,1;V}$		$E_{we,i;V}$
Humidification	$Q_{HUM;nd}$		Electricity [d]	$E_{HUM;el}$	$E_{we,1;HUM;el;A}$		$E_{we,i;HUM;el;A}$	$E_{we,1;HUM;el}$		$E_{we,i;HUM;el}$
			Carrier *j* [b]	$E_{HUM;cr,i}$	$E_{we,1;HUM;cr,j;A}$		$E_{we,i;HUM;cr,j;A}$	$E_{we,1;HUM;cr,j}$		$E_{we,i;HUM;cr,j}$
			Total		$E_{we,1;HUM;A}$		$E_{we,i;HUM;A}$	$E_{we,1;HUM}$		$E_{we,i;HUM}$
Dehumidification	$Q_{DHU;nd}$			[f]	[f]	[f]	[f]	[f]	[f]	[f]
Domestic hot water	$Q_{W;nd}$	$Q_{W;gen;out}$ or $Q_{W;ngen;in}$	Electricity [d]	$E_{W;el}$	$E_{we,1;W;el;A}$		$E_{we,i;W;el;A}$	$E_{we,1;W;el}$		$E_{we,i;W;el}$
			Carrier *j* [b]	$E_{W;cr,i}$	$E_{we,1;W;cr,j;A}$		$E_{we,i;W;cr,j;A}$	$E_{we,1;W;cr,j}$		$E_{we,i;W;cr,j}$
			Total		$E_{we,1;W;A}$		$E_{we,i;W;A}$	$E_{we,1;W}$		$E_{we,i;W}$
Lighting			Electricity [d]	$E_{L;el}$	$E_{we,1;L;A}$		$E_{we,i;L;A}$	$E_{we,1;L}$		$E_{we,i;L}$

[a] The unit for the weighted energy; for instance kW h for primary energy, see 9.6.

[b] Whichever energy carriers present.

[c] Number of columns depending on the selected weighting(s).

In case of primary energy, three columns shall be given: Pnren, Pren and Ptot.

[d] Including auxiliary energy, $W_{X;aux}$.

[e] (Void)

[f] Included in cooling and heating (C).

[g] Energy exported.

[h] Resources attributed to the exported energy (weighted sum over different energy carriers if relevant).

Table 11 *(continued)*

Service	Energy-need (building level) (kW h/an)	Generation output (building level) (kW h/an)	Energy use per energy carrier (kW h/an)		Weighted energy performance (Unit [a]/an)					
			Carrier		Step A			Final result		
			name	Amount	$E_{we,1;A}$ [c]	... [c]	$E_{we,i;A}$ [c]	$E_{we,1}$ [c]	... [c]	$E_{we,i}$ [c]
Others			Electricity [d]	$E_{O;el}$	$E_{we,1;O;el;A}$		$E_{we,i;O;el;A}$	$E_{we,1;O;el}$		$E_{we,i;O;el}$
			Carrier *j* [b]	$E_{O;cr,i}$	$E_{we,1;O;cr,j;A}$		$E_{we,i;O;cr,j;A}$	$E_{we,1;O;cr,j}$		$E_{we,i;O;cr,j}$
			Total		$E_{we,1;O;A}$		$E_{we,i;O;A}$	$E_{we,1;O}$		$E_{we,i;O}$
Total					$E_{we,1;A}$		$E_{we,i;A}$			
				g	h	h	h	h	h	h
Exported energy			Electricity	$E_{exp;el}$	$E_{we,1;exp;el;A}$		$E_{we,i;exp;el;A}$	$E_{we,1;exp;el}$		$E_{we,i;exp;el}$
			Carrier *k*	$E_{exp;cr,k}$	$E_{we,1;exp;cr,k;A}$		$E_{we,i;exp;cr,k;A}$	$E_{we,1;exp;cr,k}$		$E_{we,i;exp;cr,k}$
Total								$E_{we,1}$		$E_{we,i}$

[a] The unit for the weighted energy; for instance kW h for primary energy, see 9.6.

[b] Whichever energy carriers present.

[c] Number of columns depending on the selected weighting(s).

In case of primary energy, three columns shall be given: Pnren, Pren and Ptot.

[d] Including auxiliary energy, $W_{X;aux}$.

[e] (Void)

[f] Included in cooling and heating (C).

[g] Energy exported.

[h] Resources attributed to the exported energy (weighted sum over different energy carriers if relevant).

The same table can be completed with each value divided by the value of Ewe in order to obtain a quantitative overview of the relative impact of the individual elements.

Table 12 — Overview of the total energy performance and the overall energy balance per energy carrier

Overall energy balance	**Delivered weighted energy (Unit [a]/an)**			**Weighted energy resources attributed to exported energy (Unit [a]/an)**		**Exported energy, not valorised in the energy performance (Unit [a]/an)**	
	Electricity	**Other energy carriers *cr,i* (summed)**	**Total**	**Attributed to exported electricity**	**Attributed to exported thermal energy**	**Electricity**	**Thermal energy**
Step A, with exported energy not valorised	$E_{we;del;el}$	$\Sigma_{cr,i}(E_{we;del;cr,i})$	$E_{we;del;A}$	$E_{we;exp;el;A}$	$E_{we;exp;T;A}$	$E_{exp;el;A}$	$E_{exp;T;A}$
k_{exp}	k_{exp}	← Fraction of exported energy valorised in the energy performance					
	Weighted energy performance (Unit [a]/an)			**Weighted energy resources attributed to exported energy (Unit [a]/an)**		**Exported energy (kW h/an)**	
	Electricity	**Other energy carriers *cr,i* (summed)**	**Total**	**Attributed to exported electricity**	**Attrib. to exported thermal energy**	**Electricity**	**Thermal energy**
Exported energy valorised in the energy performance (k_{exp})				$E_{we;exp;el;AB}$	$E_{we;exp;T;AB}$	$E_{exp;el;AB}$	$E_{exp;T;AB}$
Step A+B: with exported energy valorised	$E_{we;el}$	$\Sigma_{cr,i}(E_{we;cr,i})$	$E_{\mathbf{we}}$				
				Weighted energy resources attributed to exported energy (Unit [a]/an)		**Exported energy (kW h/an)**	
Exported energy available (not valorised in the energy performance), (1 - k_{exp})				$E_{we;exp;el;avl}$	$E_{we;exp;T;avl}$	$E_{exp;el;avl}$	$E_{exp;T;avl}$

[a] The unit for the weighted energy; for instance kW h for primary energy, see 9.6.

Table 13 — Renewable energy ratio

Energy balance terms	Included	Value (kWh/an)
$E_{Pren,onst}$		
$E_{Pren,nrby}$		
$E_{Pren,dist}$		
$E_{Pren,RER}$		
E_{Ptot}		
RER		
NOTE See 9.7 and Tables A.24 and B.24 for information on the energy sources that are or are not taken into account.		

Annex A
(normative)

Input and method selection data sheet — Template

A.1 General

The template in Annex A of this document shall be used to specify the choices between methods, the required input data and references to other documents.

NOTE 1 Following this template is not enough to guarantee consistency of data.

NOTE 2 Informative default choices are provided in Annex B. Alternative values and choices can be imposed by national/regional regulations. If the default values and choices of Annex B are not adopted because of the national/regional regulations, policies or national traditions, it is expected that:

— national or regional authorities prepare data sheets containing the national or regional values and choices, in line with the template in Annex A; or

— by default, the national standards body will add or include a national annex (Annex NA) to this document, in line with the template in Annex A, giving national or regional values and choices in accordance with their legal documents.

