July 12, 2022

Informal guidance document on the Systematic Review (SR) of EPB standards published in 2017

Prepared by:

ISO/TC 205/AG1, JAG of ISO/TC 205 and ISO/TC 163 on the coordination of the ISO 52000 family

CEN/TC 371 Task Group on Systematic Review and Energy Performance of Buildings Directive revision

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Abbreviations

CCMC	CEN-CENELEC Management Centre
CEN	European standards organization
CIB	Committee Internal Ballot (of ISO or CEN)
CS	ISO Central Secretariat
EC	European Commission
EN	European standard
EPB	Energy Performance of Buildings
EPBD	Energy Performance of Buildings Directive (EU)
EPB standard	Standard for the calculation of energy performance of buildings, that complies with the requirements given in ISO 52000-1, CEN/TS 16628 and CEN/TS 16629 or later updates
EPC	Energy Performance Certificate
ISO	International organization for standardization
JAG	Joint Advisory Group
JWG	Joint Working Group
MEPS	Minimum Energy Performance Standards ("standards" in the sense of "benchmarks"/"requirements")
MS	EU Member State(s)
NA (/ND)	National Annex or National Datasheet for EPB standards
NSB	National Standards Body of CEN and/or ISO
NWIP	New Work Item Proposal (of CEN and/or ISO)
SR	Systematic Review (of ISO and/or CEN standard)
SRI	Smart Readiness Indicator (required by EPBD)
TC	Technical Committee (of CEN and/or ISO)
TR	Technical Report (of CEN and/or ISO)
TS	Technical Specification (of CEN and/or ISO)
VA	Vienna Agreement on technical cooperation between ISO and CEN
XLS	Spreadsheet

1 Introduction

1.1 Aim and status of this document

In 2017 a high number of (EN) ISO and CEN standards were published to collectively assess the overall Energy Performance of Buildings: the set of EPB standards. In the course of 2022 (5 years after publication) many of these documents will, individually, be subject to systematic review (SR).

These standards constitute an integrated and coordinated package that need to be maintained and kept coordinated.

The aim of this informal document is to increase the effectiveness of the SR and the subsequent SR evaluation by providing background information and considerations for National Standards Bodies. On the whole set of EPB standards, with additional considerations for specific individual standards.

This document is distributed to the ISO and CEN committees that are responsible for one or more of the EPB standards: ISO/TC 163, ISO/TC 163/SC 2, ISO/TC 205, CEN/TC 371, CEN/TC 89, CEN/TC 156, CEN/TC 169, CEN/TC 228 and CEN/TC 247.

Request to the National Standards Bodies:

Given the large number of documents involved, we would like to invite the National Standards Bodies (NSBs) to encourage their relevant stakeholders to consult this guidance document as part of the Systematic Review (SR).

The NSBs are invited to provide feedback specifically on:

- Chapter 9 (Questions to NSBs)
- Chapter 10 (Items for consideration)
- Chapter 11 (Focus on specific EPB standards)

If the feedback from the NSB is general for the set of EPB standards, the response may be sent to the contact persons (see chapter 12).

If the feedback is on a specific EPB standard it makes sense to send the response as comment with the national voting on the SR.

Further actions anticipated:

The core content of this document contains strategic overarching information on the set of EPB standards that is not only relevant for the current SR. Therefore it is foreseen that the information will remain available and kept up-to-date for the foreseeable future.

An introduction to this document in the form of a short webinar or video is under consideration. Also under consideration is an international on-line workshop of ISO and CEN experts, halfway the SR ballot, in September 2022.

1.2 Background

In 2017 a high number of (EN) ISO and CEN standards were published to collectively assess the overall Energy Performance of Buildings: the set of EPB standards. These standards constitute an integrated and coordinated package that need to be maintained and kept coordinated. Though the individual EPB standards can be used within national EPB assessment procedures, and external modules can be integrated in the set, the EPB standards are specifically valuable as an overall package.

In the course of 2022 (5 years after publication) each of these (over 40) documents[1] will be subject to systematic review (**SR**). The review concerns, of course, each individual document. See **Annex 1** for the list of standards involved and responsibility overview.

The challenge is to improve the overall set and to improve (and certainly not disrupt) the interoperability when all these standards are reviewed individually and in different TCs.

The project leaders for the development of the set of EPB standards (2012-2017) and experts in the responsible CEN and ISO/TC's are aware of some needed revisions. It seemed of value to include this information too.

> From feedback received in the past years (by these experts, by the ISO and CEN WG convenors and TC secretariats, and the EPB Center), we already know that some standards need some update (editorial and/or technical updates). Updates may also be needed to make standards better suited for software development which is needed to make the standards better accessible.

The Technical Reports (TRs) accompanying each EPB standard are not circulated for systematic review at this moment but, should the relevant standard need updating, the relevant TR is likely to need updating too.

1.3 Information on the SR process as to be carried out by CEN and ISO

SR is an automated process where National Standards Bodies (NSB's) receive a request to give advice on the question if a standard should be reconfirmed, revised or withdrawn.

The outcome of the SR is a basis for the TC to decide if and when to launch a New Work Item Proposal (NWIP) vote to revise/update the standard. Even if the SR shows a majority of the countries that recommends revision for a certain standard, the TC can still decide not to start a revision, or not yet.

If the TC decides on revision/amendment, they need to assure the resources are available (project leader, experts and secretariat) in the relevant WG of the TC. Since these recourses are limited, there is also coordination needed after the review.

For EN ISO Standards, CEN does not carry out systematic reviews. ISO carries out the systematic reviews on the corresponding – identical – ISO standards and decides on their future:

- if ISO confirms the ISO standard, the corresponding EN ISO standard is considered as confirmed as well;
- if ISO decides to amend or revise the ISO standard, a corresponding project (work item) is registered in the CEN programme of work, under the Vienna Agreement, ISO lead;
- if ISO decides to withdraw the ISO standard, CEN CCMC proposes to BT to withdraw the corresponding EN ISO as well.

1.4 Review from the perspective of overall quality and consistency

Each of the documents under SR is part of the whole set of EPB standards. Therefore, if each of the documents is only reviewed as a stand-alone document, there is a risk of fragmentation of the overall quality, consistency and interoperability.

The monitoring of the overall quality and consistency of the whole set of EPB standards is a task that is coordinated in ISO by the Joint Advisory Group of ISO/TC 205 and ISO/TC 163 (*Coordination of ISO 52000 family*), in collaboration with the ISO/TC 163 and TC 205 JWG 4 (*Energy Performance of Buildings using the*

[1] Unless already reviewed earlier or superseded.

holistic approach) and in CEN by CEN/TC 371 (*Energy performance of buildings*), in conjunction with the other relevant committees.

1.5 Recommendations

The ISO directives allow for the responsible technical committees to include a recommendation for whether a document under SR should be revised, confirmed, or withdrawn [2]. Such recommendation requires a formal approval by the TC, prior to the launch of the SR. The recommendation is then distributed to all ISO members.

The underlying guidance document, to be distributed simultaneously with the launch of the SR, is different: it is an informal document that aims to provide general and specific contextual information, considerations and questions on how the set of EPB standards could gain in quality, usability and global relevance. It is distributed to all members of the relevant ISO and CEN committees.

1.6 Timing

In both ISO and CEN, the launch of the 20 weeks SR has been synchronized, with July 15, 2022 as starting date for each of the documents[3]. This Guidance Document is intended to be distributed simultaneously to the responsible ISO and CEN/TCs around this date.

These recommendations and the feedback as result of the SR are to be considered as only a first step, because a major revision of the set of EPB standards (if and to the extent that it is needed) will require prioritization, depending on time, expertise and resources (financial, experts) that can be made available[4].

Figure 1 sketches the currently known and tentative future time line, for the SR and related programmes:

- Revision of the EPBD in Europe, see chapter 4.
- Revision of the quality documents for the set of EPB standards CEN/TS 16628/9, see chapter 5.
- ISO and CEN SMART Programmes (digitization), see chapter6.

[2] https://www.iso.org/sites/directives/current/consolidated/index.xhtml#_idTextAnchor224:
"Before the systematic review ballot, the committee may prepare a recommendation, to be approved by its P-members, on the future of the document. This recommendation will be made available with the SR ballot.

[3] Note that for EN ISO standards the SR is always launched by ISO.

[4] In any case, the actual decision to start a revision or not is taken by the TC, with a written, dedicated ISO/CEN TC vote, per standard. Under the rules established by joint rules document JWG N584 items under ISO/TC 163/JWG 4 are reviewed by both ISO TC 163 and TC 205.

