Subset of EPB standards on the energy use and the thermal performance of buildings and building elements

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This paper introduces the subset of EPB standards dealing with the energy use and the thermal performance of building and building elements, with the focus on the standards which are new or significantly revised.

The European Commission asked CEN (mandate M480) to develop standards supporting the application of recast EPBD (Energy Performance of Buildings Directive) in the Member States: the so called set of Energy Performance of Buildings standards (EPB standards).

A comprehensive series of European (CEN) and international (CEN & ISO) standards are in preparation, aiming at international harmonization of the methodology for the assessment of the overall energy performance of buildings, called "set of EPB standards". This work is based on a mandate given to CEN by the European Commission and the European Free Trade Association (Mandate M/480, [2]), to support essential requirements of EU Directive 2010/31/EC on the energy performance of buildings (EPBD) [1]. The main recommendations from the Intelligent Energy Europe CENSE project [3] were adopted in the Mandate.

This article introduces the subset of EPB standards dealing with the energy use and the thermal performance of building and building elements. These standards are developed or revised under the responsibility of the CEN technical committee, CEN/TC 89, *Thermal performance of buildings and building components*, in collaboration with ISO/TC 163, *Thermal performance and energy use in the built environment* or ISO/TC 163 subcommittee SC 02, *Calculation methods*. The focus in this article is on the standards which are new or significantly revised.

Set of EPB standards

EPB standard

An "EPB standard" is a standard that complies with the requirements given in the following three documents: CEN/TS 16628 [4], the basic principles for EPB standards, CEN/TS 16629 [5], the detailed technical rules of EPB standards and EN 15603 [6], the overarching EPB standard.

For many of these standards the revisions are mainly editorial plus changes to make the procedures unambiguous and software proof, to rationalize the choices and to ensure consistent interconnections.

However, some of the standards are new or completely revised and/or reorganised.

Modular structure

EN 15603 [6], the overarching EPB standard, provides a modular structure of the assessment of the overall energy performance of buildings. The structure identifies different modules, see **Table 1**.

Most EPB standards in the subseries of EPB standards under the responsibility of CEN/TC 89 in collaboration with ISO/TC 163 and/or ISO/TC 163/SC 2, are in module M2, see **Table 2**.

Unambiguous, but flexible

Although each EPB standard shall contain only unambiguous procedures, there is a need for flexibility, to take into account differences due to national or regional building traditions, building use and regulatory context. Therefore, in each EPB standard, a template is given in an Annex A, to specify in a transparent way the choices with regard to the methods and the required (default or fixed) input data or input data sources. A set of informative default choices (using the template of Annex A) is provided in Annex B of each EPB standard. In case the standard is used in the context of national or regional legal requirements, a mandatory set of choices may be given at national or regional level for those specific applications, in particular for the transposition of EU Directives such as the EPBD [1] into national legal requirements.

Accompanying technical report

The Detailed Technical Rules for the set of EPB standards [5] ask for a clear separation between normative and informative contents:

- to avoid flooding and confusing the actual normative part with informative content
- to reduce the page count of the actual standard
- to facilitate understanding of the package

Therefore, each EPB standard or group of EPB standards is accompanied by an informative Technical Report, containing the informative documentation and justification, including worked examples of the accompanied EPB standard.

Accompanying spreadsheet

Also according to The Detailed Technical Rules [5], and in agreement with the mandate M/480 [2], an accompanying spreadsheet to each EPB-standard shall be prepared to test and validate each EPB calculation procedure.

The spreadsheet shall include a tabulated overview of all output quantities (with references to the EPB module where it is intended to be used as input), all input quantities (with references to the EPB module or other source from where the data are available) and fully worked example of the application (the calculation method between the set of input and output quantities) for validation and demonstration.

Table 1. Modules main areas, from [6].

Modules	Area
M1	Overarching standards
M2	Building (as such)
M3-M11	Technical Building Systems under EPB
M12-M13	Other systems or appliances (not under EPB)

Table 2. Submodules M2, from [6].

Sub	Sub area
1	General
2	Building Energy Needs
3	(Free) Indoor Conditions without Systems
4	Ways to Express Energy Performance
5	Heat Transfer by Transmission
6	Heat Transfer by Infiltration and Ventilation
7	Internal Heat Gains
8	Solar Heat Gains
9	Building Dynamics (thermal mass)
10	Measured Energy Performance
11	Inspection

CEN and ISO

Several EPB standards are being prepared or revised as combined EN ISO standards under the so-called Vienna Agreement between CEN and ISO. This is in particular the case for the standards introduced in this article, as explained further on.

Some other CEN and ISO working groups have decided, for practical reasons, for the time being to

work in parallel on separate CEN and ISO EPB standards, aiming to keep these as similar as possible, with the aim to merge these to EN ISO standards when the drafting has reached a more mature stage.

