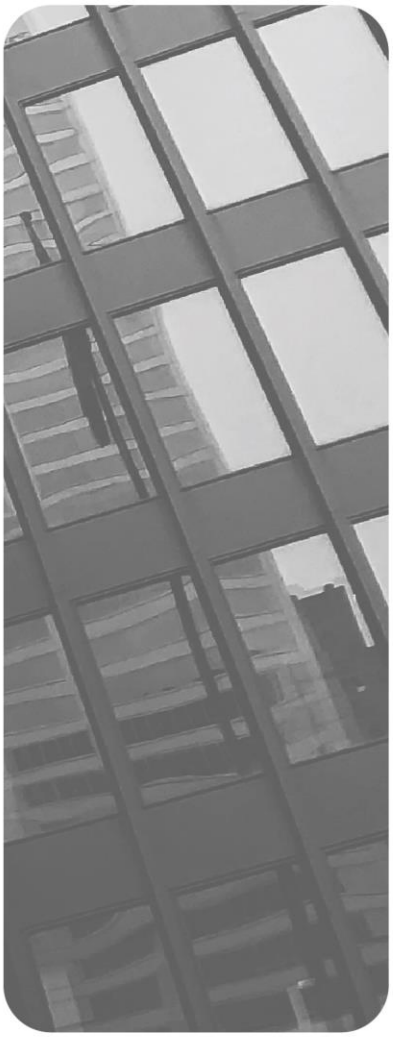

D3.1 Development of a converged set of national data sheets *(towards a U-CERT calculation methodology using the set of EPB standards)*

U-CERT
User-Centred Energy Performance Assessment and Certification

This project has received funding from the European Union's Horizon 2020 research and innovation programme under the grant agreement number 839937. The European Union is not liable for any use that may be made of the information contained in this document, which is merely representing the authors' view.

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Project duration: 1st of September 2019 – 28sh of February 2023

Grant Agreement number: 839937 (Coordination and Support Action)

WP: 3

Deliverable: 3.1

Lead beneficiary: EPB Center

Submission Date: 28 February 2023 (final version)

Dissemination Level: Public

Due date: M15

U-CERT Website: www.u-certproject.eu

Revision History:

DATE	VERSION	AUTHOR/ CONTRIBUTOR	REVISION BY	COMMENTS
03/03/2021	1.00	Dick van Dijk	Marco Hofman (ISSO), Pablo Carnero (IVE), Marleen Spiekman (TNO)	Draft final version
27/08/2021	1.50	Dick van Dijk	Various U-CERT experts	Updated version
27/02/2023	2.00	Dick van Dijk	Pablo Carnero (REHVA)	Final version

Acknowledgements:

U-CERT Consortium would like to acknowledge the financial support of the European Commission under the H2020 programme. This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement number 839937.

1 Executive summary

This report is the result of the activities carried out within U-CERT Task 3.1, *Development of a converged set of national data sheets for the set of EPB standards*, one out of 4 tasks under Work Package 3, *Supporting development of National Implementations*. The Task leader was EPB Center, and other U-CERT partners involved are REHVA, ISSO, IVE and TNO, with input from the Case studies holders.

To provide flexibility in the application of the set of EPB standards, clearly identified choices are offered in each EPB standard. This to account for national or regional differences in climate, culture and building tradition, building typologies, policy, and legal frameworks. The choices are to be specified in a National Annex to each EPB standard or in a separate document, a so-called National Datasheet, but in both cases: following a template given in the “Annex A” of each EPB standard.

The aim is to come to a converged set of National Datasheets that is harmonized where possible and flexible where needed (e.g., climatic data) and widely acceptable and applicable. Additional requirements are that the converged National Datasheets are mutually and overall consistent and enable the assessment of innovative products/solutions as much as can be foreseen.

The U-CERT EPB calculation methodology consists of the combination of the EPB standards and this converged set of U-CERT National Datasheets.