NOTE 3 The template in Annex A is applicable to different applications (e.g., the design of a new building, certification of a new building, renovation of an existing building and certification of an existing building) and for different types of buildings (e.g., small or simple buildings and large or complex buildings). A distinction in values and choices for different applications or building types could be made:

— by adding columns or rows (one for each application), if the template allows;

— by including more than one version of a table (one for each application), numbered consecutively as a, b, c, … For example: Table NA.3a, Table NA.3b;

— by developing different national/regional data sheets for the same standard. In case of a national annex to the standard these will be consecutively numbered (Annex NA, Annex NB, Annex NC, …).

NOTE 4 In the section "Introduction" of a national/regional data sheet information can be added, for example about the applicable national/regional regulations.

NOTE 5 For certain input values to be acquired by the user, a data sheet following the template of Annex A, could contain a reference to national procedures for assessing the needed input data. For instance, reference to a national assessment protocol comprising decision trees, tables and pre-calculations.

The shaded fields in the tables are part of the template and consequently not open for input.

A.2 References

The references, identified by the module code number, are given in a table complying with the format given in Table A.1 (a template).

Table A.1 — References (See Clause 2)

Reference	Reference document	
	Number	Title
M1–2		
M1–3		
M1–4		
M1–5, M1–7		
M1–8, M1–9		
M1–10		
M1–6, M2–7		
M1–11		
M1–13		
M1–14		
M2–2		
M2–3		
M2–4		
M2–5		
M2–6		
M2–7		
M2–8		
M3–1		
M3–2		
M3–3		
M3–4		
M3–5		
M3–6		
M3–7		
M3–8		
M3–9		
M3–10		
M3–11		
M3–12		
M4–1		
M4–2		
M4–3		
M4–4		
M4–5		
M4–6		
M4–7		
M4–8		
M4–9		
M4–10		
M4–11		
M4–12		
M5–1		
M5–2		

Table A.1 *(continued)*

Reference	Reference document	
	Number	Title
M5–3		
M5–4		
M5–5		
M5–6		
M5–7		
M5–8		
M5–9		
M5–10		
M5–11		
M6–1		
M6–2		
M6–3		
M6–4		
M6–5		
M6–6		
M6–7		
M6–8		
M6–9		
M6–10		
M6–11		
M7–1		
M7–2		
M7–3		
M7–4		
M7–5		
M7–6		
M7–7		
M7–8		
M7–9		
M7–10		
M7–11		
M8–1		
M8–2		
M8–3		
M8–4		
M8–5		
M8–6		
M8–7		
M8–8		
M8–9		
M8–10		
M8–11		
M9–1		

Table A.1 *(continued)*

Reference	Reference document	
	Number	Title
M9–2		
M9–3		
M9–4		
M9–5		
M9–6		
M9–8		
M9–10		
M9–11		
M10–1		
M10–2		
M10–3		
M10–4		
M10–5		
M10–6		
M10–7		
M10–8		
M10–11		
M10–12		
M11–1		
M11–4		
M11–8		

A.3 Overarching preparation steps

Table A.2 — Energy performance assessment types according to building category and application (See 5.3)

Application	Building category	Assessment type	Conditions
			-
NOTE Add rows in case of more assessment purposes.			

Table A.3 — Object types (See Clause 6 and 10.1)

EPB_OBJECT_TYPE			
Type [a]	Description	Subset [b]	Comments
< unique identifier in capitals >	*One row per type*		
NOTE The type of object may have an effect on the choices in this overarching document and in the other EPB standards. This property is therefore inherited by the other EPB standards, where relevant.			
[a] One choice is possible per subset.			
[b] Definition of the calculation case, one selection shall be done for each subset.			

Table A.4 — Building categories (See Clauses 6 and 9)

BLDNGCAT_TYPE		
Type	**Description**	**Comments**
< unique identifier in capitals >	*One row per type*	
NOTE The building category may have an effect on the choices in this overarching document and in the other EPB standards. This property is therefore inherited by the other EPB standards, where relevant.		

Table A.5 — Which building categories are included in EPB assessment (See 6.2.2)

Building categories (see Table A.3)	Identifier	Included in EPB assessment[a] Yes/No
[a] Building category for which this document applies, e.g., because there is an EPB requirement for this building category.		

Table A.6 — Differentiation of space categories (See Clauses 6, 9 and 10.1)

Choice		
Type	**Choice**	**Comments**
Differentiation of space categories in a building	Yes/No	

In case of differentiation Table A.7 has to be completed. Otherwise the list of space categories is equal to the list of building categories: (SPACECAT_X = BLDNGCAT_X).

Table A.7 — Space categories (See Clauses 6 and 9)

SPACECAT_TYPE		
Type	**Description**	**Comments**
< unique identifier in capitals >	*One row per type*	
NOTE 1 Each space category requires a set of conditions of use (temperature settings, ventilation, and lighting requirements, domestic hot water needs, etc.). NOTE 2 The space category may have an effect on the choices in this overarching document and in the other EPB standards. This property is therefore inherited by the other EPB standards, where relevant.		

Table A.8 — Application types (See Clauses 6 and 9)

EPB_APPLIC_TYPE		
Type	**Description**	**Comments**
< unique identifier in capitals >	*One row per type*	
NOTE The type of application may have an effect on the choices in this overarching document and in the other EPB standards. This property is therefore inherited by the other EPB standards, where relevant.		

Table A.9 — EPB assessment types (See Clauses 6 and 9)

EPB_ASSESS_TYPE (see Table 3)		
Type	**Description**	**Comments**
< unique identifier in capitals >	*One row per type*	
NOTE 1 The type may be different for different object types, building or space categories. NOTE 2 The type of assessment may have an effect on the choices in this overarching document and in the other EPB standards. This property is therefore inherited by the other EPB standards, where relevant.		

Table A.10 — Combination of services types (See Clauses 6 and 9)

EPB_LISTSERVICES_TYPE		
Type	**Description**	**Comments**
< unique identifier in capitals >	*One row per type*	
NOTE 1 The combination may be different for different building or space categories. NOTE 2 The type of service mix may have an effect on the choices in this overarching document and in the other EPB standards. This property is therefore inherited by the other EPB standards, where relevant.		

A.4 Method

Table A.11 — Electricity use types (See 7.3.3.4.)

Electric energy use type	Identifier
Electricity use description	*identifier for that use*

Table A.12 — Electricity generation types (See 7.3.3.6 and 9.6.6.2.4)

Electric energy generation type	Identifier
Electricity generation description	*identifier for that type*

Table A.13 — Gross calorific value of some common solid fuels (See 7.3.4 and 9.6.2)

Fuel	Gross calorific value kWh/kg
a	
a Add the rows of the energy carriers.	

Table A.14 — Gross calorific value of some common liquid fuels (See 7.3.4 and 9.6.2)

Fuel	Density kg/l	Gross calorific value kWh/kg
a		

a Add the rows of the energy carriers.

Table A.15 — Gross calorific values of some gaseous energy carriers (See 7.3.4 and 9.6.2)

Fuel	Density kg/m³	Gross calorific value kWh/m³
a		

a Add the rows of the energy carriers.

Table A.16 — Weighting factors (based on gross or net calorific value) (See 7.3.5, 9.5.1, 9.6.2, 9.6.5 and 9.6.6.3)

Energy carrier	f_{Pnren}	f_{Pren}	f_{Ptot}	a
Delivered from distant				
a b				
Delivered from nearby				
Delivered from on-site				
Exported				

a Add a column in case of other requirements, e.g., CO_2 requirement.

b Add the rows of the energy carriers.