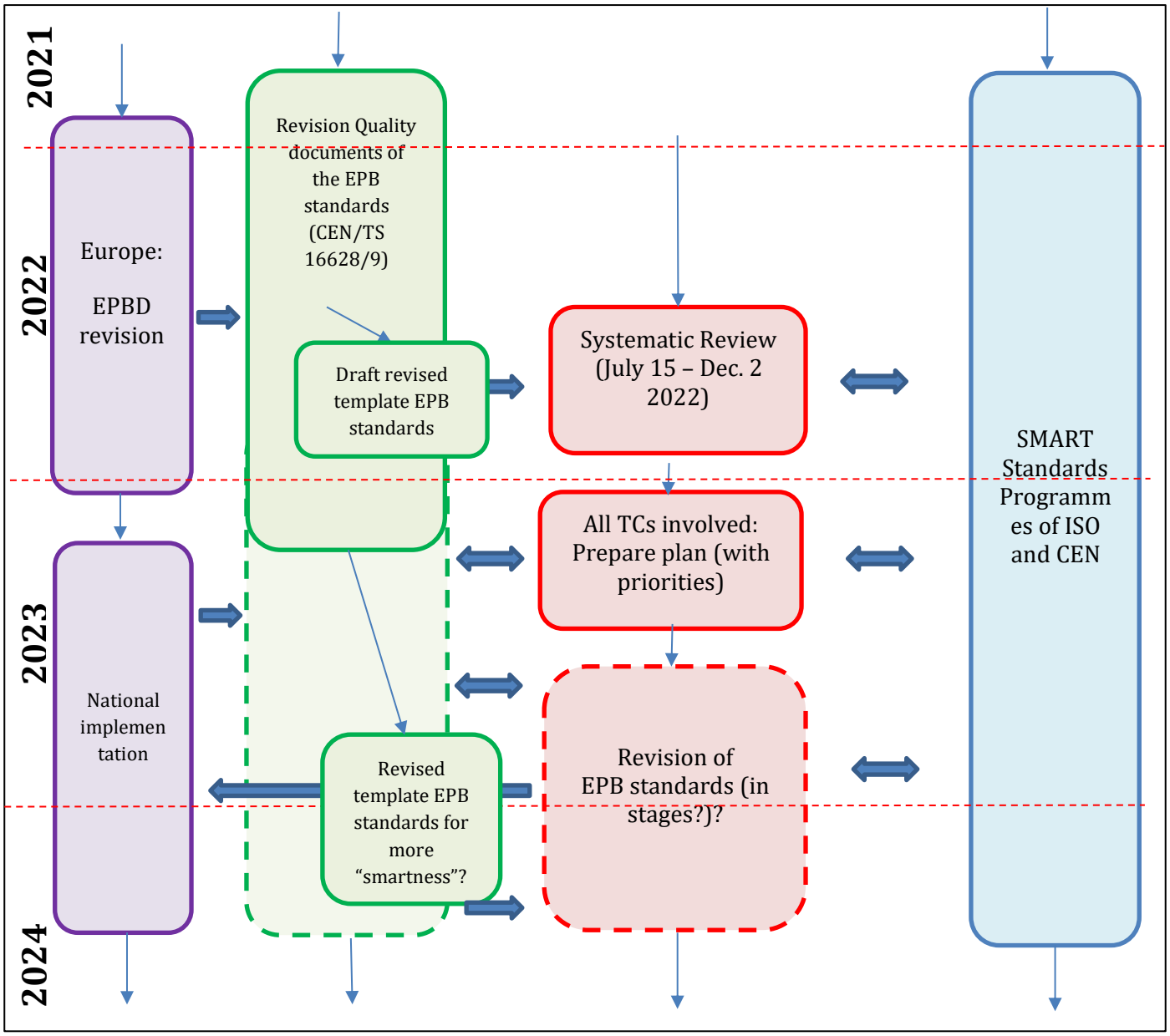


Fig. 1 – Current and partly tentative time schedule, including related initiatives

As shown in **Figure 1**, the various related activities run largely in parallel. This implies that a dynamic interaction is needed in order to come to satisfying results at all fronts.

On the other hand this creates a unique opportunity to exchange and feed in experiences.

For Europe, the main challenge will be to have revised EPB standards available in time for national implementation of the revised EPBD. A staged approach seems necessary, with priority for the main EPBD requirements on the EPB assessment methodology.

2 Information at the EPB Center

A lot of detailed information on the set of EPB standards has been made available at the website of the EPB Center [1], including spreadsheet tools, webinar presentations and short videos with explanation, example NAs, FAQs and example case calculations on individual EPB standards and overall EP.

Link: https://epb.center/

See **Annex 4** for background information on the EPB Center initiative.

3 ISO and CEN

The challenges to reduce the dependency on non-renewable sources are huge. It is in the interest of all countries and stakeholders to combine forces and facilitate cross-border trade and knowledge exchange.

Therefore, it is positive trend that an increasing number of EPB standards are becoming available not only at European (CEN) level, but also at global (ISO) level.

The benefits of global convergence and harmonization of terms and definitions and assessment procedures impact a wide variety of stakeholders:

— National and international policymakers.
— National and international regulators and energy agencies.
— EPB assessors.
— Manufacturers and component suppliers.
— Building designers and system engineers.
— Software developers.
— Project developers and building companies.
— Financial institutes.
— Research and education.

Some CEN and ISO working groups have decided, for practical reasons, (e.g. for the time being) to work in parallel on separate CEN and ISO EPB standards.

Also the limited availability of resources hinders the preparation of EPB standards at global level, even where CEN standards are already available.

The quality documents on the EPB standards (see chapter 5) provide tips/tools for harmonization at global level (ergo: to produce EN ISO standards) while still allowing necessary national and regional differentiation to facilitate implementation in different countries and the setting of national or regional energy performance requirements.

Why publish a document as EN ISO standard and not just as ISO standard?

An ISO standard is relevant at global level, so why is there then still a need for an EN ISO standard?

By publishing the standard as a combined CEN and ISO standard European interests are secured. This is important, because after the publication of a European (CEN) standard, each national standards body or committee is obliged to withdraw any national standard which conflicts with the new European standard. Hence, one European standard becomes the national standard in all the 34 member countries of CEN and/or CENELEC. In addition, some CEN standards may also be made

mandatory in the framework of EU legislation. However, this is not the case for the set of EPB standards.

4 Revision of EPBD in Europe

In Europe, an important factor that will influence the content of the NWIP is the revision of the EPBD. The current EPBD is the EPBD:2010 [3], which was amended in 2018 [4].

The EC's proposal for the EPBD revision [5], published in December 2021, clearly shows that the changes compared to the current EPBD will have impact on certain EPB standards.

However currently we don't have the final EPBD text which is expected by the end of 2022. This implies that the final evaluation of the SR results in the TC's can only be done by the end of 2022.

If CEN TCs want to prepare a standardisation request (previously called 'mandate') from the European Commission to support the work to be done, this could be developed based on the SR outcomes from the different TC's. A proposal for a standardisation request needs serious work, as the CEN/TC 371 expert group did in preparation for the mandate from the European Commission M480 [2].

A **preliminary, EPB standards related, evaluation** of the EPBD revision proposed by the EC is given in **Annex 2**.

5 Common EPB Quality documents (under revision)

The common quality documents for all EPB standards are **CEN/TS 16628** (Basic Principles) [6] and **CEN/TS 16629** (Detailed Technical Rules) [7]. These documents, published in 2014, are currently under revision (CEN/TC 371/WG 1).

Because these documents are equally relevant for **ISO** EPB standards, these common quality documents are shared with the ISO experts and made available in the relevant ISO committees.

Some of the detailed technical rules have been worked out in the overarching EPB standard, EN ISO 52000-1.
CEN/TS 16629 is also the basis for the template for each EPB standard, containing specific editorial rules complementing the ISO and CEN internal principles and rules ([15], [16]). In the new version of CEN/TS 16629 duplication with these documents will be removed.

In the new version of the template for each EPB standard there will be a distinction between EPB standards containing calculation procedures and other EPB standards (see 7.1: categorization of EPB standards), because several of the rules apply only to calculation procedures. The rules for the latter may become more stringent, to facilitate validation of the calculation procedures, convergence to software and interoperability of the whole set.

These documents present the way the EPB standards are set up. . It is likely that all EPB standards will be affected by the new basic principles and detailed technical rules. This does not mean all standards need to be revised immediately. However, *if* a revision is decided by the TC, then the new TSs will need to be taken into account.

The TS votes are expected to take place during the SR or SR evaluation period[5], see also the timeline in 1.6. Adaptation to the results of the ISO and CEN SMART programmes (see chapter 6) will require a longer term preparation, given the timeline of the latter.

[5] Pending approval of reactivation of the work items, needed to gain more time for preparation

As a requirement of the SR evaluation and SMART: the quality documents probably need to be updated again within one or two years. As soon as it becomes more concrete how the digitization of ISO and CEN standards is foreseen, then the related updating of the template for each EPB standard will deserve the highest priority.

6 Digitization of ISO and CEN standards

6.1 Hindrances for fast and wide roll out of the EPB standards

There are two major hindrances for the fast and wide roll-out, acceptance and implementation of the set of EPB standards.

Software tool needed

The biggest problem regarding the use of the EPB standards is the lack of a software engine according these standards.

For the assessment of the overall EPB, the end user of the EPB calculation standards does not use the standards themselves, but a software tool that complies with the standards.

A country considering the adoption of the EPB standards and incorporation (referencing) these in the building regulations needs to be sure that a software tool is available to apply the EPB standard(s).

At the moment, many countries choose to stick to national calculation procedures that (presuming) are close to the calculation procedures of the EPB standards or they choose the simple monthly calculation procedures, only because the transition to the hourly calculation procedures would require to change the national software used to assess the energy performance of buildings.

> NOTE To avoid any obstacle for the end user to use the hourly calculation procedures of the EPB standards: even in EN ISO 52016-1, the core standard for the overall EP calculation (see 7.3), it has been ensured that the number and type of input data that has to be acquired by the end user for the hourly calculation procedures is the same as (and not more than) for the monthly calculation procedures.

Costs of buying the standards

A second major hindrance for further development and acceptance of the standards and the necessary exchange of knowledge is the costs to obtain a licensed copy of the EPB standards and the accompanying technical reports.

For the development and acceptance of the standards and the necessary exchange of knowledge, to feed in innovative solutions and to advocate the set of standards, it is imperative that the standards and accompanying technical reports are easily available for researchers, students and teachers at academic or higher education institutes. Due to the high cost to obtain a licensed copy and copyright restrictions, only a small percentage of these communities are acquainted with the EPB standards. The large majority chooses to use and contribute to freely available or more affordable EPB assessment calculation tools.

The end users and other stakeholders, standard writers, regulators, researchers and academic institutions of all parts of the world should be able to share knowledge and build on each other's work to advance outcomes.

The first hurdle is addressed in the ISO and CEN SMART Programmes that aims at digitization of the standards. Because the digitization may affect the business model, the need to make changes in the business model is under parallel investigation in the SMART programme.

6.2 ISO and CEN SMART Programmes

ISO [8] and CEN [9] are collaborating in recently started programmes for digitization of the standards: the SMART Standards Programme (2021 – 2024).

Some information on these Programmes is given in **Annex 3.**

The SMART programme could help to further improve the set of EPB standards and to increase their implementation.

As shown in 1.6 (Figure 1), the SMART programme runs largely in parallel with the SR and the SR evaluation. This implies that a dynamic interaction is needed in order to come to satisfying results at all fronts.

On the other hand this creates a unique opportunity to exchange and feed in experiences.

6.3 The ISO and CEN SMART programme and the EPB standards

The concrete final results of the SMART programmes are not yet clear. Therefore, in this chapter we will concentrate on what seems to be needed from the perspective of the increased quality and usability of the set of EPB standards in relation to the SMART programme.

First: each EPB (calculation) standard should be software proof

The first requirement regarding the quality of each individual EPB calculation standard is that the calculation procedures are software proof.

This is currently covered: the common quality documents for all EPB standards (see chapter 5) already require that:

-- Each standard provides a complete and detailed **list of all input and output variables**. This enables a check if output provided by one standard is exactly what is needed as input to another standard.

- **Each formula** in each standard has a complete **explanation of each variable**, including the unit and source (other formula in the same standard or external).

- For each standard **a spreadsheet** (Excel) **file** is prepared parallel to the development of the standard and made publicly available. The file contains (following a common template) sheets with all these input resp. output variables, an overview of all main formulae, a working calculation sheet and example cases.
  The spreadsheet is an invaluable tool for debugging and documenting the procedure. Each step in the calculation procedures can be tracked in a fully transparent way. The spreadsheet allows to generate test cases for testing and validating compliance of calculation tools (software) with the standard.
  Spreadsheets are not suited for professional use, in particular if calculations between a suite of EPB standards need to be coupled (e.g. energy needs ⇔ ventilation system requirements & performance ⇔ system performance).