The intention is to come (eventually) to a complete and consistent set of ISO (EN ISO) standards on the Energy Performance of Buildings (EPB).

A unique Joint Working Group of ISO/TC 163 and ISO/TC 205, ISO/TC 163/WG 4 [7], [11] co-ordinates since 2009 the development of the set of EPB standards at the global (ISO) level, under the responsibility of the two ISO parent TC's.

Because the EPB standards under CEN/TC 89 are already EN ISO standards, they already need the (currently CEN only) overarching standard and the acceptance of the Basic Principles [4] and Detailed Technical Rules [5] for EPB standards not only at CEN, but also at ISO level.

Indeed, a new work item proposal is currently circulating in ISO to initiate the combined EN ISO development of the revision of FprEN 15603 [6].

The ISO 52000 series: consecutive numbering of all new ISO EPB standards

Recently, upon initiative of the ISO Joint Working Group, a series of consecutive ISO numbers has been reserved for the EPB standards, based on the modular numbering of items prepared in FprEN 15603 [6]. The numbers go from ISO 52000 until ISO 52150, with subseries for the successive modules.

This systematic set of consecutive ISO numbers may significantly boost the awareness on this EPB series. Gradually, all new or significantly revised ISO standards that are part of the set of EPB standards can receive the new number from this series.

The list covers both the standards and the corresponding technical reports. The rule is to always number a standards as an odd part number (part 1, part 3, etc.) and the corresponding Technical Report as an even part number (part 2, part 4, etc.).

For instance, the above mentioned EN ISO version of the EPB overarching standard will result in EN ISO 52000-1 and the accompanying technical report will become CEN ISO/TR 52000-2.

Subseries of EPB standards on energy use and thermal performance

There exists a long tradition of collaboration between CEN/TC 89 (*Thermal performance of buildings and building components*) and ISO/TC 163 (*Thermal performance and energy use in the built environment*) and its subcommittee SC 2 (*Calculation methods*).

Two of the "TC 89" standards are at the overarching level (M1), as shown further on. Also some of the other CEN/TC's are responsible for one or two specific overarching submodules, either by tradition or by strong affinity with other standards under their responsibility.

The other "TC 89"standards are under module M2 (building and building elements). These are prepared in collaboration between CEN and ISO either under ISO lead or under CEN lead, as shown further on.

Although all these standards and the accompanying technical reports are currently under preparation, we use in this article the stage indicators for the final published versions (e.g. EN ISO 52016-1) instead of the indicators for the current stage (e.g. prEN ISO/DIS 52016-1, draft standard for review). The (expected) period of enquiry of ach standard is mentioned in the list of references.

EPB standards on indicators, rating, requirements and certification; overall and building fabric

General considerations and overall energy performance

This concerns the new EN ISO 52003-1 [12] (plus the accompanying technical report CEN ISO/TR ISO 52003-2 [13], which provides more elaboration, explanation and justification). For the overarching module M1-4, Ways to Express Energy Performance. Lead: ISO/TC `63/WG 4 (JWG) [7].

These new texts will replace EN 15217:2007 and ISO 16343:2013, which are reworked and extended. The new standard and its technical report first provide general guidance on the intelligent use of the output of the EPB assessment methods, applicable to both overall EPB aspects and partial EPB features. Next, these principles are applied practically to the overall energy performance and its indicators, for which structured reporting formats are provided.

It is very important to realize:
if the level of sophistication of the ways to express the energy performance and the energy performance

requirements does not match the level of sophistication of the procedures to assess the energy performance, as laid down in the set of EPB standards, then these refined assessment procedures miss the target.

This is illustrated by the example in **Figure 1**.

Successively the following concepts are defined and discussed in the standard:

- Energy performance features
- Numerical EPB indicator(s)
- EPB rating
- EPB requirements
- EPB certificate

Each of these can refer to the overall energy performance and/ or (except the EPB certificate) to a specific energy feature (building element or group of elements, energy need, subsystem, etc.).

The texts give the rationale for the selection of an adequate mix of EPB requirements.

For setting sufficiently refined, tailored requirements that match the degree of sophistication of the EPB assessment methods, the specification of references requires detailed attention. In fact, proper references are tailored (project-specific), to reflect a fairly uniform technological-economic effort for each individual project over the entire and diverse range of possible building geometries. This is discussed in detail in the texts. In addition, a detailed description shows the equivalence of the formula and notional reference building approaches to determine the reference.

Structured tables are provided for reporting the chosen requirement mix and the selected numerical indicators.

Illustration

A practical example is given in **Figure 1**, which illustrates on the basis of some 200 real dwelling shapes how for a given set of technical measures the numeric value of an EPB indicator can strongly vary from one project to another.