Table A.17 — k_{exp}-factor (See 7.3.5 and 11.6.2.1)

Description	Value
k_{exp} factor that is used to control which part of the exported energy is included in the energy performance of the building	0...1

Table A.18 — Building services considered in the energy performance calculation (See 8.2 and 8.5)

Combination of services type	**Choice: included in the energy performance calculation** < ***one column per listservices type, see Table A.10*** >	
Building service [a]	***EPB***_LISTSERVICES_***RES***	***EPB***_LISTSERVICES_***NRES***
Heating	Yes/No	
Cooling	Yes/No	
Ventilation	Yes/No	
Humidification	Yes/No	
Dehumidification	Yes/No	
Domestic hot water	Yes/No	
Lighting	Yes/No	
External lighting	Yes/No	
People transport (e.g., elevators, escalators)	Yes/No	
Other services consuming electricity (e.g., appliances)	Yes/No	
Others (please specify)	Yes/No	
[a] Add rows or edit the lines in case of other/more differentiated services.		

Table A.19 — Principle assumed presence of systems (See 9.2)

Method		**Choice Yes/No** [a]
1	Principle "Assumed system"	YES or NO
2	Principle "Presence of system"	YES or NO
3	Other principle	YES or NO
In case of method 3:		
	Reference to procedure:	< reference >
[a] Only one choice possible; choice may be differentiated per service. NOTE Consistency with the conditions of use (module M1–6) is required.		

Table A.20 — Specification of the useful floor area (See 9.3)

Specification and/or reference to document with more information
< free text >

Table A.21 — Type or types of metric for the building size (See 9.3 and 9.4)

Quantity	**Unit**	**Specification and/or reference to document with more information**
NOTE Add rows for each metric.		

Table A.22 — Which space categories are contributing to the reference size (See 9.4)

Space categories	Contributing?	If YES: (Optional) fraction of size contributing to ref. size ($f_{ref;cat,}$) Default value = 1 [a]
One row per space category	YES/NO	
	YES/NO	Value between 0 and 1

[a] The choices in this table are choices that actually cannot be made without the holistic view on all EPB standards. The categorization of spaces is directly related to the assumed conditions of use for each space category and to the specific rules for combining spaces into zones. For instance, a fine subdivision into different space categories, with for each space category different conditions of use (such as temperature settings, ventilation rates, lighting levels, etc.) could easily lead to unwanted complexities in the assessment.

Table A.23 — Perimeter specification (9.5.1 and 9.6.1)

Energy carrier		Specification of nearby perimeter (see 3.4.24)
Bio fuels	Solid	
	Liquid	
	Gaseous	
Electricity		
District heating		
District cooling		

Table A.24 — Perimeter choice (See 9.5.1 and 9.7)

Perimeter choice	Choice – RER calculation (renewable energy)	Choice – RER calculation (total energy)	Choice – EPB calculation (delivered energy)
On-site	Yes/No	Yes/No	Yes/No
Nearby	Yes/No	Yes/No	Yes/No
Distant	Yes/No	Yes/No	Yes/No

Table A.25 — Conversion factors for net to gross calorific values for energy carriers (See 9.6.2)

Energy carrier [a]	Conversion factor $f_{GCV/NCV}$
[a] Add the rows of the energy carriers.	

Table A.26 — Overheads included in the primary energy and CO_2 emission factors (See 9.6.2 and 9.6.3)

	Primary energy factors	CO_2 emission coefficients
Included overheads		
— Energy to extract the primary energy carrier	Yes/No	Yes/No
— Energy to refine and/or to transform the primary energy carrier	Yes/No	Yes/No
— Energy to transport the primary energy carrier	Yes/No	Yes/No
— Energy used for any other operations necessary for the delivery to the building (e.g., storage)	Yes/No	Yes/No

Table A.26 *(continued)*

	Primary energy factors	CO_2 emission coefficients
— Energy to build, operate and dismantle the refinery units and/or the transformation units	Yes/No	Yes/No
— Energy to build, operate and dismantle the transportation system	Yes/No	Yes/No
— Energy to clean up or dispose the wastes	Yes/No	Yes/No
— Energy embedded in materials	Yes/No	Yes/No
Other greenhouse gases than CO_2 included [a]	n.a.	Yes/No
Applicable for ratings based on	net/gross calorific value	net/gross calorific value
[a] It is possible to list the other greenhouse gases.		

Table A.27 — Basis for energy performance of buildings (See 9.6.2)

Basis for the building energy performance	Choice	Application type (see Table A.8/B.8)
Total energy performance ($E_P = E_{Ptot}$) or non-renewable energy performance ($E_P = E_{Pnren}$)	$E_P = E_{Ptot}$ or $E_P = E_{Pnren}$	
NOTE Add lines in case of more assessment purposes.		

Table A.28 — Priority for generation system, export (See 9.6.6.2.4)

Priority level to export	Priority identifier	Generation type identifier
Priority level description	*identifier for that priority*	*Generation type having that priority*

Table A.29 — Subdivision rules (see 10.5.1)

Type of zone or service area [a]	General rule	Specific rules (if any)
Thermal zone		
Heating system service area		
Cooling system service area		
Ventilation service area		
DHW service area		
Lighting service area		
[a] Add lines in case of more service areas.		

Table A.30 — Energy flows taken into account in the building balance (See 11.6.2.1)

System or component	Counted as delivered energy? (Yes/No) [a]	Exported energy taken into account under Step B of the energy performance assessment (11.6.2.1) [b] (Yes/No)
Needs		
On-site		
Nearby	[c]	
(One row per additional category)		
Distant	[d]	
(One row per additional category)		

[a] A "No" in the second column implies "not applicable" in the third column.

[b] Only relevant if $k_{exp} > 0$, see Table A.29/B.29.

[c] If choice of perimeter is "nearby" (see Table A.19).

[d] If choice of perimeter is "distant" (see Table A.19).

NOTE Rows may be deleted or added.

Table A.31 — Electrical uses not satisfied by on-site electricity production (See 11.6.2.4)

On-site electricity production type	Not allowed uses	Comment
Electricity production type identifier	*Electrical use identifier*	

Table A.32 — Matching factor of produced and used electricity (See 11.6.2.4)

Calculation interval	Case	Matching factor function and parameters
Time interval description	*Case description*	*Function to get the matching factor and parameters of the function*

Annex B
(informative)

Input and method selection data sheet — Default choices

B.1 General

The template in Annex A of this document shall be used to specify the choices between methods, the required input data and references to other documents.

NOTE 1 Following this template is not enough to guarantee consistency of data.

NOTE 2 Informative default choices are provided in Annex B. Alternative values and choices can be imposed by national/regional regulations. If the default values and choices of Annex B are not adopted because of the national/regional regulations, policies or national traditions, it is expected that:

— national or regional authorities prepare data sheets containing the national or regional values and choices, in line with the template in Annex A; or

— by default, the national standards body will add or include a National Annex (Annex NA) to this document, in line with the template in Annex A, giving national or regional values and choices in accordance with their legal documents.

NOTE 3 The template in Annex A is applicable to different applications (e.g., the design of a new building, certification of a new building, renovation of an existing building and certification of an existing building) and for different types of buildings (e.g., small or simple buildings and large or complex buildings). A distinction in values and choices for different applications or building types could be made:

— by adding columns or rows (one for each application), if the template allows;

— by including more than one version of a Table (one for each application), numbered consecutively as a, b, c, … For example: Table NA.3a, Table NA.3b;

— by developing different national/regional data sheets for the same standard. In case of a national annex to the standard these will be consecutively numbered (Annex NA, Annex NB, Annex NC, …).

NOTE 4 In the section "Introduction" of a national/regional data sheet information can be added, for example about the applicable national/regional regulations.

NOTE 5 For certain input values to be acquired by the user, a data sheet following the template of Annex A, could contain a reference to national procedures for assessing the needed input data. For instance, reference to a national assessment protocol comprising decision trees, tables and pre-calculations.