- For each standard an **accompanying technical report** is prepared and published along with the standard that contains all informative content: explanation, justification and worked examples (based on the spreadsheets). The accompanied standard contains no informative content other than short notes.

Second: the interactions between the EPB standards should be software proof

The next requirement, not yet covered, is to create **electronic links** from the **output data** produced by one EPB standard (source document) that are needed as **input data** in another EPB calculation standard (destination document).

This concerns several EPB standards with often dynamic (time dependent, hourly) interactions. So it is not only a matter of identifying the static data, but also about the **time varying values**.

And not only that: **the properties apply to a specific space and service**: within a specific thermal zone of a building: different lighting regimes may occur (daylight vs. other zone), heat may be dissipated from pipes (heating system) or ducts (ventilation system) that are "underway" to service another thermal zone, etc.

So it is important to prepare for efficient and precise information exchange between these standards (and within software covering different parts of this set of EPB standards). To do this, the input/output information provided in each EPB standard should be structured and digitized.

Data templates and dictionaries have been developed in the BIM committees: ISO/TC 59/SC 13 and CEN/TC 442. Recently published standards are:

- EN ISO 23386 (March 2020): Methodology to provide the rules for an unambiguous definition of properties used in construction.
- EN ISO 23387 (July 2020): Principles and structure for data templates for construction objects.

However, these standards contain "only" the rules of data templates. The content has to be prepared by the domain experts, *in cas*u the EPB standard writers.

Third: the obstacle to come from the standard to a software tool should be lifted:

Each EPB (calculation) standard separately:

So the spreadsheets are the current machine-readable content presented to standards users. However, the spreadsheet formulae have important limitations for daily use and are not suited for direct use as part of a software tool.

And actually, the current EPB calculation standards are no fish, no meat: neither 100% human readable friendly nor 100% machine readable friendly. The accompanying technical reports are human readable friendly and are intended to help the end user to better understand the calculation procedures in the standard.

So, from the point of view of keeping the standard understood by humans, the role of the accompanying technical report could be reinforced, to give room for the EPB calculation standard to optimize for machine reading.

This would significantly facilitate the preparation and implementation of software.

> To give an impression: already the hourly calculation procedures of energy needs for heating and cooling in EN ISO 52016-1 consist of about 100 coupled energy balance equations that have to be solved (partly as a matrix, partly iteratively) for each hour of a year for each thermal zone in the building. This means that writing a software tool requires serious efforts.

The level 3 or level 4 ambition of the ISO SMART programme seems to satisfy (some of?) these needs.

Interrelation between the calculated EPB assessment and measured energy performance:

Software tools to be developed should also anticipate an increased interest in interrelating measurements of the building's energy performance with the calculated energy performance, aiming at bridging the gap between the calculated EP of the building under standard conditions and the actual use and to increase the quality of information at the energy performance certificate. See also chapter 9 (question on operational rating).***The set of EPB standards:***

The spreadsheets on individual EPB calculation standards are the current machine-readable content presented to standards users. As stated above, these spreadsheets are not suited for direct use as part of a software tool. On top of that, it is in practice not feasible to couple several individual spreadsheets to demonstrate the combined calculation of several (dynamically, hourly) interacting EPB calculation standards.

> NOTE This has been shown in extensive case studies by the EPB Center (link) where on an ad hoc basis pairs of spreadsheets were coupled as proof of principle of the EP calculation procedures.

For building a software tool for the set of EPB standards to calculate the overall energy performance of a building the issue is also to know how to couple e.g. the calculation of needs and technical building systems for the various services and handling the (dynamic, hourly) interactions.

It's not only a question of a list of items, but also (actually: mostly) of when to calculate what. And to decide at several points if (and how…) to iterate or e.g. accept values from previous time steps. In particular for the interaction between the calculation of the energy needs and internal temperatures with ventilation and with systems that are undersized, leading to indoor conditions that deviate from the targeted conditions, in terms of thermal comfort and indoor air quality.

A **framework** is needed to ensure correct bookkeeping (at each timestep) of all input data, boundary conditions and calculated properties from and to different services and spaces or zones in the building and to organize the order of calculation of the individual modules and their (multiple) dynamic interactions. This concerns both the physics for the connections and the mathematics for solving the iterations, etc.

7 Priority standards from perspective of overall EP assessment

7.1 Different categories of EPB standards

> **Disclaimer:**
> The set of EPB standards consists in total of over 60 standards. Categorization and prioritization of individual EPB standards is therefore inevitable to "disclose the huge amount of information. On the other hand, the categorization and prioritization inevitably contains some arbitrary choices. Consequently, it should only be regarded as a practical guidance.

The EPB standards can be categorized according to:

- Module: the technology
- Theme: the step in the assessment
- Typical user: the actual user (incl. National Annex or Datasheet) in practice

Note that a single EPB standard can cover more than one theme and have more than one typical user.

See **Table 1**.

Table 1 – Categorization of the EPB standards

	Module	**Theme** [a)]	**Typical user** [b)]
	M1 Overarching standards	1) (EP) Calculation procedures (core or other)	a) Regulator
	M2 Building (as such)	2 (indoor and outdoor conditions)	b) EPB assessor
	M3 Heating	3) EP post-processing (EP indicators, requirements or ratings)	c) Designer [c)]
	M4 Cooling	4) (EP) Measurement procedures	d) Product/component manufacturer or supplier
	M5 Ventilation	5) Building, system or component design procedures	e) (EP) standard writers (incl. reference procedures)
	M6 Humidification	6) Inspection procedures	
	M7 Dehumidification	7) Certification procedures	
	M8 Domestic hot water	8) Other	
	M9 Lighting		
	M10 Building automation and control		
	M11 PV, wind, ..		

7.2 EPB standards for overall EPB calculation

The EPB standards that are directly used for the overall EPB assessment by calculation, are the standards containing EP calculation or pre- or postprocessing procedures.

A detailed overview is given in **Figure 2**.

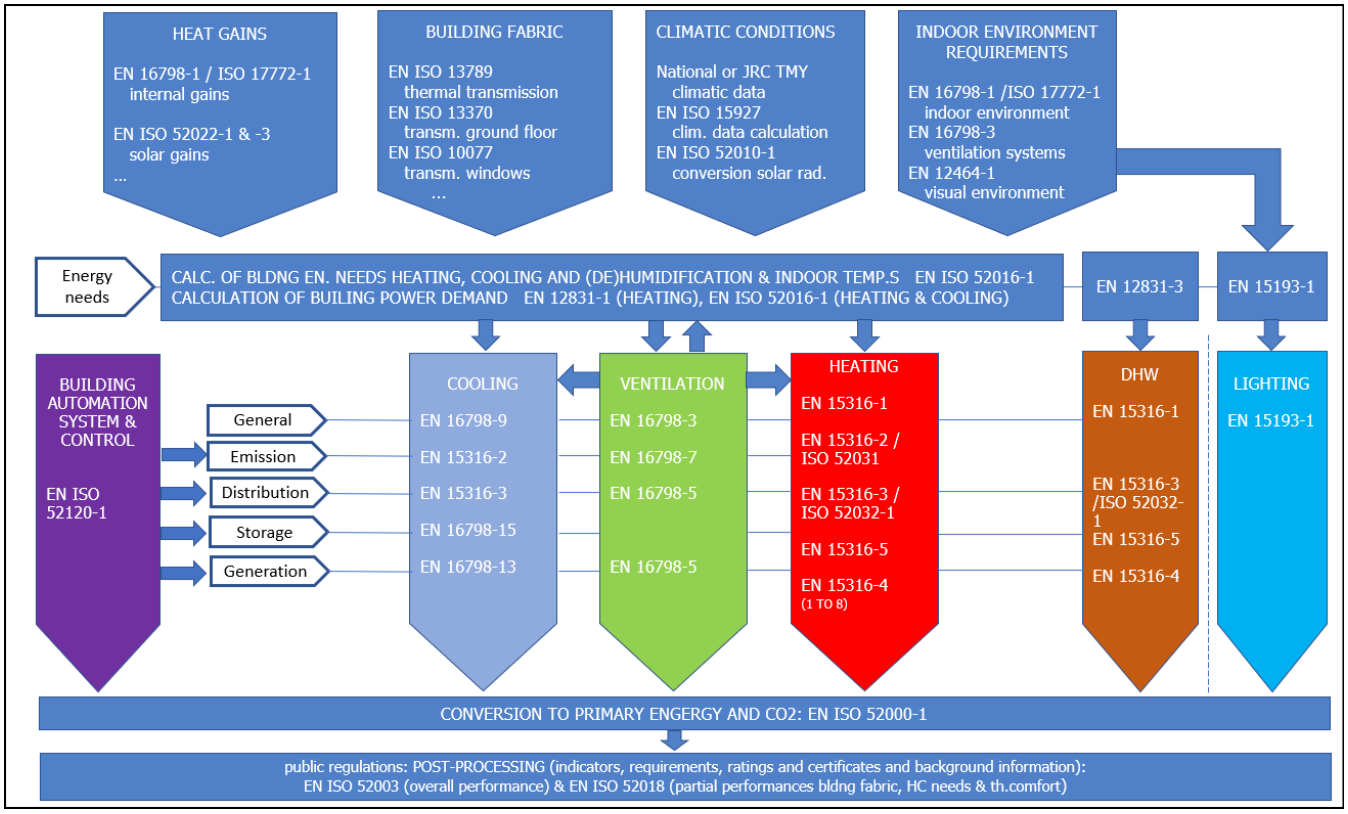


Fig. 2 – Detailed overview of EPB standards needed for the overall EPB assessment by calculation

7.3 Key EPB standards for overall EPB calculation

From these EPB standards, the standards that provide the backbone of the chain and which are the most interacting with other standards require the highest priority from the perspective of the overall coherence of the set of EPB standards. This concerns **EN ISO 52000-1** (the overarching EPB standard, the "alpha and omega" of the EPB assessment) and **EN ISO 52016-1** (calculation of the energy needs for heating and cooling, (de-)humidification and indoor temperatures and humidity).

The calculation of the ventilation air flow rates and ventilation system performance is highly interacting with the calculation of the energy needs and indoor temperature and humidity. Therefore, these EPB standards are added to the list: **EN 16798-7** and **EN 16798-5-1**.

The general part of the series of EPB standards on heating and DHW systems, **EN 15316-1**, is also added, because this standard connects the system standards to the backbone.

In addition, the pre-processing EPB standards, on outdoor and on indoor conditions (**EN ISO 52010-1**, **EN 16798-1** (~ ISO 17772-1) are added as key EPB standards, as well as the post-processing EPB standards that are essential for the information on the EP Certificate and for benchmarking & checking compliance with minimum EP requirements: **EN ISO 52003-1** (overall) and **EN ISO 52018-1** (partial: building fabric, energy needs, thermal comfort).