If the reference value that is used for rating and/or to set a requirement is a fixed value (in casu: requirement expressed as maximum value in kWh/m² floor area disregarding building shape or size), then buildings with a relatively large envelope area would need a large technological-economic effort to meet the requirement, while on the other hand buildings with a relatively small envelope area would need only a small technological-economic effort to meet the same requirement. A more appropriate reference for the rating and/or requirement would take into account this variation.

Building fabric

This concerns the new standard EN ISO 52018-1 [19] (with the accompanying technical report EN ISO/TR 52018-2 [20]), for module M2-4, Ways to Express Energy Performance. Lead: ISO/TC 163/SC 02/WG 15 [9].

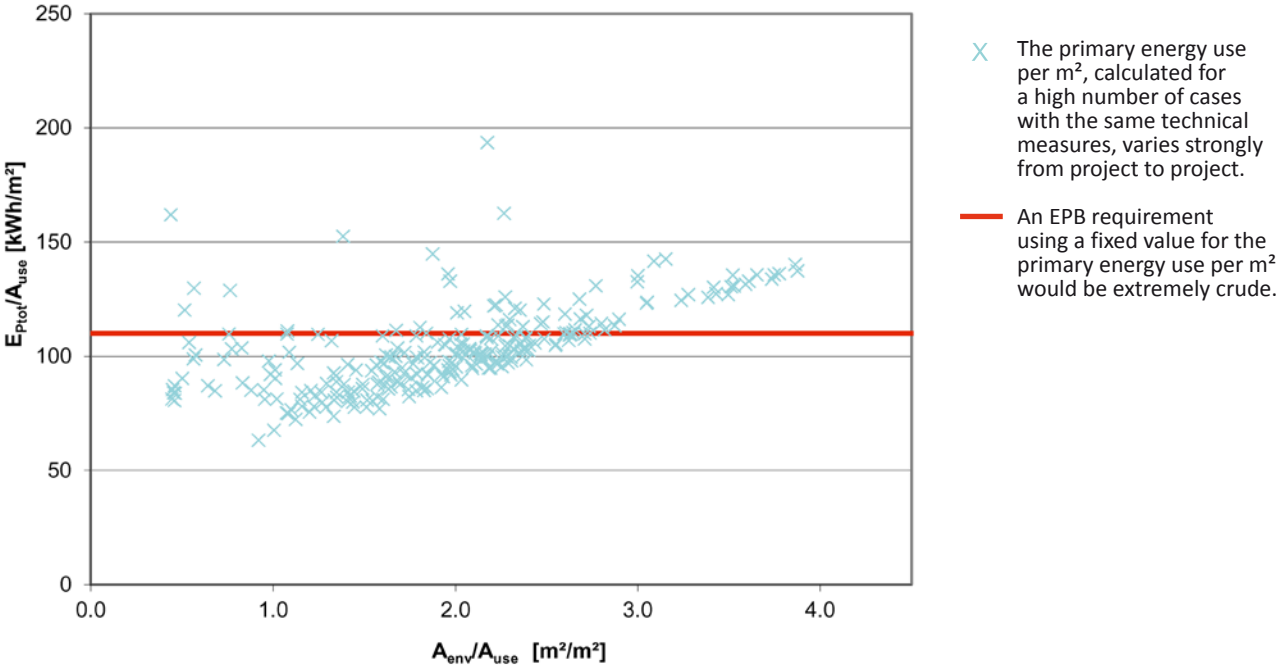


Figure 1. Example how the impact of a sophisticated energy performance assessment misses its target if the corresponding energy performance requirements are less refined.

These new texts discuss in detail the many possible EPB features and their respective numeric indicators that can be used for setting requirements related to the energy efficiency of the fabric and to the heating and cooling energy needs. Here too, structured reporting formats for these aspects are provided. In the technical report, the following aspects are discussed for each of the features: possible motivations for setting a requirement, possible numeric indicators, comparable economic strictness of the requirements, practical points of attention, testing aspects when applicable, new construction and renovation issues and exceptions. This information helps public and private actors to set in well-informed manner EPB requirements with a view of achieving the objectives that are pursued.

Overarching EPB standard on external environment conditions

This concerns a new standard, EN ISO 52010-1 [14] (plus the accompanying technical report CEN ISO/TR ISO 52010-2 [15]), for the overarching module M1-13, External Environment Conditions. Lead: ISO/TC 163/SC 02/WG 15 [9].

This International Standard provides the common standard climatic data that shall be used for the all relevant EPB modules.

The standard gives procedures to calculate the distribution of solar irradiation on a non-horizontal plane based on measured hourly solar radiation data on a horizontal surface, obtained from EN ISO 15927 (part 1, 2 and 4) [21]. The procedures include assumptions to assess the impact of surrounding obstacles on the irradiation (shading). A simple method for conversion of solar irradiance to illuminance is also provided. The solar irradiance and illuminance on an arbitrary surface are needed as input for energy and daylighting calculations.