The shaded fields in the tables are part of the template and consequently not open for input.

B.2 References

The references, identified by the module code number, are given in Table B.1.

Table B.1 — References (See Clause 2)

Reference	Reference document	
	Number	Title
M1–1	ISO 52000-1	This document
M1–2		See M1–1
M1–3		See M1–1
M1–4	ISO 52003-1	*Energy performance of buildings – Indicators, requirements, ratings and certificates – Part 1: General aspects and application to the overall energy performance*
M1–5, M1–7		See M1–1
M1–8, M1–9		See M1–1
M1–10		
M1–6, M2–7	ISO 17772-1	*Energy performance of buildings – Indoor environmental quality – Part 1: Indoor environmental input parameters for the design and assessment of energy performance of buildings*
	EN 16798–1 (Under preparation)	*Energy performance of buildings – Ventilation of buildings – Part 1: Indoor environmental input parameters for design and assessment of energy performance of buildings addressing indoor air quality, thermal environment, lighting and acoustics* (Module M1–6)
M1–11		See M1–6
M1–13	ISO 52010-1	*Energy performance of buildings – External climatic conditions – Part 1: Conversion of climatic data for energy calculations*
M1–14	EN 15459-1	*Energy performance of buildings – Economic evaluation procedure for energy systems in buildings – Part 1: Calculation procedures, Module M1–14*
M2–2	ISO 52016-1	*Energy performance of buildings – Energy needs for heating and cooling, internal temperatures and sensible and latent heat loads – Part 1: Calculation procedures*
M2–3	ISO 52017-1	*Energy performance of buildings – Sensible and latent heat loads and internal temperatures – Part 1: Generic calculation procedures*
M2–4	ISO 52018-1	*Energy performance of buildings – Indicators for partial EPB requirements related to thermal energy balance and fabric features – Part 1: Overview of options*
M2–5.1	ISO 13789	*Thermal performance of buildings – Transmission and ventilation heat transfer coefficients – Calculation method*
M2–5.2	ISO 13370	*Thermal performance of buildings – Heat transfer via the ground – Calculation methods*
M2–5.3	ISO 6946	*Building components and building elements – Thermal resistance and thermal transmittance – Calculation methods*
M2–5.4	ISO 10211	*Thermal bridges in building construction – Heat flows and surface temperatures – Detailed calculations*
M2–5.5	ISO 14683	*Thermal bridges in building construction – Linear thermal transmittance – Simplified methods and default values*
M2–5.6	ISO 10077-1	*Thermal performance of windows, doors and shutters – Calculation of thermal transmittance – Part 1: General*
M2–5.7	ISO 10077-2	*Thermal performance of windows, doors and shutters – Calculation of thermal transmittance – Part 2: Numerical method for frames*
M2–5.8	ISO 12631	*Thermal performance of curtain walling – Calculation of thermal transmittance*
M2–9	ISO 13786	*Thermal performance of building components – Dynamic thermal characteristics – Calculation methods*
M2–7		See M2–5

Table B.1 *(continued)*

Reference	Reference document	
	Number	Title
M2–8	ISO 52022-3	*Energy performance of buildings – Thermal, solar and daylight properties of building components and elements – Part 3: Detailed calculation method of the solar and daylight characteristics for solar protection devices combined with glazing*
	ISO 52022-1	*Energy performance of buildings – Thermal, solar and daylight properties of building components and elements – Part 1: Simplified calculation method of the solar and daylight characteristics for solar protection devices combined with glazing*
M3–1	EN 15316–1	*Energy performance of buildings – Method for calculation of system energy requirements and system efficiencies – Part 1: General and Energy performance expression, Module M3–1, M3–4, M3–9, M8–1, M8–4*
M3–2		
M3–3	EN 12831–1	*Energy performance of buildings – Method for calculation of the design heat load – Part 1: Space heating load, Module M3–3*
M3–4	EN 15316–1	See M3–1
M3–5	EN 15316–2	*Energy performance of buildings – Method for calculation of system energy requirements and system efficiencies – Part 2: Space emission systems (heating and cooling), Module M3–5, M4–5*
M3–6	EN 15316–3	*Energy performance of buildings – Method for calculation of system energy requirements and system efficiencies – Part 3: Space distribution systems (DHW, heating and cooling), Module M3–6, M4–6, M8–6*
M3–7	EN 15316–5	*Energy performance of buildings – Method for calculation of system energy requirements and system efficiencies – Part 5: Space heating and DHW storage systems (not cooling), Module M3–7, M8–7*
M3–8	EN 15316–4-1	*Energy performance of buildings – Method for calculation of system energy requirements and system efficiencies – Part 4–1: Space heating and DHW generation systems, combustion systems (boilers, biomass), Module M3–8-1 and M 8–8-1*
	EN 15316–4-2	*Energy performance of buildings – Method for calculation of system energy requirements and system efficiencies – Part 4–2: Space heating generation systems, heat pump systems, Module M3–8-2, M8–8-2*
	EN 15316–4-3	*Energy performance of buildings – Method for calculation of system energy requirements and system efficiencies – Part 4–3: Heat generation systems, thermal solar and photovoltaic systems, Module M3–8-3, M8–8-3, M11–8-3*
	EN 15316–4-4	*Energy performance of buildings – Method for calculation of system energy requirements and system efficiencies – Part 4–4: Heat generation systems, building-integrated cogeneration systems, Module M8–3-4, M8–8-4, M8–11-4*
	EN 15316–4-5	*Energy performance of buildings – Method for calculation of system energy requirements and system efficiencies – Part 4–5: District heating and cooling, Module M3–8-5, M4–8-5, M8–8-5, M11–8-5*
	EN 15316–4-8	*Energy performance of buildings – Method for calculation of system energy requirements and system efficiencies – Part 4–8: Space heating generation systems, air heating and overhead radiant heating systems, including stoves (local), Module M3–8-8*
M3–9		
M3–10	EN 15378–3	*Energy performance of buildings –Heating and DHW systems in buildings – Part 3: Measured energy performance, Module M3–10 and M8–10*

Table B.1 *(continued)*

Reference	Reference document	
	Number	Title
M3–11	EN 15378–1	*Energy performance of buildings – Heating systems and DHW in buildings – Inspection of boilers, heating systems and DHW, Module M3–11, M8–11*
M3–12		
M4–1	EN 16798–9	*Energy performance of buildings –Ventilation for buildings – Part 9: Calculation methods for energy requirements of cooling systems (Modules M4-1, M4-4, M4-9) – General*
M4–2		
M4–3	ISO 52016–1	See M2-2
M4–4	EN 16798–9	See M4–1
M4–5	EN 15316–2	See M3–5
M4–6	EN 15316–3	See M3–6
M4–7	EN 16798–15	*Energy performance of buildings – Ventilation for buildings – Part 15: Calculation of cooling systems (Module M4–7) – Storage*
M4–8	EN 16798–13	*Energy performance of buildings – Ventilation for buildings – Part 13: Calculation of cooling systems (Module M4–8) – Generation*
	EN 15316–4-5	See M3–8
M4–9		
M4–10		
M4–11	EN 16798–17	*Energy performance of buildings – Ventilation for buildings – Part 17: Guidelines for inspection of ventilation and air conditioning systems (Module M4–11, M5–11, M6–11, M7–11)*
M4–12		
M5–1	EN 16798–3	*Energy performance of buildings – Ventilation for buildings – Part 3: For non-residential buildings – Performance requirements for ventilation and room-conditioning systems (Modules M5–1, M5–4)*
M5–2		
M5–3		
M5–4	EN 16798–3	See M5–1
M5–5	EN 16798–7	*Energy performance of buildings – Ventilation for buildings – Part 7: Calculation methods for the determination of air flow rates in buildings including infiltration (Module M5–5)*
M5–6	EN 16798–5–1 and EN 16798–5–2	*Energy performance of buildings – Ventilation for buildings – Part 5–1: Calculation methods for energy requirements of ventilation and air conditioning systems (Modules M5–6, M5–8, M6–5, M6–8, M7–5, M7–8) – Method 1: Distribution and generation* *Energy performance of buildings – Ventilation for buildings – Part 5–2: Calculation methods for energy requirements of ventilation and air conditioning systems (Modules M5–6, M5–8, M6–5, M6–8, M7–5, M7–8) – Method 2: Distribution and generation*
M5–7		
M5–8	EN 16798–5–1 and EN 16798–5–2	See M5–6
M5–9		
M5–10		
M5–11	EN 16798–17	See M4–11
M6–1		See M5–1
M6–2		See M5–2