EN ISO 52120-1 has a special position: it describes the general framework and procedures for the contribution of building automation, controls and building management. To avoid a duplication of calculation due to the BAC (avoid double impact), no calculation is done in this document itself, but each relevant EPB standard has to work out and incorporate the BAC procedures introduced in this framework, see also 11.10.

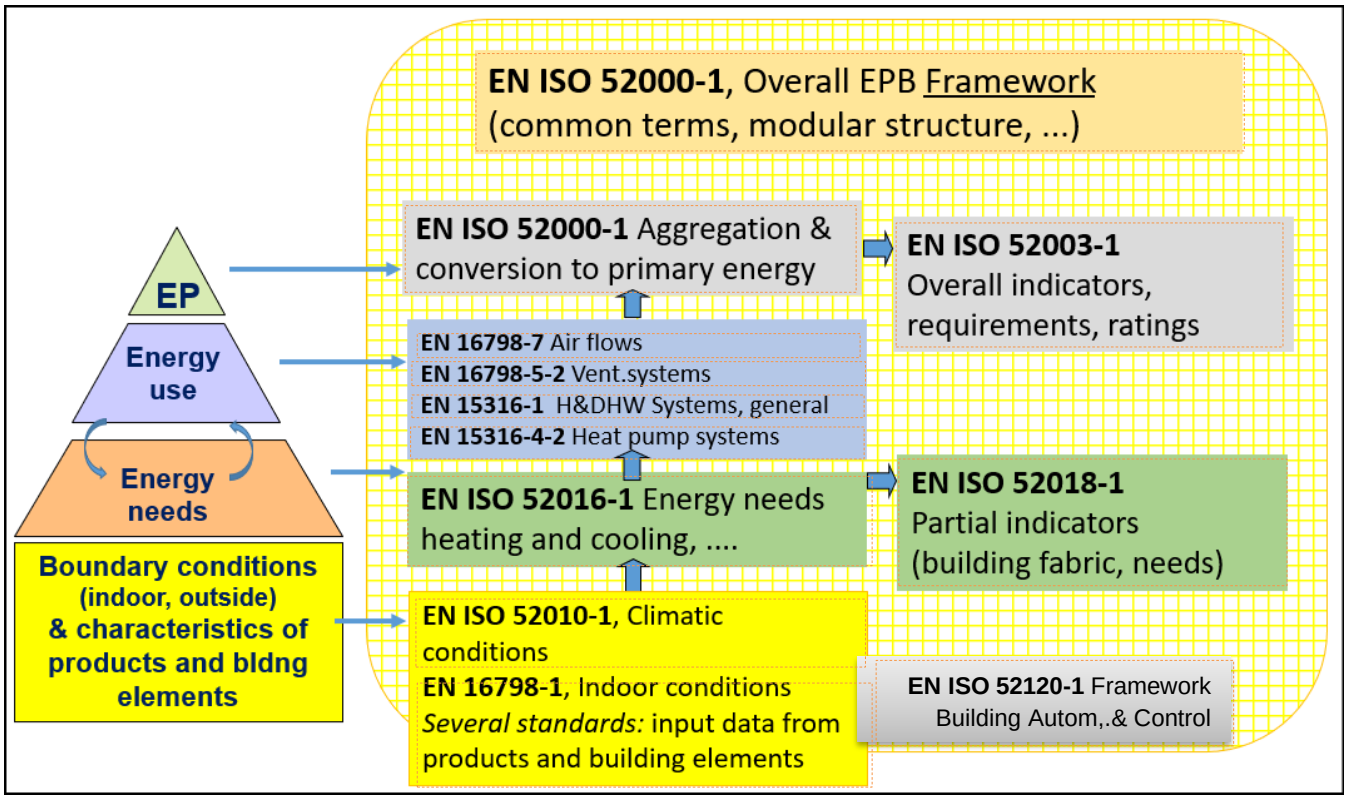
Most other EPB standards relevant for the overall EPB calculation provide output that can be used as input in other EPB standards, without 'dynamic' (e.g. hourly) interaction. This concerns many building and system components and elements. Often, the properties of the components are provided by a product/component manufacturer or supplier.

Some other EPB standards with calculation procedures deal with specific technologies that are only used in special situations.

A special place has been reserved for the standard to calculate the heat pump system performance, **prEN 15316-4-2** (succeeding EN 15316-4-2:2017), because of the growing importance of that technology, combined with the internal complexity of the calculation and the links with product data. Moreover, the performance and capacity of a heat pump system can be significantly influenced by the actual (hourly) source temperature and required power output, which requires a dynamic (hourly) link with the calculation according to EN ISO 52016-1.

With this in mind, the diagram in **Figure 3** gives an overview of the key EPB standards and how they relate.

NOTE Consequently: not selected as highest priority EPB calculation standards: e.g. boilers, chillers, lighting and several EPB standards providing data from products and building elements



Hyperlinks to more information
You can click on each standard in the diagram to open the page at the EPB Center website with more detailed information, incl. tools, presentations, case studies, FAQs, errata (if available).

Fig. 3 – Key EPB standards needed for the overall EPB assessment by calculation

Note that in the draft for the revised EPBD in Europe [5], the following 7 EPB standards are listed as key standards:
EN ISO 52000-1 (2017), 52003-1 (2017), 52010-1 (2017), 52016-1 (2017), 52018-1 (2017), EN 16798-1 (2019), EN 17423 (2020).
Only the last standard in this list is not adopted in the set of 10 core EPB standards, because EN 17423 is not part of the calculation procedures within the building (it deals with the determination of weighting factors that reflect the characteristics of the world around the building). In addition, EN 16798-1 is not included in the SR, because it was published in 2019. But: EN 16798-1, and in parallel ISO 17772-1, are currently subject to revision, because the need for improvement was already identified, see 11.5.

8 Rationalization of the choices given in Annex A of each EPB standard

To provide flexibility in the application of the set of EPB standards, clearly identified options and national data are assumed to be necessary due to differences in climate, culture and building tradition, building typologies, policy and legal frameworks.

The harmonized procedures in the EPB standards need to be separated from the national or regional options (choices). This has been achieved by the "Annex A/Annex B" approach.

Each EPB standard has (or should have) the following two Annexes:

- **Annex A** (normative): mandatory (empty) framework template for choices and input data and references to other EPB standards
- **Annex B** (informative): framework template of Annex A completed with one set of voluntary default choices and input data and references to other EPB standards.

Each NSB has the possibility to add or include a National Annex to the EPB standard, in agreement with the template of Annex A. In this case the building code could refer to the EPB standards plus National Annexes as the national or regional energy performance assessment procedures.

As alternative, national or regional authorities may prepare **National Data sheets** containing the choices and national or regional values, according to the template in Annex A. In this case the building code could refer to the EPB standards plus National Datasheets as the national or regional energy performance assessment procedures.

A Guide *how to fill in* National Annexes [10] is available at the EPB Center website. This guide also contains other practical information.

The EPB Center experts made an overview of the current choices in 10 selected EPB standards (**Figure 4a**). These choices were categorized (**Figure 4b**) to make a distinction in importance and impact [12]. In the EU project U-CERT the links between the choices in different EPB standards were identified and proposals were made for all the 237 (!!) choices in 10 selected EPB standards (in process of finalization [11]). The EPB Center is also preparing a public document with examples of the most important “Annex A choices”, including explanation [13].

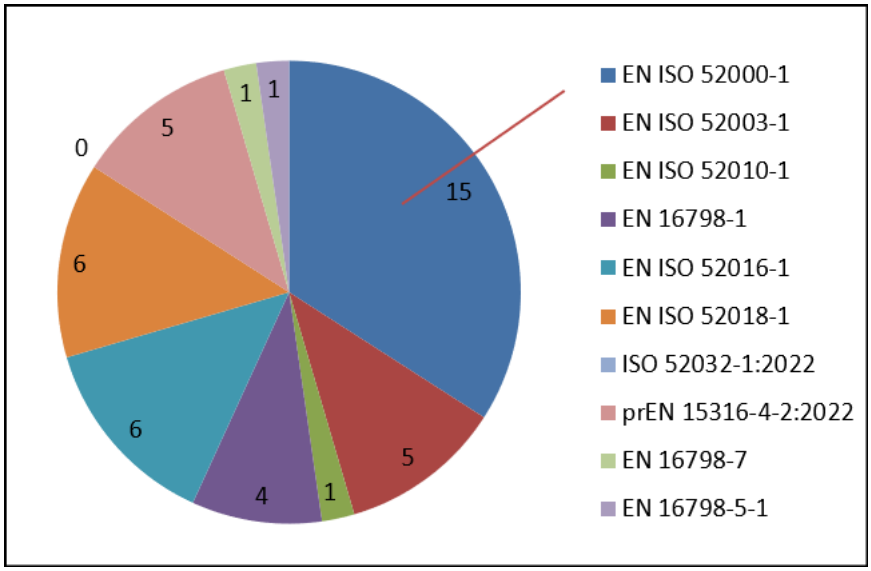
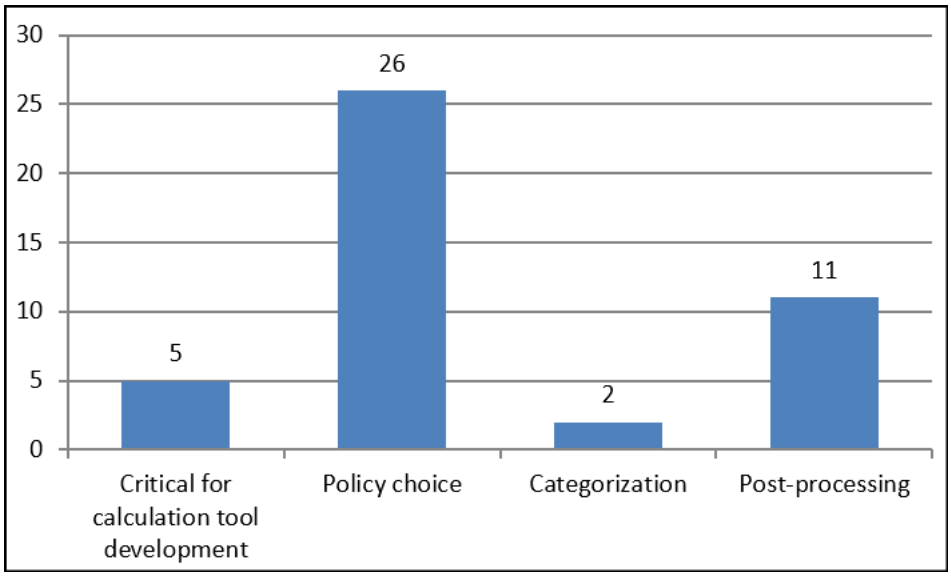


Fig. 4a – For 10 selected EPB standards, 44 (out of 237) choices were identified as "Important choices for the calculated EP" [12]



NOTE: The numbers don't add up, because more than one type is possible

Fig. 4b – Further categorization of the 44 "important choices" in the 10 selected EPB standards [12]

The details of the findings of these activities do not need to be used already in the SR ballots, but a general observation could be that a critical review of the Annexes A could lead to further harmonization and more transparency.