The standard also contains procedures for the use of (other) output from EN ISO 15927 (part 1, 2, and 4) as input for the EPB assessment.

Calculation of the distribution of solar irradiation on a non-horizontal plane

The model is named after Mr Perez. Several improvements were made in the course of time. The calculation procedure described in this standard is based on the ”simplified Perez model” proposed in the early 90’s. The explanation and justification is given in CEN ISO/TR 52010-2 [15]. Essentially, the model is composed of three different components:

1) a geometric representation of the sky dome;

2) a parametric representation of the insolation conditions, and;

3) a statistic component linking both components mentioned before.

It is a model of anisotropic sky, where the sky dome is geometrically divided into three areas, each of them showing a constant radiance, different from the other two.

These three areas are:

- Isotropic diffuse (for the sky hemisphere);
- Circumsolar radiation;
- Horizon brightness.

For the purposes of this International Standard the following is added:

- Isotropic ground reflected radiation

The diffuse (sky) radiation for the surface uses as input hourly values of diffuse horizontal and direct beam solar radiation. Other inputs to the model include the sun's incident angle to the surface, the surface tilt angle from the horizontal, and the sun's zenith angle.

Calculation of illuminance

For the luminance distribution of the sky and ground the irradiation is converted into illuminance by multiplication with the global luminous efficacy (Lm/W).

Calculation of shading by external objects

Shading by distant objects is taken into account through a shading correction coefficient for the direct radiation. Shading of diffuse radiation and reflection by distant objects is not taken into account, as explained below. Shading by fins and overhangs is calculated in EN ISO 52016-1.

Objects in the environment may block part of the solar irradiation on a plane (e.g. hills, trees, other buildings). The same or other objects may also reflect solar radiation and consequently lead to a higher irradiation. For example, , a highly reflecting surface (e.g. glazed adjacent building) in front of the (on the Northern hemisphere) North facing façade of the assessed building.

In order to avoid that for those objects specific solar reflectivity data have to be gathered, it is, as simplification, assumed that:

a) The direct radiation (including circumsolar irradiation) is partially blocked, if the object is in the path between sun and plane;

b) the diffuse irradiation (including irradiation from ground reflectance) remains unaffected.

This is physically equal to the situation where the radiation reflected (and/or transmitted) by the objects in the environment is equal to the diffuse radiation blocked by these objects.

This approach is chosen for simplicity. The effects on the accuracy of the calculated solar radiation have to be determined. An alternative method is to take diffuse shading into account. In order to do this sky view factors have to be calculated. This can be simplified by dividing the skyline in different segments and calculate the sky view factors for each segment separately assuming an equal skyline height over the segment.

Other climatic data

The standard also contains procedures for the use of (other) output from EN ISO 15927 (part 1, 2, and 4) [21] as input for the EPB assessment, such as:

- air temperature;
- atmospheric humidity;
- wind speed;
- precipitation;
- solar radiation;
- longwave radiation.

The reason for passing these data via this standard is to have one single and consistent source for all EPB standards and to enable any conversion or other treatment if needed for specific application.

EPB standards on calculation of the energy needs for heating and cooling, internal temperatures and heating and cooling load in a building or building zone

This concerns the new standards EN ISO 52016-1 [16], EN ISO 52017-1 [17] (plus accompanying technical report CEN ISO/TR ISO 52016-2 [18]), for the modules M2-2, Building Energy Needs, M2-3, (Free) Indoor Conditions without Systems, but also for M4-3, Maximum Cooling Load. Lead: ISO/TC 163/SC 02/WG 15 [9].

Reorganization

Current set:

Currently, there are several strongly related international standards available in which an hourly calculation method is described. These standards all have a different purpose, but there is a large overlap between them, in input data, boundary conditions, assumptions, calculation procedures and validation procedures. This concern:

- EN ISO 13790:2008, Energy performance of buildings – Calculation of energy use for space heating and cooling
- EN 15265:2007, Thermal performance of buildings – Calculation of energy use for space heating and cooling – General criteria and validation procedures
- EN ISO 13791:2012, Thermal performance of buildings – Calculation of internal temperatures of a room in summer without mechanical cooling – General criteria and validation procedures
- EN ISO 13792:2012, Thermal performance of buildings – Calculation of internal temperatures of a room in summer without mechanical cooling – Simplified methods
- EN 15255:2007, Thermal performance of buildings - Sensible room cooling load calculation - General criteria and validation procedures

Therefore a restructuring of these standards was proposed and agreed in ISO/TC 163/SC 2 and CEN/TC 89.

New set:

These standards are replaced by EN ISO 52017-1, EN ISO 52016-1 and the accompanying technical report CEN ISO/TR 52016-2.