Table B.1 *(continued)*

Reference	Reference document	
	Number	Title
M6–3		See M5–3
M6–4		See M5–4
M6–5	EN 16798–5–1 and EN 16798–5–2	See M5–6
M6–6		See M5–6
M6–7		See M5–7
M6–8	EN 16798–5–1 and EN 16798–5–2	See M5–6
M6–9		See M5–9
M6–10		See M5–10
M6–11	EN 16798–17	See M5–11
M7–1		See M5–1
M7–2		See M5–2
M7–3		See M5–3
M7–4		See M5–4
M7–5	EN 16798–5–1 and EN 16798–5–2	See M5–6
M7–6		See M5–6
M7–7		See M5–7
M7–8	EN 16798–5–1 and EN 16798–5–2	See M5–6
M7–9		See M5–9
M7–10		See M5–10
M7–11	EN 16798–17	See M5–11
M8–1	EN 15316–1	See M3–1
M8–2	EN 12831–3	*Energy performance of buildings – Method for calculation of the design heat load – Domestic hot water systems heat load and characterization of needs, Module M8–2, M8–3*
M8–3	EN 12831–3	See M8–2
M8–4	EN 15316–1	See M8–1
M8–5		
M8–6	EN 15316–3	See M3–6
M8–7	EN 15316–5	See M3–7
M8–8	EN 15316–4-1	See M3–8
	EN 15316–4-3	See M3–8
	EN 15316–4-4	See M3–8
	EN 15316–4-5	See M3–8
	EN 15316–4-8	See M3–8
M8–9		
M8–10	EN 15378–3	See M3–10
M8–11	EN 15378–1	See M3–11
M9–1	EN 15193–1	*Energy performance of buildings – Energy requirements for lighting – Part 1: Specifications, Module M9*
M9–2	EN 15193–1	See M9–1
M9–3		

Table B.1 *(continued)*

Reference	Reference document	
	Number	Title
M9–4	EN 15193–1	See M9–1
M9–5		
M9–6		
M9–8		
M9–10	EN 15193–1	See M9–1
M9–11	EN 15193–1	See M9–1
M10–1	EN 15232–1	*Energy performance of buildings – Part 1: Impact of Building Automation, Controls and Building Management – Modules M10–4,5,6,7,8,9,10*
M10–2		
M10–3		
M10–4		
M10–5	EN 15232–1	See M10–1
M10–6	EN 15232–1	See M10–1
M10–7	EN 15232–1	See M10–1
M10–8	EN 15232–1	See M10–1
M10–11	EN 16946-1	*Energy Performance of Buildings – Inspection of Automation, Controls and Technical Building Management – Part 1: Module M10–11*
M10–12	EN 16947-1	*Energy Performance of Buildings – Building Management System – Part 1: Module M10–12*
M11–1		
M11–4		
M11–8	EN 15316–4-3	See M3–8
	EN 15316–4-4	See M3–8
	EN 15316–4-5	See M3–8
	EN 15316–4-10	*Energy performance of buildings – Method for calculation of system energy requirements and system efficiencies – Part 4–10: Wind power generation systems, Module M11–8-3*

B.3 Overarching preparation steps

Table B.2 — Energy performance assessment types according to building category and application [a] (See 5.3)

Application	Building category	Assessment type	Conditions
Energy performance certificate	All categories	As built type	-
Building permit	All categories	Design type	-
Permit to use	All categories	As built type	-
Energy audit	All categories	Tailored type	-
NOTE Add rows in case of more assessment purposes.			

Table B.3 — Object types (See Clause 6 and 10.1)

EPB_OBJECT_TYPE			
Type [a]	**Description**	**Subset** [b]	**Comments**
EPB_OBJECT_BLDNG_TOT	Whole building	1	
EPB_OBJECT_BLDNG_UNIT	Building unit	1	
EPB_OBJECT_BLDNG_PART	Part of a building (lacking one or more features of a complete building or building unit)	1	
EPB_OBJECT_ LCYCLE_NEW.DESIGN	New building design	2	
EPB_OBJECT_ LCYCLE_AS.BUILT	Existing building as built (without long term use data)	2	
EPB_OBJECT_ LCYCLE_EXIST.RENOV	Existing building after renovation (without long term use data)	2	
EPB_OBJECT_ LCYCLE_EXIST.EXTENS	Existing building extension (without long term use data)	2	
EPB_OBJECT_ LCYCLE_EXIST.IN.USE	Existing building in use	2	
EPB_OBJECT_CAT_RES	Residential building	3	
EPB_OBJECT_CAT_NRES	Non-residential building	3	
EPB_OBJECT_USER_L.PUBL	Large public building	4	
EPB_OBJECT_USER_OTHER	Other	4	

NOTE The type of object may have an effect on the choices in this overarching document and in the other EPB standards. This property is therefore inherited by the other EPB standards, where relevant.

[a] One choice is possible per subset (1, 2, 3, 4).

[b] Definition of the calculation case, one selection shall be done for each subset.

Table B.4 — Building categories (See Clauses 6 and 9)

BLDNGCAT_TYPE		
Type	**Description**	**Comments**
BLDNGCAT_RES_SINGLE	Single-family houses of different types	[a]
BLDNGCAT_RES_APPBLOCK	Apartment blocks	
BLDNGCAT_RES_ELDER	Homes for elderly and disabled people	
BLDNGCAT_RES_COLL	Residence for collective use	
BLDNGCAT_RES_MOBIL	Mobile home	
BLDNGCAT_RES_HOL	Holiday home	
BLDNGCAT_OFF	Offices	
BLDNGCAT_EDUC	Educational buildings	
BLDNGCAT_HOSP	Hospitals	
BLDNGCAT_HOTEL	Hotels and restaurants	
BLDNGCAT_SPORT	Sports facilities	
BLDNGCAT_RETAIL	Wholesale and retail trade services buildings	
BLDNGCAT_DATA_CENTER	Data centre	
BLDNGCAT_INDUS	Industrial sites	
BLDNGCAT_WORKS	Workshops	

Table B.4 *(continued)*

BLDNGCAT_TYPE		
Type	**Description**	**Comments**
BLDNGCAT_AGRIC	Non-residential agricultural buildings	
a List copied from ISO 13675, Annex 1.5[8], but residential sector more differentiated and other buildings use energy more differentiated.		
NOTE The building category may have an effect on the choices in this overarching document and in the other EPB standards. This property is therefore inherited by the other EPB standards, where relevant.		