The development and use of a set of National Datasheets for the implementation of the set of EPB standards is a national responsibility of the Member States. Each MS has its own program and timeline to realize this. The project’s objective is that the U-CERT EPB calculation methodology will assist the eleven involved Member States in the process of drafting the national implementation of the set of EPB standards. More in general, the U-CERT converged set of National Datasheets may significantly support further harmonization of the national EPB Assessment methodologies and certification schemes.

The results of this part of the project are also important input for the work under other parts of the project, the assessment of the applicability of the developed assessment and the certification schemes (U-CERT report D.4.1 [7]) and supporting tool 1 (U-CERT report D5.4, [8]).

The intended starting point for the work was a collection of National Annexes or National Datasheets from the EU Member States (see U-CERT report D2.1 [4]). However, the implementation of the set of EPB standards in the EU Member States has been delayed compared to the expectations. Likely causes for these delays are e.g. the time needed for each country for the process to change the national assessment procedures and difficulties due to the COVID-19 crisis.

This led to a change of approach: the use of the expert knowledge of the EPB Center and feed back from the other U-CERT partners (specifically the partners responsible for the related work packages) to prepare the U-CERT proposed converged set of National Datasheets for the most relevant EPB standards, including explanation and points of attention.

2 The set of EPB standards

2.1 General

To assess the overall energy performance of a building, the European Commission has established a set of standards and accompanying technical reports to support the EPBD (mandate M/480 to CEN, *the European Committee for Standardisation*, 2012-2017 [2]). These are called the energy performance of buildings standards or "set of EPB standards". See **Figure 1** (*next page*).

All of these standards have been developed by CEN (Europe). And several of them, including the core set mentioned in the European Directive (EPBD:2018, Annex 1, see 2.2 below), have been developed in collaboration with ISO (global). Consequently, these EN ISO standards are applicable at worldwide level. Others are at this moment only available in Europe (EN standards). However, several EPB standards already published in CEN are now being developed in ISO as well.

To provide flexibility in the application each EPB standard offers clearly identified choices to account for (national or regional) differences in climate, culture and building tradition, building typologies, policy and legal frameworks. The choices are to be specified in a National Annex to each EPB standard or in a separate document, a so-called National Datasheet, but in both cases: following a template given in the "Annex A" of each EPB standard (see **Figure 2** for an example).

The development of a set of National Datasheets for the implementation of the set of EPB standards is a national responsibility of the EU Member States and each MS has its own program and timeline to realize this.

According to expectation, most EU Member States intend to develop and use a set of National Annexes or National Datasheets for the implementation of the set of EPB standards. This implies the use of the templates provided in the Annex A of each EPB standard. And, as part of a step-by-step implementation of the whole set, several MS will for the time being continue using elements of their national assessment method, for specific modules where the set of EPB standards (for whatever reason) is still difficult to implement.

Table A.2 — Choice between hourly or monthly calculation method (see 5.2)

Type of object and/or application	….. [b]	…. [b]
Description	Choice [a]	Choice [a]
Only hourly method allowed	Yes/No	Yes/No
Only monthly method allowed	Yes/No	Yes/No
Both methods are allowed	Yes/No	Yes/No

[a] Only one Yes per column possible.

[b] Add more columns if needed to differentiate between type of object, type of building or space, type of application or type of assessment. Use the list of identifiers from ISO 52000-1:2017, Tables A.2 to A.7 (normative template, with informative default choices in Tables B.2 to B.7).

Fig. 2 – Example of an "Annex A" choice (from (EN) ISO 52016-1)