In the new set, there is a clear separation between a generic calculation method, and specific applications of this calculation method with specific assumptions, simplifications and specific input data, depending on the application:

EN ISO 52017-1 contains a generic (reference) method to calculate the hourly thermal balance in a building (zone). This method is based on and replaces EN ISO 13791. This standard contains no specific assumptions, boundary conditions, specific simplifications or input data that are not needed to apply the generic calculation method. This standard also includes validation cases (as in EN ISO 13791). Specific assumptions and input data are given that only apply to these validation cases. In this way

the generic method and validation cases are clearly distinguished.

EN ISO 52016-1 cancels and replaces EN ISO 13790:2008, which was developed during the first EPBD mandate (M/343). It contains a (new) simplified hourly calculation method and a monthly calculation method. The hourly calculation method is a specific application of the generic method provided in EN ISO 52017-1. This standard further contains specific boundary conditions, specific simplifications and input data for different applications (energy needs for heating and cooling, internal temperatures, heating or cooling load).

Moreover, the hourly and the monthly method in EN ISO 52016-1 are closely linked: they use as much as possible the same input data and assumptions. And the hourly method produces as additional output the key monthly quantities needed to generate parameters for the monthly calculation method. This means that a number of (nationally) representative cases can be run with the hourly method and from the key monthly quantities the monthly correlation factors can be derived.

Reference hourly method in EN ISO 52017-1

EN ISO 52017-1 provides a generic hourly calculation procedure, with only a minimum number of assumptions needed to define the energy balance equations, with no specific application, no specific solution technique and no specific input data. Specific assumptions and input data are only given for a set of test cases to validate the procedures.

The generic reference hourly calculation method to calculate the thermal balance in a building or building zone produces as main output the hourly indoor air, mean radiant and operative temperature.

The content of EN ISO 13791:2012 has been re-used without major changes, except:

- The heating or cooling needs are added, but just as a term in the thermal balance. The control of heating and cooling, involving temperature set points and control types, is left to the specific application standard(s) such as EN ISO 52016-1.
- Specific boundary conditions that are not relevant for the reference method have been moved to EN ISO 52106-1 and/or to the validation cases.