Table B.5 — Which building categories are included in EPB assessment (See 6.2.2)

Building categories	Identifier	Included in EPB assessment [a] Yes/No
Residential buildings:		
Single family houses of different types	*BLDNGCAT_RES_SINGLE*	YES
Apartment block	*BLDNGCAT_RES_APPBLOCK*	YES
Homes for elderly and disabled people	*BLDNGCAT_RES_ELDER*	YES
Residence for collective use	*BLDNGCAT_RES_COLL*	YES
Mobile home	*BLDNGCAT_RES_MOBIL*	YES
Holiday home	*BLDNGCAT_RES_HOL*	YES
Non-residential buildings:		
Office buildings	*BLDNGCAT_OFF*	YES
Educational buildings	*BLDNGCAT_EDUC*	YES
Hospitals	*BLDNGCAT_HOSP*	YES
Hotels and restaurants	*BLDNGCAT_HOTEL*	YES
Sport facilities	*BLDNGCAT_SPORT*	YES
Wholesale and retail trade services buildings	*BLDNGCAT_RETAIL*	YES
Industrial sites	*BLDNGCAT_INDUS*	NO
Workshops	*BLDNGCAT_WORKS*	NO
Non-residential agricultural buildings	*BLDNGCAT_AGRIC*	NO
[a] Building category for which this document applies, e.g. because there is an EPB requirement for this building category.		

Table B.6 — Differentiation of space categories (See Clauses 6, 9 and 10.1)

Choice		
Type	**Choice**	**Comments**
Differentiation of space categories in a building	Yes	

In case of differentiation Table B.7 has to be completed. Otherwise the list of space categories is equal to the list of building categories: (SPACECAT_X = BLDNGCAT_X).

Table B.7 — Space categories (See Clauses 6 and 9)

SPACECAT_TYPE		
Type	**Description**	**Comments**
SPACECAT_RES_LIV	Residential living space, kitchen, bed room, study, bath room or toilet	
SPACECAT_RES_INDIV_OTHER	Residential individual: hall, corridor, staircase inside thermal envelope, attic inside thermal envelope	
SPACECAT _RES_COLL	Residential collective or non-residential: hall, corridor, staircase inside thermal envelope	
SPACECAT_TH.UNCOND_OTHER	Thermally unconditioned adjacent space, such as storage room or unconditioned attic	
SPACECAT_TH.UNCOND_SUN	Thermally unconditioned sunspace or atrium	
SPACECAT_HALL	Entrance hall/foyer	
SPACECAT_CORR	Corridor	
SPACECAT_TH.UNCOND_CORR	Hall, corridor outside thermal envelope	
SPACECAT_OFF	Office space	
SPACECAT_EDUC	Educational space	
SPACECAT_HOSP_BED	Hospital bed room	
SPACECAT_HOSP_OTHER	Hospital other room	
SPACECAT_HOTEL	Hotels room	
SPACECAT_REST	Restaurant space	
SPACECAT_REST_KITCH	Restaurant kitchen	
SPACECAT_MEET	Meeting or seminar space	
SPACECAT_AUDIT	Auditorium, lecture room	
SPACECAT_THEAT	Theatre or cinema space	
SPACECAT_SERVER	Server or computer room	
SPACECAT_SPORT_TH.COND	Sport facilities, thermally conditioned	
SPACECAT_SPORT_TH.UNCOND	Sport facilities, thermally unconditioned	
SPACECAT_RETAIL	Wholesale and retail trade services space (shop)	
SPACECAT_NONRES_BATH	Non-residential bath room, shower, toilet, if inside thermal envelope	
SPACECAT_SPA	Spa area with sauna shower and/or relaxing area	
SPACECAT_SWIMM	Space with indoor swimming pool	
SPACECAT_STOR_HEAT	Heated storage space	
SPACECAT_STOR_COOL	Cooled storage space	
SPACECAT_STOR_NOCON	Non conditioned storage space	
SPACECAT ENGINE	Engine room	
SPACECAT_CAR	Individual garage or collective indoor car park	
SPACECAT _BARN	Barn	
NOTE 1 Each space category requires a set of conditions of use (temperature settings, ventilation, and lighting requirements, domestic hot water needs, etc.), to be specified in M1–6. NOTE 2 The space category may have an effect on the choices in this overarching document and in the other EPB standards. This property is therefore inherited by the other EPB standards, where relevant.		

Table B.8 — Application types (See Clauses 6, 9 and 10.1)

EPB_APPLIC_TYPE		
Type	**Description**	**Comments**
EPB_APPLIC_REQ	To check compliance with energy performance requirements	
EPB_APPLIC_CERTIF	Energy performance certification	
EPB_APPLIC_PERMIT_BLD	To obtain building permit	
EPB_APPLIC_PERMIT_USE	To obtain permit to use	
EPB_APPLIC_AUDIT	Energy audit (tailored)	
EPB_APPLIC_INSP	Energy performance inspection	
NOTE The type of application may have an effect on the choices in this overarching document and in the other EPB standards. This property is therefore inherited by the other EPB standards, where relevant.		

Table B.9 — EPB assessment types (See Clauses 6 and 9)

EPB_ASSESS_TYPE (see Table 3)		
Type	**Description**	**Comments**
EPB_ASSESS_CALC_DESIGN	Calculated, design	
EPB_ASSESS_CALC_ASBUILT	Calculated, as built	
EPB_ASSESS_CALC_ACTUAL	Calculated, actual	
EPB_ASSESS_CALC_TAILORED	Calculated, tailored	
EPB_ASSESS_MEAS_ACTUAL	Measured, actual	
EPB_ASSESS_MEAS_ CORR_CLIM	Measured, corrected for climate	
EPB_ASSESS_MEAS_ CORR_USE	Measured, corrected for use	
EPB_ASSESS_MEAS_STAND	Measured, standard (corrected for climate and use)	
NOTE 1 The type may be different for different object types, building or space categories. NOTE 2 The type of assessment may have an effect on the choices in this overarching document and in the other EPB standards. This property is therefore inherited by the other EPB standards, where relevant.		

Table B.10 — Combination services types (See Clauses 6 and 9)

EPB_LISTSERVICES_TYPE		
Type	**Description**	**Comments**
EPB_*LISTSERVICES_*RES	Services included for the EPB assessment of residential buildings	
EPB_*LISTSERVICES_*NRES	Services included for the EPB assessment of non-residential buildings	
NOTE 1 The combination may be different for different building or space categories. NOTE 2 The type of services combination may have an effect on the choices in this overarching document and in the other EPB standards. This property is therefore inherited by the other EPB standards, where relevant.		

B.4 Method

Table B.11 — Electricity use types (See 7.3.3.4.)

Electric energy use type	Identifier
Main input to a generator	EL_USE_MAIN
Auxiliary energy	EL_USE_AUX
Direct heating (Joule effect)	EL_USE_JOULE
Non EPB uses	EL_USE_NEPB

Table B.12 — Electricity generation types (See 7.3.3.6 and 9.6.6.2.4)

Electric energy generation type	Identifier
Photovoltaic	EL_PROD_PV
Wind turbine	EL_PROD_WIND
Cogeneration	EL_PROD_CHP

Table B.13 — Gross calorific value of some common solid fuels (See 7.3.4 and 9.6.2)

Fuel	Gross calorific value kWh/kg
Anthracite	8,9 – 9,7
Bituminous coal	4,7–6,9
Charcoal	8,22
Coke	7,8 – 8,6
Lignite	4,2 – 8,3
Peat	3,6 – 5,6
Wood (dry)	3,9 – 4,7
NOTE Add the rows of the energy carriers.	

Table B.14 — Gross calorific value of some common liquid fuels (See 7.3.4 and 9.6.2)

Fuel	Density kg/l	Gross calorific value kWh/kg
Oil		
Heating oil, light	0,84 – 0,85	12,44
Heating oil, heavy	0,96	13,94 – 11,75
Liquid gas		
80 propane:20 butane	0,52	13,83
70 propane:30 butane	0,53	13,83
60 propane:40 butane	0,53	13,81
50 propane:50 butane	0,55	13,78
Commercial propane	0,51	13,89
[a] Confidence interval for liquid gas is about ± 0,1 MJ/kg.		
NOTE Add the rows of the energy carriers.		