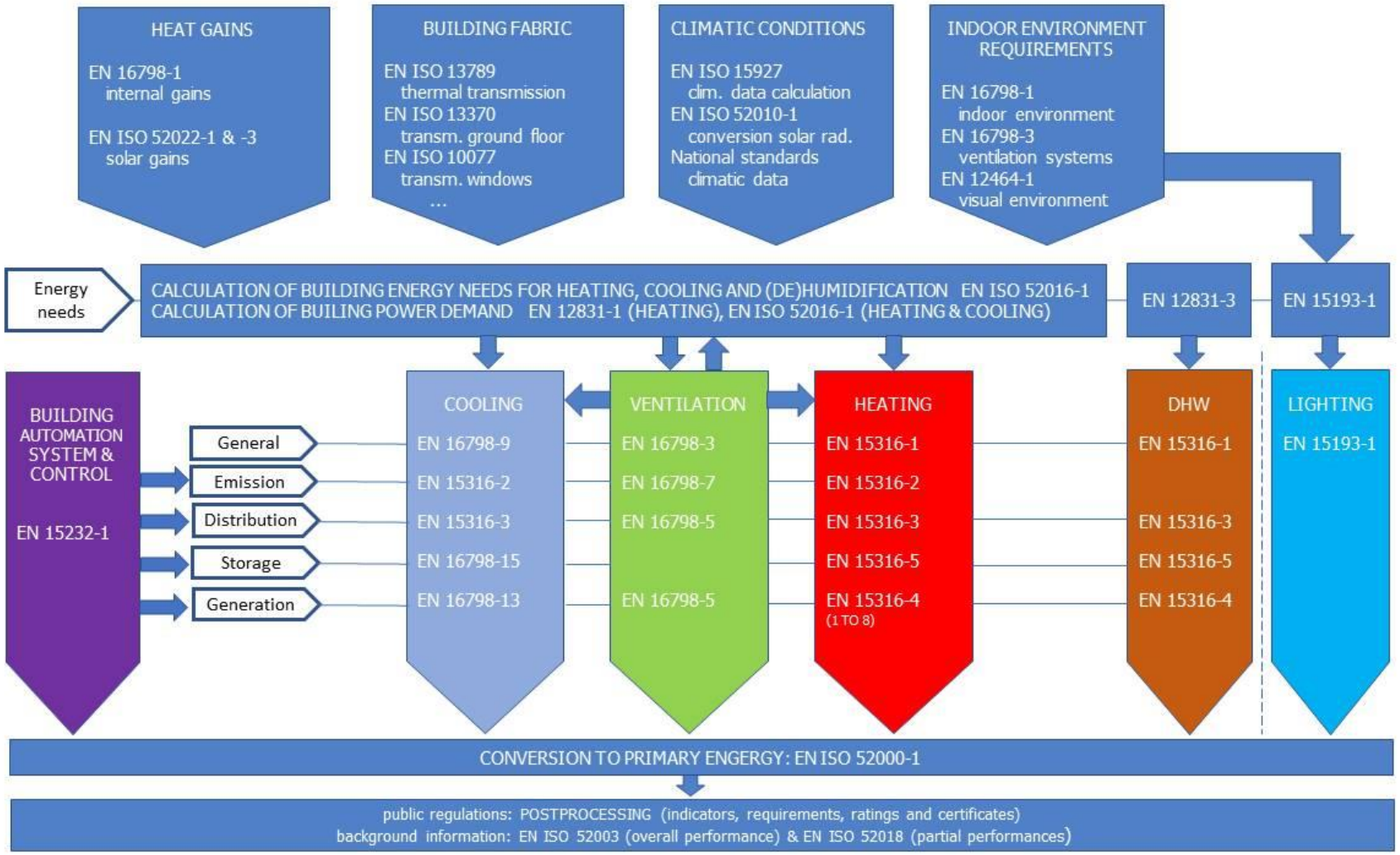


Fig.1 – Schematic overview of the set of EPB standards

More information:

- https://epb.center/epb-standards/
- https://epb.center/support/documents/guide-national-annexes/
- https://epb.center/epb-standards/background/iso-and-cen-road-ahead/

2.2 EPBD and the set of EPB standards

The set of EPB standards play a key role to support the Energy Performance of Buildings Directive (EPBD) of the European Union [1]. Member States are encouraged to consider applicable standards, in particular from the list of EPB standards.