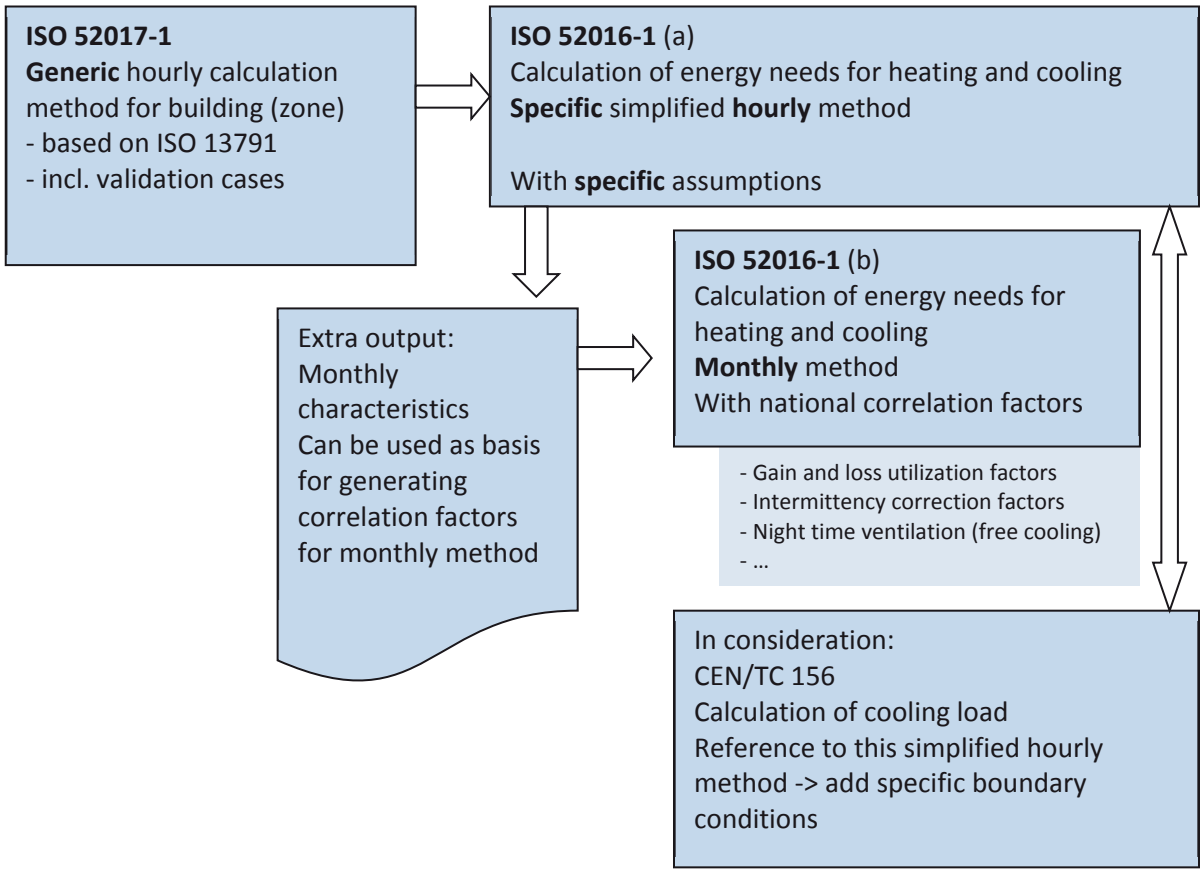


Figure 2. The relation between EN ISO 52016-1 and EN ISO 52017-1.

- The moisture balance equation from (informative) Annex K of EN ISO 13791 has been added to EN ISO 52017-1, also in the form of (normative) generic equations. The control of latent heat flow, involving humidity set points and control types, is left to the specific application standard(s) such as EN ISO 52016-1.

So EN ISO 5207-1 focuses on the reference hourly calculation procedures and associated validation cases and criteria.

Application in EN ISO 52016-1

Introduction

This International Standard presents a coherent set of methods at different levels of detail, for the calculation of the energy needs for space heating and cooling and/or calculation of the internal temperatures and/or calculation of the heating and/or cooling loads of a building or building zone, including the influence from technical buildings systems, control aspects and boundary conditions where relevant for the calculation. More in detail:

Simplified hourly method in EN ISO 52016-1

The hourly calculation procedure in this International Standard has been derived from the reference calculation procedure as given in EN ISO 52017-1.

EN ISO 52016-1 contains a specific (simplified) hourly method to calculate the hourly energy needs for heating and cooling and/or the hourly indoor temperature (air, mean radiant and operative) and latent energy needs (humidification and dehumidification).

The simplified hourly method in EN ISO 52016-1 is more advanced than the simplified hourly method given in EN ISO 13790:2008. The main difference is that the building elements are not aggregated to a few lumped parameters, but kept separate in the model. This makes the method more transparent and more widely usable, e.g. because:

- there is no worry about how to combine e.g. the heat flow through the roof and through the ground floor, with their very different environment conditions (ground temperature and ground inertia, solar radiation on the roof);
- the thermal mass of the building or building zone can be specified per building element and there is no need for an arbitrary lumping into one overall thermal capacity for the building or building zone;
- the mean indoor surface temperature (mean radiant temperature) can be clearly identified.

At the same time, the input data to be supplied by the user are (still) the same as for the monthly method.

Only the standard writers will have to introduce extra data: hourly operation schedules and weather data. On the other hand, the standard writers don't need to prepare tables with pre-calculated factors (on operation of blinds, effect of solar shading, etc.).

The drawback is that due to the much higher number of nodes a robust numerical solution method is required (software).

EN ISO 52016-1 is an application of the method provided in EN ISO 52017-1. In function of the application, specific assumptions, simplifications, solution techniques and input data restrictions are provided in the standard. See CEN ISO/TR 52016-2 for extensive explanation and justification.

With the hourly calculation method the thermal balance of the building or building zone is made up at an hourly time interval.

The main goal of the hourly calculation method compared to the monthly method is to be able to take into account the influence of hourly and daily variations in weather, operation (solar blinds, thermostats, heating and cooling needs, occupation, heat accumulation, etc.) and their dynamic interactions for heating and cooling. This limited goal enables to keep the extra input for the user compared to the monthly calculation method to a minimum.

The hourly climatic data are given in EN ISO 52010-1 and the hourly and daily patterns of the conditions of use (operating schedules) are given in the relevant other EPB standards. The hourly method produces also key monthly data that are essential for a quick understanding of the main processes involved and as a means to derive correction and adjustment factors for the monthly method.

Monthly method in EN ISO 52016-1

EN ISO 52016-1 contains also a specific monthly method to calculate the (monthly) energy needs for heating and cooling.

Because the physical processes are highly nonlinear (because at one moment there is a heating or cooling need and at other moments there is not; because of the inertia of the building; because of the dynamic interactions with the systems and users), there are many dynamic effects, which cannot be explicitly accounted for by taking monthly mean values. These are approximated by

simplified equations using correlation factors or simple correction factors. For instance for the utilization of the momentary gains and losses, for intermittent heating and cooling, for free cooling by ventilation, et cetera.

These correlation and correction factors can be developed on the basis of the results from series of calculations on a variety of cases using the hourly calculation procedures, as shown in **Figure 2**. E.g. at national or regional level, to produce national or regional correction and adjustment factors replacing the informative default values from Annex B if needed.