Table B.15 — Gross calorific values of some gaseous energy carriers (see 7.3.4 and 9.6.2)

Fuel	Density kg/m³	Gross calorific value kWh/m³
Natural gas L	0,64	9,75 – 9,78
Natural gas H	0,61	11,41 – 11,47
Methane	0,55	11,06 – 11,08
Propane	1,56	28,03
Butane	2,09	37,19
Hydrogen	0,09	39
Biogas	1,2	4 to 8 [a]
[a] Depending on its methane content.		
NOTE Add the rows of the energy carriers.		

Table B.16 — Weighting factors (based on gross or net calorific value) (See 7.3.5, 9.5.1, 9.6.2, 9.6.5 and 9.6.6.3)

	Energy carrier Delivered from distant		f_{Pnren}	f_{Pren}	f_{Ptot}	K_{CO2e} (g/kW h)
1	Fossil fuels	Solid	1,1	0	1,1	360
2		Liquid	1,1	0	1,1	290
3		Gaseous	1,1	0	1,1	220
4	Bio fuels	Solid	0,2	1	1,2	40
5		Liquid	0,5	1	1,5	70
6		Gaseous	0,4	1	1,4	100
7	Electricity [c]		2,3	0,2	2,5	420
	Delivered from nearby					
8	District heating [a]		1,3	0	1,3	260
9	District cooling		1,3	0	1,3	260
	Delivered from on-site					
10	Solar	PV electricity	0	1	1	0
11		Thermal	0	1	1	0
12	Wind		0	1	1	0
13	Environment	Geo-, aero-, hydrothermal	0	1	1	0
	Exported					
14	Electricity [b c]	To the grid	2,3	0,2	2,5	420
15		To non EPB uses	2,3	0,2	2,5	420

[a] Default value based on a natural gas boiler. Specific values are calculated according to M3–8.5.

[b] It is possible to differentiate between different sources of electricity like wind or solar.

[c] These values are established in line with the default coefficient provided in Annex IV of Directive 2012/27/EU. This default coefficient is currently being reviewed and a later amendment of the above factors could be needed.

NOTE 1 Add a column in case of other requirements, e.g., CO_2 requirement.

NOTE 2 Add rows for each relevant energy carrier.

Table B.17 — k_{exp}-factor (See 7.3.5 and 11.6.2.1)

Description	Value
k_{exp} factor that is used to control which part of the exported energy is included in the energy performance of the building	1

Table B.18 — Building services considered in the energy performance calculation (See 8.2 and 8.5)

Combination of services type	**Choice: included in the energy performance calculation** *< one column per service mix type, see Table B.10 >*	
Building service [a]	***EPB***_LISTSERVICES_***RES***	***EPB***_LISTSERVICES_***NRES***
Heating	Yes	Yes
Cooling	Yes	Yes
Ventilation	Yes	Yes
Humidification	Yes	Yes
Dehumidification	Yes	Yes
Domestic hot water	Yes	Yes
Lighting	No	Yes
External lighting	No	No
People transport (e.g., elevators, escalators)	No	No
Other services consuming electricity (e.g., appliances)	No	No
Others	No	No
[a] Add rows or edit the lines in case of other/more differentiated services.		

Table B.19 — Principle assumed presence of systems (See 9.2)

Method		**Choice Yes/No** [a]
1	Principle “Assumed system”	YES
2	Principle “Presence of system”	NO
3	Other principle	NO
In case of method 3:		
	Reference to procedure:	< reference >
[a] Only one choice possible; choice may be differentiated per service. NOTE Consistency with the conditions of use (module M1–6) is required.		

Table B.20 — Specification of the useful floor area (See 9.3)

Specification and/or reference to document with more information
The useful floor area is equal to the area of the floor with the following specific rules: Excluded: The floor area under a load bearing construction is excluded. The open floor area in vides (no floor) is excluded. The floor area with height under the ceiling of less than 1,5 m (except for incidental beams). Included: The floor area under a non-load bearing construction at the boundary of the considered space or spaces: measured to the centre. The floor area under a non-load bearing construction inside the considered space or spaces.

Table B.21 — Type or types of metric for the building size (See 9.3 and 9.4)

Quantity	Unit	Specification and/or reference to document with more information
Reference floor area	m^2	Useful floor area as in Table B.20 of this document, with fractions according to Table B.22
NOTE Add rows for each metric.		

Table B.22 — Which space categories are contributing to the reference size (See 9.4)

Space categories	Contributing?	If YES: (Optional) fraction of-size contributing to ref. size ($f_{ref;cat,}$). Default value = 1 [a]
Residential living space, kitchen, bed room, study, bath room or toilet	YES	1,0
Residential individual: hall, corridor, staircase inside thermal envelope, attic inside thermal envelope	YES	1,0
Residential collective or non-residential: hall, corridor, staircase inside thermal envelope	YES	1,0
Thermally unconditioned adjacent space, such as storage room or unconditioned attic	NO	
Thermally unconditioned sunspace or atrium	NO	
Hall, corridor outside thermal envelope	NO	
Office space	YES	1,0
Educational space	YES	1,0
Hospital bed room	YES	1,0
Hospital other room	YES	1,0
Hotels room	YES	1,0
Restaurant space	YES	1,0
Restaurant kitchen	NO	
Meeting or seminar space	YES	1,0
Auditorium, lecture room	YES	1,0
Theatre or cinema space	YES	1,0

Table B.22 *(continued)*

Space categories	Contributing?	If YES: (Optional) fraction of-size contributing to ref. size ($f_{ref;cat,}$). Default value = 1 [a]
Server or computer room	NO	
Sport facilities, thermally conditioned	YES	1,0
Sport facilities, thermally unconditioned	YES	0,5
Wholesale and retail trade services space (shop)	YES	1,0
Non-residential bath room, shower, toilet, if inside thermal envelope	YES	1,0
Heated storage space	NO	
Cooled storage space	NO	
Engine room	NO	
individual garage or collective indoor car park	NO	
Barn	NO	
[a] The choices in this table are choices that actually cannot be made without the holistic view on all EPB standards. The categorization of spaces is directly related to the assumed conditions of use for each space category and to the specific rules for combining spaces into zones. For instance, a fine subdivision into different space categories, with for each space category different conditions of use (such as temperature settings, ventilation rates, lighting levels, etc.) could easily lead to unwanted complexities in the assessment.		

Table B.23 — Perimeter specification (See 9.5.1 and 9.6.1)

Energy carrier		Specification of nearby perimeter (see 3.4.24)
Bio fuels	Solid	Not specified further
	Liquid	Connected to the same branch of the distribution network or having a dedicated connection, requiring specific equipment for the assessed object to be connected to it
	Gaseous	Connected to the same branch of the distribution network or having a dedicated connection, requiring specific equipment for the assessed object to be connected to it
Electricity		Connected to the same branch of the distribution network, meaning medium voltage or lower
District heating		Always nearby
District cooling		Always nearby

Table B.24 — Perimeter choice (See 9.5.1 and 9.7)

Perimeter choice	Choice – RER calculation (renewable energy)	Choice – RER calculation (total energy)	Choice – EPB calculation (delivered energy)
On-site	Yes	Yes	Yes
Nearby	Yes	Yes	Yes
Distant	No	Yes	Yes

Table B.25 — Conversion factors for net to gross calorific values for energy carriers (See 9.6.2)

Energy carrier	Conversion factor $f_{GCV/NCV}$
oil	1,06
gas	1,11
LPG	1,09

Table B.25 *(continued)*

Energy carrier	Conversion factor $f_{GCV/NCV}$
coal	1,04
lignite	1,08
wood	1,08
NOTE Add the rows of the energy carriers.	