A separate subject is: ensure overall consistency in the choices in the Annexes B that provide informative default choices.

In addition, improvements of the set up could be taken into consideration. For instance, to publish a form with fillable Annex A choices as separate file attachment. The new generation of Eurocode standards might serve as source of inspiration.

Link to landing page at EPB Center website on National Annexes (including the Guide, examples, webinar presentations, …)

9 Questions to NSBs regarding the quality, consistency and usability of the (set of) EPB standards

The NSBs are invited to prepare answers (as part of the SR ballot).
Also national regulators are invited to prepare answers.

We are highly interested in obtaining feedback from the NSBs how the quality, consistency and usability of the EPB standards can be improved.

For the convenience of preparing feedback, these questions are **also available as (separate) editable MS Word file**, to be downloaded as N document from the relevant ISO and CEN committees or from the EPB Center website (https://epb.center/epb-standards/).

If the feedback from the NSB is general for the set of EPB standards, the response may be sent to the contact persons at coordination level (see chapter 12).

If the feedback is on a specific EPB standard it makes sense to send the response as comment with the national voting on the SR.

Question 1 (global coverage):

Consideration: Specifically in ISO, several modules (standards) in the set of EPB standards are missing, while they are available in CEN.
But, since energy shortage and carbon emissions are a universal concern, it is also in the European interest to ensure that the set of EPB standards has a global coverage.

Question: do you agree that it is important for the whole set of EPB standards to become also available at global (ISO) level?

Answer:

Organization & contact person:	….
Yes / No agree?	**Explanation**
…	… …

Question 2 (missing or conflicting parts of an EPB standard):

Consideration: The main application of the set of EPB standards is the assessment of the overall energy performance of a building in the context of building regulations, to check compliance with minimum energy performance (EP) requirements and to provide information for the EP label and the EP Certificate. Specific details of the EPB assessment procedures in the set of EPB standards may be missing or conflicting with national needs for the overall EPB assessment. This could hinder adoption and referencing to that standard in national or regional building regulations.

Specifically in ISO: several modules (standards) in the set of EPB standards are missing, while they are available in CEN. But also in the CEN set of EPB standards specific procedures may be missing or procedures may be conflicting with national needs.

Question: are, in individual EPB standards, specific details of the EPB assessment procedures missing or conflicting with national needs for the overall EPB assessment that prevented adoption and referencing to that standard in your building regulations? If so, can you indicate how this problem might be resolved? Is it resolved by standards in other regions of the world? .

Answer:

Organization & contact person:	….	
EPB standard	**Which missing or conflicting part of the EPB standard?**	**Suggested solution**
…	…	…
…	…	…

Question 3 (availability of product/input data):

Consideration: Product, component or other information is needed as input for the overall EPB assessment.

Question: are there, in individual EPB standards, problems with the availability of the product or component or other data needed as input?

Answer:

Organization & contact person:	….	
EPB standard	**Which input data not (easily) available?**	**Suggested solution**
…	…	…
…	…	…

Question 4 (operational rating):

Consideration: The set of EPB standards contains only 1 standard on EPB assessment based on measurements (operational rating). This is EN 15387-3, that deals only with heating and domestic hot water systems.

Question: is there a need for a more comprehensive EPB standard on overall EPB assessment based on measurements (operational rating) for use in the context of the national or regional building regulations?

And if so: is it needed for the prime EP indicator (to check compliance with minimum EP requirements) or only as information for the EP certificate (as information tailored to the actual conditions and use of the building)

Answer:

Organization & contact person:	….	
Yes/No for the prime EP indicator (min. EP requirements)?	**Yes/No for the EP certificate (informative)?**	**Explanation**
…	…	…
…	…	…

Question 5 (Structure and comprehensiveness of the set):

Consideration: at the EPB Center website you can find a complete overview of all published EPB standards (and accompanying technical reports; link), grouped per topic (=module).
In 7.1 the EPB standards have been categorized further. The total number of EPB standards is high, but as explained in chapter 7, they can be categorized for different applications and different user types.

Combining all EPB standards into a single document would have the advantage of having all EPB assessment procedures together, but such a document would be too voluminous and too wide in scope to handle and to evaluate, involving several different teams of experts. Also, acceptance of the document by the NSBs and reference to the document in building codes or product declarations would depend on acceptance of the whole document.

However, this does not mean that restructuring of the set of EPB standards is not an option.

Question: In addition to your response to Question 2 (missing or conflicting parts of an EPB standard) : do you see a need for restructuring the set or a specific subset of the EPB standards? Different structure? Should it be less comprehensive? More comprehensive?

Answer:

Organization & contact person:	….
… <Free text> …	

Question 6 (Annex A / Annex B approach):

Consideration: See chapter 8: each EPB standard has a normative Annex A containing a template for specific national choices that are allowed in the standard, plus an informative Annex B with informative default choices.

Each specific Annex A may be critically reviewed with respect to the need for the provided options. This is one of the items for consideration for each EPB standard under SR in ***chapter 10***.

This question *here* is about ***the set up in general***: the common layout of Annex A / Annex B has been designed to be clear and unambiguous on the options that are provided, e.g. by shading the cells in the tables of which the content is part of the template that shall not be changed. But other and better possibilities may be explored (see chapter 8).

Question: Do you have suggestions for improving the set up of the Annex A / Annex B approach?

Answer:

Organization & contact person:	….
… <Free text> …	

Question 7 (Overall consistency of Annexes B):

Consideration: See chapter 8: each EPB standard has an Annex B that provides informative default choices based on the normative template of Annex A.

Most of these Annexes B have been prepared from the perspective to provide a practical example for the specific EPB standard. This implies that if for all EPB standards the Annexes B are chosen as the national or regional choice, this may lead to (perhaps unforeseen) inconsistencies in the choices.

Question: How important is it for your country that the Annexes B of all EPB standards are mutually and overall consistent?

Answer:

Organization & contact person:	….
… <Free text> …	

Question 8 (digitization, pro-active role):

Consideration: in chapter 6 a preliminary outlook is given on the plans for digitization of ISO and CEN standards and how this could become important for the usability and use of the set of EPB standards.

Question: Do you consider it important for the set of EPB standards that the responsible committees are pro-active in this field (e.g. by participating in pilot projects)?

Answer:

Organization & contact person:	….
… <Free text>	

Question 9 (digitization, machine readable standards):

Consideration: in chapter 6 a preliminary outlook is given on the plans for digitization of ISO and CEN standards and how this could become important for the usability and use of the set of EPB standards.

Question: Do you consider it important for the set of EPB calculation standards to become (more) machine readable (with a stronger role for the accompanying technical reports to provide explanation)?

Answer:

Organization & contact person:	….
… <Free text>	

Question 10 (digitization, digitized description of objects):

Consideration: in chapter 6 a preliminary outlook is given on the plans for digitization of ISO and CEN standards and how this could become important for the usability and use of the set of EPB standards.

Question: Do you consider it important for the validation of the set of EPB calculation standards and the conversion into software, that in the future all objects and their (also time varying) properties are described according to data templates and dictionaries that have been developed in the BIM committees ISO/TC 59/SC 13 and CEN/TC 442)?

Answer:

Organization & contact person:	….
… <Free text>	

Question 11 (digitization, software engine):

Consideration: in chapter 6 a preliminary outlook is given on the plans for digitization of ISO and CEN standards and how this could become important for the usability and use of the set of EPB standards.

Question: Do you consider it important for the wide roll-out and implementation of the set of EPB calculation standards, that a common software engine or 'framework' is made available?

Answer:

Organization & contact person:	….
… <Free text>	

NOTE Concerning the issues mentioned in chapter 6, there is no question formulated on the business model, because that deserves a discussion at another level.

Question 12 (Overall quality):

Consideration: The general objective of the set of EPB standards is to strive for the highest possible quality, trying to present the state-of-the-art overall EPB assessment methodology in the context of EPB regulations.

A unique feature of all ISO and CEN standards is the model of collaboration and consensus, quality and trust. A more specific unique feature of the EPB standards (compared to e.g. building simulation programmes that also enable to assess the EPB) is that it has been specifically designed for use in public regulations. This implies:

1. full documentation and transparency
2. performance oriented and technological neutrality
3. adequate, unambiguous and realistic calculation methods
4. balanced with respect to required input of (reliable and available) component and product data
5. covering all possible technologies (as much as possible), certainly all the cost effective ones

6. providing information on the integration in EPB regulations (notably post processing, such as requirement setting, EP certificate development, etc.
7. ...?

Question: What other distinctive features are to be pursued? And to which extent is each of these objectives important, but not fully achieved?

Answer:

Organization & contact person:	….
Feature	**Comment**
…	…
…	…

Question 13 (Other):

Consideration: are there other issues on the set of EPB standards as a whole? Note that some specific issues are listed on specific EPB standards (e.g. on EN ISO 52000-1, the overarching EPB standard), see chapter 11.

Question: Do you see other important issues ?

Answer:

Organization & contact person:	….
… <Free text> …	

10 Items for consideration for each EPB standard under SR

The following items are suggested to take into consideration for the overall consistency and interoperability when answering the questions of the SR:

For each EPB standard under SR separately:

- For each EPB calculation standard: is the output specified with respect to which spatial distribution (space, zone, building) and which calculation time interval (hourly, monthly, annual) it applies?

- For each EPB calculation standard: If the input is supposed to come as output from another EPB standard: is it specified for the same spatial distribution (space, zone, building) and the same time interval (hourly, monthly, annual) and is the originating module or EPB standard specified, including (if different) the symbol & subscript used in the originating module?

- For each EPB calculation standard: For the interoperability of the set of EPB standards, all EPB calculation standards have to use the same choices with respect to the specification of different building and different space categories, as provided by Annex A of EN ISO 52000-1.
  Does the EPB standard indeed use the same choices?

- For each EPB calculation standard: For the interoperability of the set of EPB standards, all EPB calculation standards have to use the same assumptions on indoor environment quality and conditions of use for different space categories, as provided by EN 16798-1 or ISO 17772-1 (see 11.5).
  Does the EPB standard use the assumptions from EN 16798-1 or ISO 17772-1?.
  If not, because of incompatibility with EN 16798-1 or ISO 17772-1: see 11.5.
  Can the number of options given in Annex A of each EPB standard be reduced? If so, which ones? See chapter 8.