An explicit requirement can be found in EPBD Annex 1, point 1:

> *"Member States shall describe their national calculation methodology following the national annexes of the overarching standards, namely ISO 52000-1, 52003-1, 52010-1, 52016-1, and 52018-1, developed under mandate M/480 given to the European Committee for Standardisation (CEN). This provision shall not constitute a legal codification of those standards."*

Although the EPBD does not force the Member States to apply the set of EPB standards, the obligation to describe the national calculation methodology following the National Annexes of these 'overarching standards' or 'core EPB standards') will push the Member States to explain where and why they deviate from these standards. This will lead to an increased recognition and promotion of the set of EPB standards across the Member States and will have a positive impact on the implementation of the Directive.

In the proposal for the EPBD recast (2022-2023) the role of the EPB standards is further strengthened (see also U-CERT report D3.4 [15]).

More information:

- https://epb.center/epb-standards/energy-performance-buildings-directive-epbd/

3 Objectives

The objective of WP3 (*Supporting development of National Implementations*) is that U-CERT will use and strengthen the services of the EPB Center to assist the eleven involved EU Member States in the process of drafting the national implementation of the Energy Performance Assessment and Certification, including application of the set of (CEN and ISO) EPB standards, developed under the mandate M/480 of the European Commission (2012-2017) and the integration of the Smart Readiness Indicator with a holistic end user centric approach.

The objective of Task 3.1 is to facilitate the implementation of the set of EPB standards by preparing a converged set of National Datasheets that is harmonized where possible and flexible where needed (e.g., climatic data) and widely acceptable and applicable. Each EPB standard describes a specific element in the calculation of the energy performance, so it is crucial that the converged set of National Datasheets are mutually and overall consistent. An additional requirement is that the converged National Datasheets enable the assessment of innovative products/solutions as much as can be foreseen.

The development and use of a set of National Datasheets for the implementation of the set of EPB standards is a national responsibility of the Member States and each MS has its own program and timeline to realize this; U-CERT will not interfere with this. However, the objective is that the U-CERT EPB calculation methodology will assist the eleven involved Member States in the process of drafting the national implementation of the set of EPB standards, offering a holistic end user centric approach.

More in general, the U-CERT converged set of National Datasheets, including the in-depth analysis of the type, background, and impact of each of the choices offered in the “Annexes A”, might be a strong stimulus for further harmonization of the set of EPB standards.

4 Selection of EPB calculation standards

4.1 Introduction

The set of EPB standards consists of about 50 documents, each covering a specific aspect.

However, not all EPB standards contain (EP) calculation procedures, because the set of EPB standards also comprise e.g., inspection procedures, building, system, or component design, (EP) measurement procedures, standards on EP indicators, requirements, or ratings and e.g., reference calculation procedures (as basis for practical calculation procedures provided in other EPB standards).

Moreover, not all EPB standards that describe calculation procedures are equally relevant for the practitioner, as will be explained in 4.2.

See for more detailed information the following links:

- At EPB Center website:
  - General background information: https://epb.center/epb-standards/
  - List of all EPB standards: https://epb.center/support/documents/?title=&group=2
  - Webinar 2 presentation by Dick van Dijk (introduction to the different categories of EPB standards).
    recording of this presentation
    combined pdf of all webinar 2 presentations
- CEN-CE, CEN standard certified experts *(EU-wide training / qualification scheme based on EPBD mandated CEN standards)*
  - https://www.cen-ce.eu/

Consequently, the first step towards a coherent U-CERT EPB calculation methodology concerns the **categorization** and **hierarchy** of EPB standards, from the perspective of the **application in practice**.

4.2 Categorization of EPB standards

The set of EPB standards is divided into **modules**.

NOTE At the EPB Center website the modules are presented as "**Topics**".

Furthermore, several **themes** are distinguished.

See the subdivision of modules and themes in **Table 1**.

The green colored categories are within the selection for the calculation method, the red ones are not.