The calculation method is basically the same method as in EN ISO 13790:2008.

For intermittent heating and cooling new straightforward formulae were developed (see explanation in CEN ISO/TR 52016-2), because the equations from EN ISO 13790:2008 appeared to lead to unintended results. The challenge was to develop a simple method that provides a rough approximation of the mean internal temperature over the intermittency period. A refined approximation would not be justified, because there are many inevitable simplifications anyway. The monthly method is not capable to deal accurately with the dynamics in the heat balance, for instance:

- no distinction in ventilation rate, operation of solar blinds, internal heat gains (incl. lighting) during occupancy periods (e.g. office hours) and during the periods with reduced heating or cooling set-point temperature (e.g. for offices: nights and weekends): the monthly method can only deal with monthly mean values;
- no distinction between operational and air temperature;
- no possibility to take into account a boost mode, with –optionally- a maximum heating or cooling power during the boost period;
- no distinction between periods (e.g. days or hours) in heating or cooling mode: the monthly method calculates for each month both the heating need *and* the cooling need as two completely separate calculations, without interaction, each with the specific assumptions, e.g. on the use of solar blinds, ventilation, etc., for the heating and the cooling mode respectively. In reality there will be days in heating mode and days, alternating, in cooling mode.

Because of the dynamic character of the moisture balance in a thermal zone, the calculation of the latent heat for (de-)humidification is not foreseen in the monthly method.

The monthly method uses monthly climatic data and monthly mean conditions of use and occupancy patterns.

Specific assumptions per application in EN ISO 52016-1

- Although aim and outcome of the hourly calculation of the internal temperature, the energy need for heating and cooling and the calculation of the heating and cooling load are different, the calculation method is the same and they use the same inputs as far as possible. However, specific assumptions of the calculations may differ. This is foreseen in the standard.
- As much as possible the monthly and hourly calculation of the energy need for heating and cooling use the same assumptions and boundary conditions. Also the same inputs are used as far as possible, although for the monthly method averaged on monthly basis and where relevant corrected to approximate the impact of dynamic effects and dynamic interactions (e.g. recoverable heat or cold from the technical building systems, control actions) that are not covered by the monthly time step.

Removal of overarching elements from EN ISO 52016-1

Several parts of EN ISO 13790:2008, preceding or following the actual calculation of the energy needs for heating and cooling, are now covered at overarching level and should therefore be removed from the standard on the energy needs for heating and cooling:

- assessment boundaries (moved to overarching standard, M1-5);
- general zoning rules (moved to overarching standard, M1-8);
- assessment of conditioned floor area (moved to overarching standard, M1-5);
- conditions of use (moved to overarching level, EN 16798-1, M1-6).

Consequently these elements are not taken over in EN ISO 52016-1 from EN ISO 13790:2008.

Relation EN ISO 52016-1 with other EPB standards

For the input-output relations with the other EN and EN ISO standards in the set of EPB standards, only EN ISO 52016-1 (and not EN ISO 52017-1) is relevant.

There are many inputs from and many interactions with many other EPB standards. More details are given in the technical report [18].

EPB standards on hygrothermal performance of building components and building elements

This concerns the revision of a suite of standards mainly under module M2-5: EN ISO 6946, EN ISO 10211, EN ISO 13370, EN ISO 13786, EN ISO 13789 and EN ISO 14683, plus the preparation of one accompanying technical report on this cluster, CEN ISO/TR 52019-2. Lead: ISO/TC 163/SC 2/WG 9 [8].