- For each EPB calculation standard: has the influence of controls (EN ISO 52120-1, see 11.10) been taken into account directly in the calculation procedures. If not: do you have suggestions?

- Do you believe that the accompanying technical report shall be reviewed?
  (note that the answer could be "Yes" even if you believe that the related EPB standard can be confirmed)

- For each EPB calculation standard: does the standard have ambiguous elements (definitions, formulae, conditions or input data) that need to be made unambiguous in order to become software proof?

- General and technical comments are in this stage more relevant than (minor) editorial comments, because editorial issues can still be flagged when the decision is taken to revise the standard.

11 Focus on specific EPB standards or clusters

11.1 General

An overview of all published EPB standards can be found at the EPB Center website under Support/Documents. Direct link.

All EPB standards under SR are listed in Annex 1. In the following paragraphs some known issues and hints on some of these standards are listed.

This list is in no way intended to discourage the NSBs from adding other issues on these or the other EPB standards under SR. The only purpose is to provide information to the stakeholders that may (optionally) help them to deal more effectively with answering the questions of the SR.

11.2 EN ISO 52000-1

Link to EN ISO 52000-1 at EPB Center website.

Items for specific attention:

- Comments (possible errata) and suggestions for improvement have been collected by the EPB Center experts, in collaboration with CEN/TC 371 and published in the template of an ISO Comment sheet, in April 2020. See link. [6]
- Additional EPBD requirements (see Annex 2)
  - Check the definitions of useful and reference (floor) area. The details are now open for national choice. This is causing one of the biggest gaps between the calculated EPs between countries.
  - The performance gap is addressed in the new EPBD; the EPB standard calculation methods are essential tools for assessing the impact of (deep) renovation measures. Is more attention needed for added information from measurements (metering), to recommend EP improvements?
  - Definition of "Ambient energy" as renewable energy source…
  - There will be a shift to emissions, but the energy efficiency first principle will stay the most important issue. Both EP and CO_2 are important, so we should stick to the holistic approach. Is additional information for emissions calculations needed (link with EN 52000-1 and EN 17423) or is the post-processing approach sufficient?
  - Are life-cycle Global Warming Potential (GWP) calculations possible?
  - MEPS will lead to deep renovation. Energy assessment is moving from the in-use phase to LCA. Perhaps the EPB standards should prepare for this. EN 15978-1 *Sustainability of construction works – Methodology for the assessment of performance of buildings - Part 1: Environmental Performance* is a relevant CEN/TC 350/WG 8 standard, the enquiry of a revised version is just closed. There is mutual interest in deep renovation and the EPB role in LCA's.
  - Add "Cool built environment"
- Add (on-site) electric battery to assess the impact on the optimization of the grid interaction.
- Provide guidance on the overall order of calculation for all modules in the EP calculation. This includes explicit choices for iteration/use data from previous calculation time interval
- …

11.3 EN ISO 52003-1

Link to information page on EN ISO 52003-1 at EPB Center website

Items for specific attention:

- Comments (possible errata) and suggestions for improvement have been collected by the EPB Center experts and published in the template of an ISO Comment sheet <in preparation>. [7]

Additional EPBD requirements: a more stringent role of the EP certificates requires more attention for the post-processing of the assessed EP that needs to be provided in this EPB standard.

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[6] **DISCLAIMER**
The only purpose of the clarifications and proposals communicated by the EPB Center is to support the implementation and application of the EPB documents in practice. This can help users to deal more rapidly with any issues in an EPB document. In no way these clarifications or proposals shall be regarded as corrigenda or addenda of the related CEN or ISO documents. It is up to the competent official standardization bodies to decide upon the preparation of an amendment or the revision of the EPB document in question in accordance with the official CEN or ISO procedures. The information in this document is purely informal and it neither represents the views of any of the standardization bodies, nor the official opinion of the European Union. Neither the CEN or ISO bodies, nor the European Union institutions and bodies, or any person acting on their behalf may be held responsible for the use which may be made of the information contained therein.

[7] See Disclaimer in footnote of 11.2

11.4 EN ISO 52010-1

Link to information page on EN ISO 52010-1 at EPB Center website

- No issues known
- Note that the European Joint Research Centre (JRC) has prepared a publicly available on-line tool to acquire hourly climatic data for energy calculations, covering almost any location worldwide. The EPB Center has prepared a conversion tool (see Link).

11.5 EN 16798-1, ISO 17772-1

Links to information pages on EN 16798-1 and ISO 17772-1 at EPB Center website.

EN 16798-1 is not included in the SR, because it was published in 2019. But: EN 16798-1, and in parallel ISO 17772-1, are currently subject to revision.

These EPB standards on indoor environment conditions are important for specifying the assumed IEQ and conditions of use for the EPB calculation standards.

11.6 EN ISO 52016-1

Link to information page on EN ISO 52016-1 at EPB Center website.

Items for specific attention:

- Comments (possible errata) and suggestions for improvement have been collected by the EPB Center experts and published in the template of an ISO Comment sheet <in preparation>..[8]
- Additional EPBD requirement (IEQ performance indicator): ensure that the output (hourly indoor temperatures) can be used as basis for thermal comfort indicator (see EN ISO 52018-1).
- Complete balance equations for humidification and dehumidification and add balance equations for CO2 by making the links with the EPB ventilation standards more concrete;
-

11.7 EN ISO 52018-1

Link to information page on EN ISO 52018-1 at EPB Center website

Items for specific attention:

- Comments (possible errata) and suggestions for improvement have been collected by the EPB Center experts and published in the template of an ISO Comment sheet <in preparation>. [9]
- Additional EPBD requirement (see Annex 2):
  - a more stringent role of the EP certificates requires more attention for the post-processing of the assessed EP that needs to be provided in this EPB standard
  - IEQ performance indicator: Thermal comfort indicator, specifically in case of calculation taking into account undersized or absent systems (see Annex 2).

[8] See Disclaimer in footnote of 11.2

[9] See Disclaimer in footnote of 11.2

- ….

11.8 Hygrothermal performance of building components and building elements

Link to list of all EPB standards on Buildings and building components (M2) at EPB Center website

Link to scheme at EPB Center website showing the main linkages between the EPB standards under this topic.

11.9 Technical Building Systems

Link to overview of all EPB standards on technical building systems (M3-M9) at EPB Center website

Items for specific attention:

- Where systems interact with the energy needs, it needs to be made more clear how these are linked in an hourly calculation.
  This is in particular relevant for the combination between:
  - energy needs for heating and cooling
  - ventilation systems, including humidification and dehumidification;
  - heating and cooling systems.

  State explicitly any rule for iteration
  NOTE: detailed experience was obtained in recent EPB Center cases studies (link).

- Additional EPBD requirement: hourly calculation intervals: may require revisions, if relevant for the specific system.

11.10 Building Control and Automation

Link to overview of all EPB standards on BAC (M10) at EPB Center website.

No EPB standard in the SR.

These EPB standards are not directly used in the EPB calculations, but are important for the design of BAC. These standards are currently not part of the SR, because the CEN EPB standards published in 2017 have been superseded by more recent EN ISO standards.

EN ISO 52120-1 provides the framework tor EPB calculation standards to take into account the impact of BAC.

- Check point: have the EPB calculation standards on energy needs (EN ISO 52016-1) and technical building systems (various) sufficiently taken into account the BAC systems in line with EN ISO 52120-1? And/or: are the control options in EN ISO 52120-1 adequately described to be included in the chain of building and system equations in the relevant other EPB standards?

12 Contact

If you have any questions about this Guidance Document, please contact:

- Dick van Dijk and Stephanie Reiniche (leadership of ISO/TC 205 & TC 163 JAG on coordination of ISO 52000 family).
  Email: EPB-research@dickvandijk.nl; sreiniche@ashrae.org
- Jaap Hogeling and Annet van der Horn (leadership of CEN/TC 371 on the energy performance of buildings).
  Email: j.hogeling@isso.nl; annet.vanderhorn@nen.nl

Annex 1.
Overview of ISO and CEN EPB standards subject to Systematic Review in 2022

The following EPB standards are subject to SR in 2022, in ISO or CEN (between brackets the total number of EPB standards published in 2017):

ISO and/or CEN	**Published in 2017**	**Under SR 2022**
ISO only	1	1
EN ISO	17	17
CEN	32	24
Total	**50**	**42**

ISO or CEN committees responsible for the evaluation of the SR:

	EPB standards under SR 2022
ISO/TC 163&TC205 (JWG):	3
ISO/TC 163	-
ISO/TC 205	-
ISO/TC 163/SC 2	15
CEN/TC 371	(see ISO)
CEN/TC 89	(see ISO)
CEN/TC 228	13
CEN/TC 156	8
CEN/TC 169	1
CEN/TC 247	2
Total	**42**

ISO or CEN number	Title	Responsible for development (≤ 2017)	Publication date
EN ISO 52000-1	Energy Performance of Buildings – Overarching EPB assessment – Part 1: General framework and procedures	CEN/TC 371/WG 1	Published 2017-06
EN ISO 52003-1	Energy performance of buildings – Indicators, requirements, ratings and certificates – Part 1: General aspects and application to the overall energy performance	ISO/TC 163/WG 4 (JWG)	Published 2017-06
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	ISO/TC 163/WG 4 (JWG)	Published 2017-06
EN ISO 52010-1	Energy performance of buildings - External climatic conditions - Part 1: Conversion of climatic data for energy calculations	ISO/TC 163/SC 2/WG 15	Published 2017-06
EN 15459-1	Energy performance of buildings – Economic evaluation procedure for energy systems in buildings – Part 1: Calculation procedures, Module M1–14	CEN/TC 228/WG 4	Published 2017-05
EN 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	ISO/TC 163/SC 2/WG 15	Published 2017-06
EN ISO 52017-1	Energy performance of buildings - Sensible and latent heat loads and internal temperatures – Part 1: Generic calculation procedures	ISO/TC 163/SC 2/WG 15	Published 2017-06
EN 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	ISO/TC 163/SC 2/WG 15	Published 2017-06
EN ISO 13789	Thermal performance of buildings - Transmission and ventilation heat transfer coefficients - Calculation method	ISO/TC 163/SC 2/WG 9	Published 2017-06
EN ISO 13370	Thermal performance of buildings – Heat transfer via the ground – Calculation methods	ISO/TC 163/SC 2/WG 9	Published 2017-06
EN ISO 6946	Building components and building elements – Thermal resistance and thermal transmittance – Calculation method	ISO/TC 163/SC 2/WG 9	Published 2017-06
EN ISO 10211	Thermal bridges in building construction - Heat flows and surface temperatures - Detailed calculations	ISO/TC 163/SC 2/WG 9	Published 2017-06
EN ISO 14683	Thermal bridges in building construction – Linear thermal transmittance – Simplified methods and default values	ISO/TC 163/SC 2/WG 9	Published 2017-06
EN ISO 13786	Thermal performance of building components – Dynamic thermal characteristics – Calculation methods	ISO/TC 163/SC 2/WG 9	Published 2017-06
EN ISO 10077-1	Thermal performance of windows, doors and shutters – Calculation of thermal transmittance – Part 1: General	CEN/TC 89/WG 7	Published 2017-06
EN ISO 10077-2	Thermal performance of windows, doors and shutters – Calculation of thermal transmittance – Part 2: Numerical method for frames	CEN/TC 89/WG 7	Published 2017-06
EN ISO 12631	Thermal performance of curtain walling – Calculation of thermal transmittance	CEN/TC 89/WG 7	Published 2017-06
EN 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	CEN/TC 89/WG 7	Published 2017-06