Table B.26 — Overheads included in the primary energy and CO_2 emission factors (See 9.6.2 and 9.6.3)

		Primary energy factors	Emission coefficients
Included overheads	Energy to extract the primary energy carrier	Yes	Yes
	Energy to transport the primary energy carrier	Yes	Yes
	Energy used for any other operations necessary for the delivery to the building (e.g., storage)	Yes	Yes
	Energy to build, operate and dismantle the transformation units	No	No
	Energy to build, operate and dismantle the transportation system	No	No
	Energy to clean up or dispose the wastes	No	No
	Energy embedded in materials	No	No
Other greenhouse gases than CO_2 included [a]		n.a.	Yes
Applicable for ratings based on		net calorific value	net calorific value
[a] It is possible to list the other greenhouse gases.			

Table B.27 — Basis for the energy performance of buildings (See 9.6.2)

Basis for the building energy performance	Choice	Application type (see Table A.6/B.6)
Total energy performance ($E_P = E_{Ptot}$) or non-renewable energy performance ($E_P = E_{Pnren}$)	$E_P = E_{Pnren}$	All application types in Table B.6
NOTE Add lines incase of more assessment purposes.		

Table B.28 — Priority for generation system, export (See 7.3.3.6 and 9.6.6.2.4)

Priority level to export	Priority identifier	Generation type
Priority level 1 (highest)	EL_EXP_PRIO_LEVEL_1	EL_PROD_PV
Priority level 2	EL_EXP_PRIO_LEVEL_2	EL_PROD_WIND
Priority level 3 (lowest)	EL_EXP_PRIO_LEVEL_3	EL_PROD_CHP

Table B.29 — Subdivision rules (See 10.5.1)

Type of zone or service area [a]	General rule	Specific rules (if any)
Thermal zone	Useful floor area weighted	See ISO 52016-1
Heating system service area	Useful floor area weighted	
Cooling system service area	Useful floor area weighted	
Ventilation service area	Useful floor area weighted	
DHW service area	Useful floor area weighted	
Lighting service area	Useful floor area weighted	
[a] Add lines in case of more service areas.		

Table B.30 — Energy flows taken into account in the building balance (See 11.6.2.1)

System or component	Counted as delivered energy? (Yes/No) [a]	Exported energy taken into account under step B of the energy performance assessment (11.6.2.1)[b] (Yes/No)
Needs		
Passive renewable energy	No	Not applicable
On-site		
Technical building systems located "on-site" and producing energy from renewable sources	Yes	Yes
Solar energy captured by thermal solar panels	Yes	Yes
Free cooling as renewable energy	Yes	Not applicable
Free heating as renewable energy	Yes	Not applicable
Heat from environment captured by heat pumps	Yes	Yes
Electricity produced by wind power	Yes	No
Nearby	[c]	
District heating	Yes	No
District cooling	Yes	No
Heat produced by biomass	Yes	No
Distant	[d]	
Electricity production from renewable sources	Yes	No
[a] A "No" in the second column implies "not applicable" in the third column.		
[b] Only relevant if $k_{exp} > 0$, see Table A.19/B.19.		
[c] If choice of perimeter is "nearby" (see Table A.9).		
[d] If choice of perimeter is "distant" (see Table A.9).		
NOTE Rows may be deleted or added.		

Table B.31 — Electrical uses not satisfied by on-site electricity production (See 11.6.2)

On-site electricity production type	Not allowed uses	Comment
All	None	Any EPB use of electricity can be satisfied by any type of on-site electricity production

Table B.32 — Matching factor of produced and used electricity (See 11.6.2.4)

Calculation interval	Case	Matching factor function and parameters
Hourly	All building categories	$f_{match} = 1$
Monthly	All building categories	$f_{match} = \frac{x^n + \frac{1}{x^n} - k}{x^n + \frac{1}{x^n}}$ with $x = E_{pr;el}/E_{EPus;el}$, k = carrier = 1 and n = subsystem = 1

Annex C
(normative)

Common subscripts

C.1 General

EPB calculation involves a huge number of quantities. Annex C specifies rules to guarantee consistency and avoid duplication in the naming of quantities throughout EPB documents.

With reference to an individual EPB standard, quantities can be divided in two main categories:

— common quantities, that are intended to be an input from or an output to other standards of the EPB package;

— internal quantities, that are intended to be used only within the specific EPB standard.

Annex C includes:

— common basic subscripts and rules to generate new subscripts;

definitions;

— definition of case identifiers.

Clause 4 contains the list of common EPB symbols, units and subscripts.

NOTE For each symbol and subscript the German and French translation of the English term is given in ISO/TR 52000-2[6].

C.2 Common subscripts

C.2.1 Order of subscripts

The subscripts are categorized into different levels, which are placed in the following order:

— 1st position: level 1;

— 2nd position: level 2 (if applicable)

— etc.

At each level there may be different sets of subscripts, for different contexts.

NOTE In a certain context a distinction is required between type of energy use (heating versus cooling versus ventilation, etc.), while in another context a distinction is needed between the energy carrier (gas versus oil versus electricity). But a distinction is never required between energy use for heating versus gas.

The levels are hierarchical, to harmonize the order of the subscripts used in different EPB standards. Subscripts shall be in the order (level) from the most general to the most detailed.

EXAMPLE Recoverable ventilation system losses: $Q_{V,sys,ls,rbl}$ and not $Q_{ls,V,rbl}$.

C.2.2 Rule for omitting a level if not applicable

When the subscripts at a given level describe a subdivision which is not applicable, the subscript for that level is omitted.

C.2.3 Rule for omitting a level if obvious from context

Within an EPB standard, if the quantity is not passed to other EPB standards, one or more of the subscripts may be omitted provided that the meaning is clear from the context (otherwise the full list of subscripts is used).

NOTE This rule is applied to avoid a long list of subscripts when a subscript is always the same in the given context.

EXAMPLE The subscript "calc" can be omitted from $Q_{V;sys;ls;rbl;calc}$ (so that it is written $Q_{V;sys;ls;rbl}$) within a clause dealing only with calculated quantities.

C.2.4 Local quantities

Local quantities are quantities that are intended to be used and referenced only within a module.

To avoid possible duplication of symbols within EPB standards and other relating documents, a unique first level subscript shall be used for all local quantities of an EPB standard for a module.

EXAMPLE Heat-pump module could be given the subscript "hp" for all its internal quantities subscripts.

C.2.5 Common quantities

Common quantities are quantities that are intended to be passed or to be referenced by other EPB standards.

EXAMPLE Heating distribution heat input is intended to be referenced as a basis for heat generation output.

Subscripts for common quantities are defined for the following three domains:

— building needs balance domain, where the first subscript shall be the service (H, C, W, ..) and then the balance item is specified;

— technical systems domain, where the first subscript shall be the service (H, C, W, ..) and then the following levels are the sub-system, the balance item within the sub-system and further specifications;

— interactions across the assessment boundary, where the first subscript shall be the type of energy flow (delivered, exported, primary) and then further specification.

C.2.6 Terms for subscripts

C.2.6.1 General

The first three or four levels for the three domains are shown in Tables C.1 through C.4.

These may be followed by extra subscripts to indicate the spatial (zones) and/or time-span (calculation interval) etc. (see Table C.5).

C.2.6.2 Subscripts for the building domain

In the building domain:

— the first level is the service;

— the second level is the energy balance item;

— the third level is a custom specification.

Common subscripts for the building domain are given in Table C.1.