Table 1 – The EPB modules and themes

Modules	Themes
1. Overarching 2. Building as such 3. Heating systems 4. Cooling systems 5. Ventilation systems 6. Domestic hot water systems 7. Humidification 8. Dehumidification 9. Lighting 10. Building automation and control 11. PV, wind power	○ (EP) Calculation procedures ○ EP pre- processing (indoor and outdoor conditions) ○ EP post-processing (EP indicators, requirements or ratings) ○ (EP) Measurement procedures ○ Building, system or component design procedures ○ Inspection procedures ○ Certification procedures ○ Other

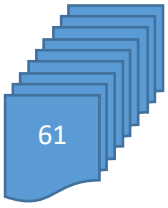
NOTE It may be that a standard covers more than one theme. For the purpose of this report the key question is whether the standard contains EP calculation procedures and/or EP pre- or post-processing procedures or not.

NOTE At the EPB Center website the distinction between Themes is also used, but less refined.
In the set of EPB standards, each module is subdivided. Each subdivision relates to a specific theme or technical aspect.

4.3 Selection

4.3.1 Overview of all EPB standards

Annex 1 of this report provides the complete overview of all EPB standards, listed per module, with the Theme presented in a separate column. The total number of EPB standards in this overview is 61.



4.3.2 Selection step 1: ignore duplicates

If we ignore the **duplicates** in the published EPB standards (2x CEN and ISO different standards on the same topic), and the duplicates in the EPB standards in **preparation** (6 x EN standards being prepared as EN ISO standards[1]), the number of selected EPB standards is reduced from 61 to 53.

NOTE When there are duplicate CEN and ISO versions, the CEN version is listed (with the ISO number added between brackets).

[1] At the time of making the selection (2021)

4.3.3 Selection step 2: focus on EP calculations

For the U-CERT calculation procedures, we are not interested in the EPB standards that contain building, system or component design procedures, inspection, or certification procedures and "other" EPB standards that do not contain **EP Calculation or Pre- and Post-processing procedures**. This reduces the number of standards further, from 53 to 37. These 37 EPB standards are listed in **Table 4** further on.

4.3.4 Selection step 3: filter on user type

The selection is further refined by adding another subdivision of the EPB calculation standards: what are the typical users of the set. See **Table 2**. The green colored categories will be adopted within the selection, the red ones will not.

Table 2 – Subdivision of typical user and position in the hierarchy

The typical user [a] of the EPB standard
• Regulator • **EPB assessor** • **System engineer [b]** • Product/component manufacturer or supplier • (EP) standard writers (incl. reference procedures)
a): The actual user of the standard (incl. National Annex or Datasheet) in practice b): This remains of course arbitrary because it depends on: (1) the complexity of the system, and (2) whether a detailed or simplified calculation procedure is selected/allowed (e.g., selected as part of the choices in Annex A of that standard)

NOTE The average EPB assessors will probably not use the EPB standard itself (also not the national method). They will use only the software. But the main issue here is they are interested in choosing the input data and how these impact the output. So, they are interested in the *U*-value of a window but have less direct interest in the material data that is used as input for the standard to calculate this *U*-value.

In **Table 4** each EPB standard is subdivided according to the typical user.

Regulators and (EP) standard writers are not *actual users in practice* of the EPB standards containing calculation or pre- or post-processing procedures. Therefore, they are disregarded in Table 4.

If we count all the EPB standards in **Table 4** that have as typical user categories the EPB assessor or the system engineer, then the selection is reduced from 37 to 25.

Warning:

- As footnote b) in **Table 2** explains, the subdivision remains arbitrary, for instance because a system engineer may not be needed in case of an **uncomplicated system or** in case a **simplified calculation procedure** is selected/allowed (e.g., selected/allowed as part of the choices in Annex A of that standard) to waive specific complexities.

4.3.5 Selection step 4: filter on position in the hierarchy

Finally, the selection is further refined by adding as subdivision of the EPB calculation standards: what is the position in the hierarchy of the set. See **Table 3**.

Again, the green colored categories will be adopted within the selection, the red ones will not.