ISO or CEN number	Title	Responsible for development (≤ 2017)	Publication date
	daylight characteristics for solar protection devices combined with glazing		
EN 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	CEN/TC 89/WG 7	Published 2017-06
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	CEN/TC 228/WG 4	Published 2017-04
EN 12831-1	Energy performance of buildings – Method for calculation of the design heat load – Part 1: Space heating load, Module M3–3	CEN/TC 228/WG 4	Published 2017-07
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	CEN/TC 228/WG 4	Published 2017-05
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	CEN/TC 228/WG 4	Published 2017-04 *)
**): Systematic review will be launched, but this doc might in the future be replaced by EN ISO 52032-1:2022 that is more recent and based on EN 15316-3*			
~~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~~	~~CEN/TC 228/WG 4~~	Published 2017-05, but no SR *)
**): No systematic review will be launched, because this doc will be replaced (Public Enquiry of prEN 15316-5 is launched March 3, 2022)*			
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	CEN/TC 228/WG 4	Published 2017-05
~~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~~	~~CEN/TC 228/WG 4~~	Published 2017-04, but no SR *)
**): No systematic review will be launched, because this doc will be replaced (Public Enquiry of prEN 15316-4-2 is launched March 3, 2022)*			
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	CEN/TC 228/WG 4	Published 2017-05
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	CEN/TC 228/WG 4	Published 2017-04
EN 15316-4-5	Energy performance of buildings – Method for calculation of system energy requirements and system efficiencies –	CEN/TC 228/WG 4	Published 2017-05

ISO or CEN number	Title	Responsible for development (≤ 2017)	Publication date
	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	CEN/TC 228/WG 4	Published 2017-04
EN 15378-3	Energy performance of buildings –Heating and DHW systems in buildings – Part 3: Measured energy performance, Module M3–10 and M8–10	CEN/TC 228/WG 4	Published 2017-04
EN 15378-1	Energy performance of buildings – Heating systems and DHW in buildings - Part 1: Inspection of boilers, heating systems and DHW, Module M3–11, M8–11	CEN/TC 228/WG 4	Published 2017-05
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	CEN/TC 156/WG 21	Published 2017-06
EN 16798-15	Energy performance of buildings – Ventilation for buildings – Part 15: Calculation of cooling systems (Module M4–7) – Storage	CEN/TC 156/WG 22	Published 2017-06
EN 16798-13	Energy performance of buildings – Ventilation for buildings – Part 13: Calculation of cooling systems (Module M4–8) – Generation	CEN/TC 156/WG 22	Published 2017-06
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)	CEN/TC 156/WG 23	Published 2017-06
~~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)~~	~~CEN/TC 156/WG 20~~	Published 2017-08 but no SR *)
**): No systematic review will be launched because revision is ongoing (prEN 16798-3 expected in June 2022)*			
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)	CEN/TC 156/WG 21	Published 2017-06
EN 16798-5-1	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	CEN/TC 156/WG 21	Published 2017-05
EN 16798-5-2	Energy performance of buildings – Ventilation for buildings – Part 5–2: Calculation methods for energy requirements of ventilation systems (Modules M5-6, M5-8, M6-5, M6-8, M7-5, M7-8) - Method 2: Distribution and generation	CEN/TC 156/WG 21	Published 2017-08*)
**) Normally the SR will start in October 2022, but CEN/TC 156 will ask CCMC to have the SR earlier.*			
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	CEN/TC 228/WG 4	Published 2017-07 /FprA1 FV 2022-08-17 *)

ISO or CEN number	Title	Responsible for development (≤ 2017)	Publication date
**): In principle the amendment should not impact the SR*			
EN 15193-1	Energy performance of buildings – Energy requirements for lighting – Part 1: Specifications, Module M9	CEN/TC169/WG 9	Published 2017-04 EN 15193-1/A1 published 2021 *)
**) In principle the amendment should not impact the SR*			
~~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~~	~~CEN/TC 247/WG 6~~	Published 2017-05, but no SR *)
**): No systematic review will be launched because this doc has been superseded by EN ISO 52120-1 (published 2021-12).*			
EN 16946-1	Energy Performance of Buildings – Inspection of Automation, Controls and Technical Building Management – Part 1: Module M10–11	CEN/TC 247/WG 6	Published 2017-04
~~EN 16947-1~~	~~Energy Performance of Buildings – Building Management System – Part 1: Module M10-12~~	~~CEN/TC 247/WG 6~~	Published 2017-05, but no SR *)
**): No systematic review will be launched because this doc has been superseded by EN ISO 52127-1 (published 2021-02)*			
EN 15500-1	Energy Performance of Buildings - Control for heating, ventilating and air conditioning applications - Part 1: Electronic individual zone control equipment - Modules M3-5, M4-5, M5-5	CEN/TC 247/WG 6	Published 2017-05
~~EN 12098-1~~	~~Energy Performance of Buildings - Controls for heating systems - Part 1: Control equipment for hot water heating systems - Modules M3-5, 6, 7, 8~~	~~CEN/TC 247/WG 6~~	Published 2017-05, but no SR *)
**): No systematic review will be launched because revision is ongoing (FprEN 12098-1 rev1 FV 2022-06-27)*			
~~EN 12098-3~~	~~Energy Performance of Buildings - Controls for heating systems - Part 3: Control equipment for electrical heating systems - Modules M3-5,6,7,8~~	~~CEN/TC 247/WG 6~~	Published 2017-05, but no SR *)
**): No systematic review will be launched because revision is ongoing (FprEN 12098-3 rev1 FV 2022-06-27)*			
~~EN 12098-5~~	~~Energy Performance of Buildings - Controls for heating systems - Part 5: Start-stop schedulers for heating systems - Modules M3-5,6,7,8~~	~~CEN/TC 247/WG 6~~	Published 2017-05 but no SR *)
**): No systematic review will be launched because revision is ongoing*			
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 M11-8-7	CEN/TC 228/WG 4	Published 2017-05

Annex 2. Preliminary evaluation of the 2022 revision of the EPBD (Europe)

An introduction to the 2022 revision of the EPBD is given in chapter 4.

Preliminary, EPB standards related evaluation of the EC's proposal to revise the EPBD [5]:

Revision of the EPBD is needed to:

- follow-up the policy measures from EU Green Deal, Renovation Wave: Fit for 55 by 2030 towards Zero Carbon emission by 2050.
  - making the Energy Performance Certificate (EPC) more attractive and reliable.

It intends to improve the EPC by:

Adding a requirement for the Indoor Environmental Quality:

Include an IEQ performance indicator at the EPC and by doing so, include the energy use of absent or underperforming building systems in the reported Energy performance on the EP-Certificate (label).

The EPBD addresses this as follows:

- in the expected EPBD this is softly addressed in art.4 (related to **MEPS**),
- in art.6 (New Buildings) **IEQ** issues shall be addressed. Annex I art.2 : *indoor conditions, and in order to optimise health, indoor air quality and comfort levels defined by MS's*
- EPBD Annex I refers to the **EN ISO 52016-1** which is the energy need calculation which enables to calculate the impact of **underperforming or absent building systems**.

Hourly calculation intervals required:

Reducing the performance gap by improving the comparability (harmonisation) of the EP assessment procedure

Annex I. art. 2: The energy needs and energy use for space heating, space cooling, domestic hot water, ventilation, lighting and other technical building systems shall be calculated using **hourly or sub-hourly time calculation intervals** in order to account for varying conditions that significantly affect the operation and performance of the system and the indoor conditions, and in order to optimise health, indoor air quality and comfort levels defined by Member States at national or regional level.

- This hourly procedure is more easy to use, more transparent, reproduceable and innovation supportive, it is also expected that it will reduce the performance gap.
- Interaction with the grid cannot be identified with a monthly calculation.
- The effect of advanced controls and BACs cannot be evaluated via a monthly procedure.

Common framework for EP calculation:

EPBD Article 3: Adoption of a methodology for calculating the energy performance of buildings: Member States shall apply a methodology for calculating the energy performance of buildings in accordance with the common general framework set out in EPBD Annex 1.

- EPBD Annex I art.1: National methods shall be described according EN ISO 52000-1, 52003-1, 52010-1, 52016-1, 52018-1, EN 16798-1, EN 17423

  These last two standards on IEQ and PEF & CO_2 emission are new compared to EPBD:2018.

Towards improved EP & reduction of GHG emission from buildings:
Zero-emission Buildings:

- EPBD art.2: 'zero-emission building' means a building with a very high energy performance, as determined in accordance with Annex I, where the very low amount of energy still required is fully covered by energy from renewable sources generated on-site, from a renewable energy community within the meaning of Directive (EU) 2018/2001 [amended RED] or from a district heating and cooling system, in accordance with the requirements set out in Annex III;
- Annex I art.3: For the purpose of expressing the energy performance of a building, Member States may define additional numeric indicators of total, non-renewable and renewable primary energy use, and of operational greenhouse gas emissions produced in kgCO2eq/(m2 .y).
    - Zero-Emission Building : The NZEB (Nearly Zero Energy Performance Building) approach is deleted and replaced by **Zero-Emission Building (ZEmB)**
        - Very low Energy Use assessed according Annex I (and Benchmark Annex III) still needed shall be fully covered by renewable sources produced on site.
    - Building Renovation Passport: providing a tailored roadmap to ZEmB, issued by accredited expert, follows visit on site. (delegated act by 2023),
    - Sustainable mobility infrastructure in and adjacent to buildings (smart charging (2-way) and bicycle parking)
- Renewable Energy Sources includes now geothermal and **ambient** energy

Zero-emission Buildings:

- Deep Renovation leading to ZEmB: only deep if more as 30% reduction
- Definitions for Useful and Reference floor area according EN ISO 52000-1

For new buildings:

- All ZEmB by 2030, public buildings by 2027
- Life-Cycle GWP has to be calculated according EN 15978 and reported at EPC by 2027 (>2000m2) and for all **by 2030**
- IEQ shall be addressed as well

Impact on the use of EPB standards:

- A more stringent policy regarding EPC's, their quality and acceptance will emphasize the role of a correct use of the set of EPB standards
- An EU-harmonised GHG metric will make use of the EN 17423
- Reducing the performance gap by improving the reliability of the calculated asset rating is supported by the required hourly calculation step
- Hourly calculation step brings the use of the SRI to a next stage where the building and grid interaction will become visible and able to demonstrate the level of decarbonisation of the energy used by the building systems

Annex 3.
The ISO and CEN SMART Standards Programmes
(towards digitization of standards)

Some information extracted from the ISO SMART website [8] Link.