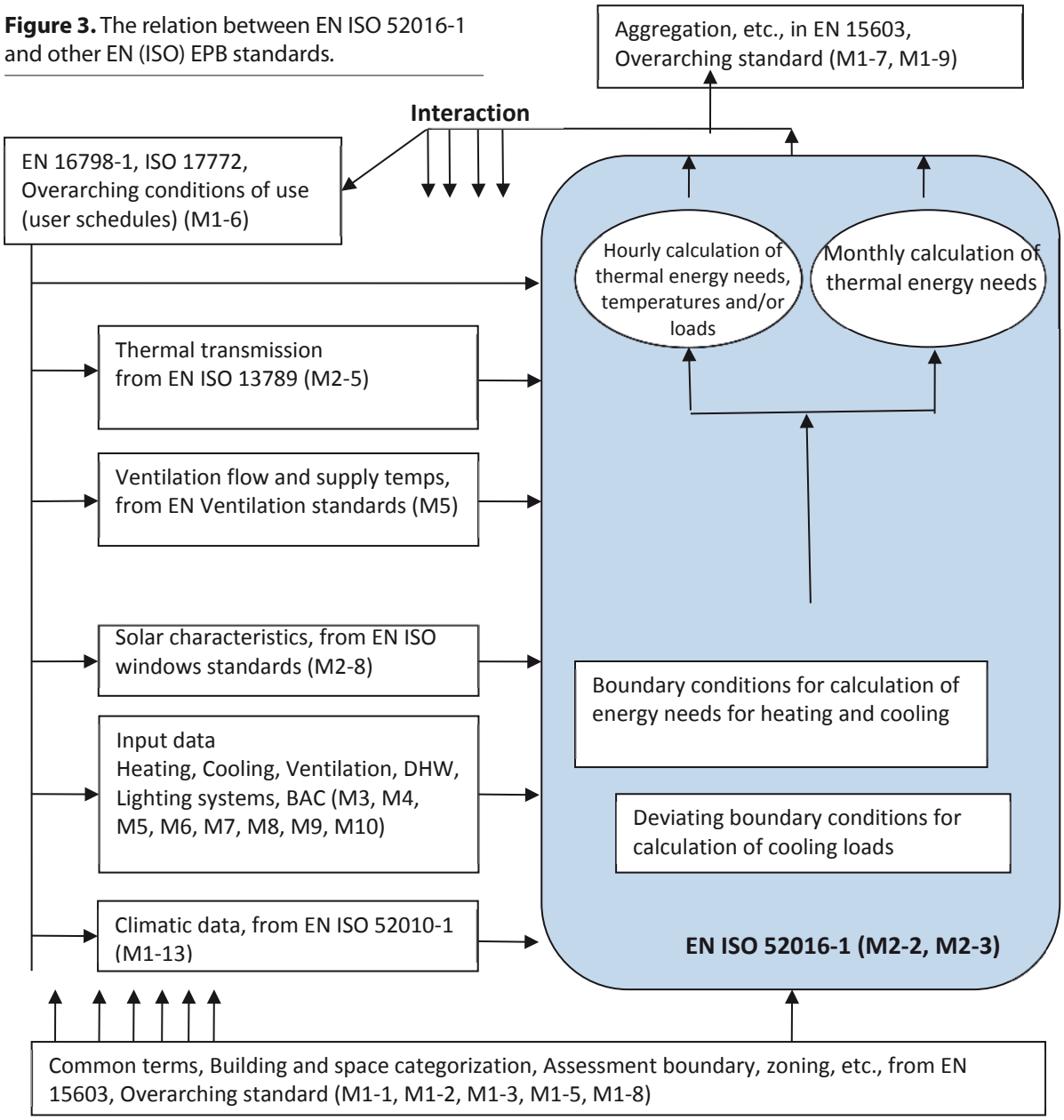
For these standards the revisions are mainly editorial, plus changes to make the procedures unambiguous and software proof, to rationalize the choices and to ensure consistent interconnections, in particular with all the other standards in the "CEN/TC 89" family of EPB standards.

EPB standards on thermal, solar and daylight properties of windows and facades

This also concerns the revision of a suite of standards under module M2-5 and M2-8: EN ISO 10077-1, EN ISO 10077-2 and EN ISO 12631 as well as EN 13363-1 (new number: ISO 52022-1) and EN 13363-2 (new number: ISO 52022-3), plus the preparation of one accompanying technical report on this cluster, CEN ISO/TR 52022-2. Lead: CEN/TC 89/WG 7 [10], in collaboration with ISO/TC 163/SC 2/WG 9 [8].

Also for these standards the revisions are mainly editorial, plus changes to make the procedures unambiguous and software proof, to rationalize the choices and to ensure consistent interconnections, in particular with the other standards in the "CEN/TC 89" family of EPB standards and with the (CEN) product standards in this field.

Figure 3. The relation between EN ISO 52016-1 and other EN (ISO) EPB standards.



In addition, a new work item proposal on dynamic facades was proposed. For the time being this subject is adopted as Annex G in EN ISO 52016-1. This annex provides a framework for the energy, load and internal temperature calculations in case of dynamic transparent building elements. Dynamic transparent building elements are elements with thermal and/or solar and/or visual properties that vary with boundary conditions, either passively or due to an active control.

Conclusion

In this paper the subset of EPB standards dealing with the energy use and the thermal performance of building and building elements were introduced, with the focus on the standards which are new or significantly revised. All these standards are being prepared as EN ISO standards, continuing the tradition of successful collaboration between CEN/TC 89, *Thermal performance of buildings and building components* and ISO/TC 163, *Thermal performance and energy use in the built environment*.

These standards cover a wide ranging chain, from building components and elements, and climatic data, to hourly and monthly calculation of the energy needs for heating and cooling and indoor temperatures, to energy performance indicators and expressions for energy performance rating and requirements. The main goal is to make these standards credible and useable, unambiguous but flexible and consistent. ■

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The authors would also like to acknowledge, for their valuable input and comments, all the active experts in the ISO and CEN working groups to which the preparation of these standards has been assigned.

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