SMART stands for 'Standards Machine Applicable Readable and Transferable'.

Levels of SMART (see Figure Annex3.1)::

Level 0, 1 and 2 refers respectively to Paper, PDF and XML. Those level are not considered "SMART".

However, Level 3 is when the machine can identify content from the standard.

Level 4 is where the machine can take that content, interpret and use it.

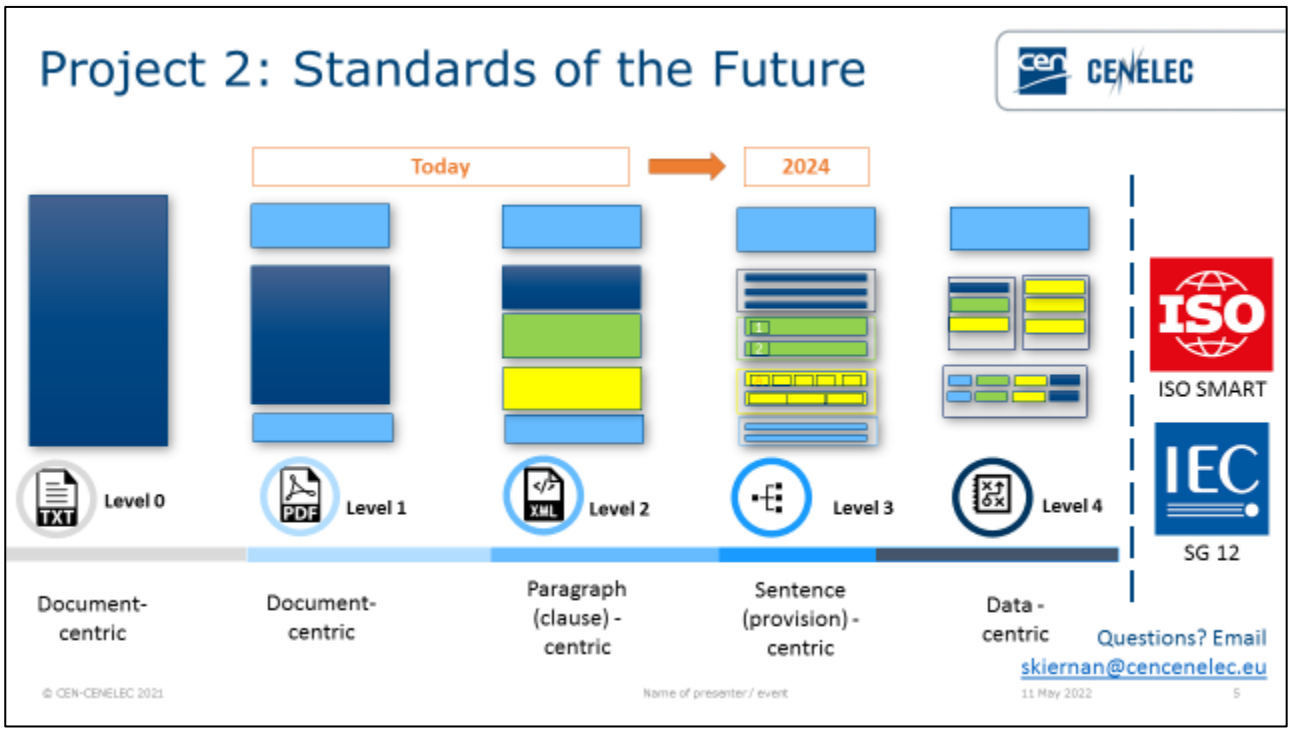

Fig. Annex3.1 – Digital transformation *(picture from ppt CEN)*

We need SMART Standards because today it's becoming difficult for industries to keep up with the ever-evolving regulation, and to adapt their processes to the changes in a manual way. Standards users are seeking innovative means to use ISO content in a manner that leverages technological innovations within and across economic sectors.

The objective of ISO SMART is to move standards content from being human consumption only to being also machine readable. A programme taking us to the next level in standardization and advancing the digitalization of our portfolio.

The vision for ISO SMART is to transform the current way of creating, managing, delivering and consuming standard thus increasing efficiencies and facilitating social and economic interactions worldwide.

Timeline for ISO SMART: the plan is to have an implementable roadmap with several tested/proven and recommended solutions within2024

ISO SMART has the potential to change the way your business uses standards. In addition to trusted paper and PDF formats, ISO SMART will offer trusted machine-readable content from existing standards that can make the application of standards more efficient.

As a result, ISO will have to change its business model. It is not known yet how; there is a dedicated team working on it.

ISO SMART will transform the way standards content is consumed. In addition to traditional human-readable content, ISO SMART will facilitate direct machine-readable access to specific content. Note that for the foreseeable future, paper, pdf and xml format will still be available.

The aim is to have a complete framework in place, fully tested in production, by December 2024.

Fig. Annex3.2 – Overall timeline ISO SMART Programme

From CEN website (link):

We will aim for Level 3 machine readable standards, as defined by the SMART Standards Utility Model (which was developed by IEC and which has been adopted by both ISO and CEN-CENELEC). We will collaborate with ISO and IEC who are running similar projects in order to represent European interests at international level.

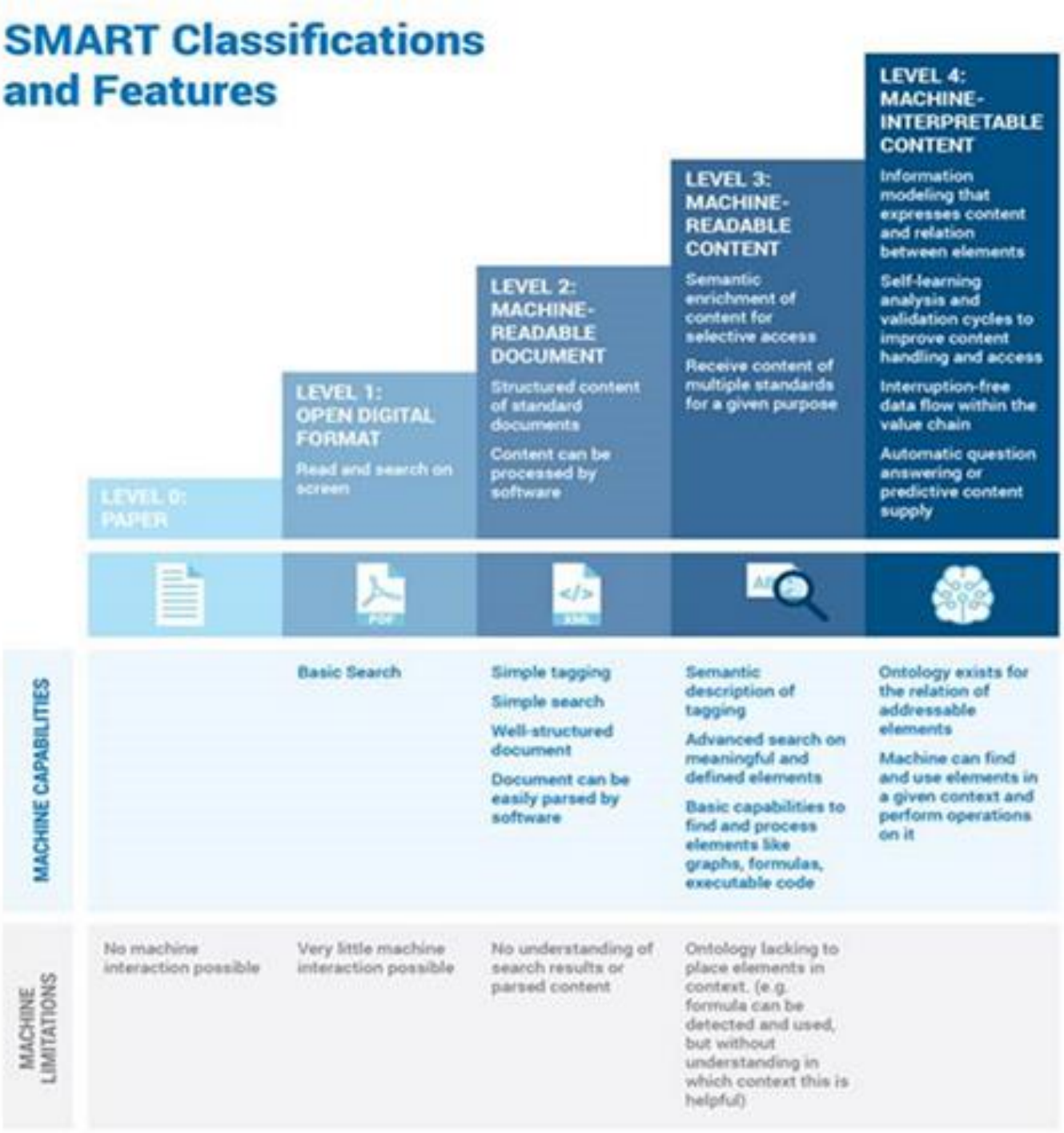

Fig. Annex3.3 – SMART classifications and features,with some more details; *(from CEN website)*

Annex 4. The EPB Center

The EPB Center has been initiated by the main experts involved in the development of the set of EPB standards, after the finishing the work under the EC Mandate M/480 in 2017 [2].

Their aim was (1) to avoid that the expertise and many years of experience and knowledge on the development of the set of EPB standards would be scattered and lost and (2) to promote the implementation and further improvement and globalization of the set of standards.

The EPB Center collects and makes available a wide variety of information on the set of EPB standards for the various target groups. This includes overviews, short videos and webinar presentations, (spreadsheet) tools, example NAs, FAQs and calculation examples (case studies).

For this work the EPB Center received e.g. a three years' service contract from the European Commission (2018-2021).

The EPB Center experts are available to answer specific questions on the set or individual EPB standards.

In particular, the EPB Center encourages comments, questions and suggestions that will lead to future improvement of the standards.

These comments, questions and suggestions are synthesized and forwarded to the responsible CEN or ISO committees at appropriate intervals.

https://epb.center/

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