Table 3 – Subdivision of position in the hierarchy

The position in the hierarchy [a] **of EPB standards**
• **General application** • Special application (technologies, situations) [b] • Whether General or Special: May often be simplified, without major impact on the overall EP [c]
a): Although to some extent arbitrary b): But EPB standards that contain procedures for innovative technologies that are applied in case studies may in second instance be added c): But depends on the technologies

In **Table 4** each EPB standard is also subdivided according to the position in the hierarchy.

If we count all 25 already selected EPB standards in Table 4 that have a **"general application"**, then the selection is reduced from 25 to 16.

Finally, from these 16 EPB standards, the standards that "may often be simplified without major impact on the overall EP" are in the first instance ignored. For instance, EPB standards that, in reasonably simple situations, allow for tabulated values instead of a detailed calculation. If we skip these EPB standards from the selection, the selection is (finally) reduced from 16 to 9. In a later stage one of these EPB standards (on distribution systems) was added, because of the attention it received at the EPB Center (in presentations and in questions).

Warning:

Again, as footnote b) in Table 3 explains, these subdivisions remain arbitrary, for instance because EPB standards containing procedures for **innovative technologies** that are applied in case studies may in second instance be needed.

4.3.6 Result

Table 4 shows all EP calculation and EP pre-/post-processing standards with the above-mentioned subdivisions. The 10 green colored standards are the ones that are part of the final selection of the EPB standards for the core of the U-CERT EPB calculation methodology.

However, this final selection is not cast in stone, as explained in the previous paragraph.

Table 4 – All EPB standards containing EP Calculation or EP pre- or post-processing procedures and further subdivision with (in green) the final selection

M#	Number	Title	Typical user			Hierarchy		
			EPB assessor	System engineer	Prod.supplier	General	Special	May be simplified
M1	EN ISO 52000-1	Energy Performance of Buildings – Overarching EPB assessment – Part 1: General framework and procedures	E	-	-	G	-	
M1	EN ISO 52003-1	Energy performance of buildings – Indicators, requirements, ratings and certificates – Part 1: General aspects and application to the overall energy performance	E	-	-	G	-	
M1	EN 16798-1 (alt.: ISO 17772-1) (revisions in prep. since 2023)	Energy performance of buildings – Ventilation of buildings – Part 1: Indoor environmental input parameters for design and assessment of energy performance of buildings addressing indoor air quality, thermal environment, lighting and acoustics (Module M1–6)	E	-	-	G	-	
M1	EN ISO 52010-1	Energy performance of buildings - External climatic conditions - Part 1: Conversion of climatic data for energy calculations	E	-	-	G	-	
M2	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	E	-	-	G	-	
M2	EN ISO 52016-3	Energy performance of buildings – Energy needs for heating and cooling, internal temperatures and sensible and latent heat loads - Part 3: Calculation procedures regarding adaptive building envelope elements (in preparation)	E	-	-	-	S	
M2	EN ISO 52016-5	Energy performance of buildings – Energy needs for heating and cooling, internal temperatures and sensible and latent heat loads - Part 5: Specific criteria and validation procedures (in preparation)	E	-	-	-	S	
M2	EN ISO 52018-1	Energy performance of buildings — Indicators for partial EPB requirements related to thermal energy balance and fabric features —	E	-	-	G	-	-

M#	Number	Title	Typical user			Hierarchy		
			EPB assessor	System engineer	Prod.supplier	General	Special	May be simplified
		Part 1: Overview of options						
M2	EN ISO 13789	Thermal performance of buildings - Transmission and ventilation heat transfer coefficients - Calculation method	-	-	P	G	-	-
M2	EN ISO 13370	Thermal performance of buildings – Heat transfer via the ground – Calculation methods	-	-	P	G	-	-
M2	EN ISO 6946	Building components and building elements – Thermal resistance and thermal transmittance – Calculation method	-	-	P	G	-	-
M2	EN ISO 10211	Thermal bridges in building construction - Heat flows and surface temperatures - Detailed calculations	-	-	P	-	S	-
M2	EN ISO 14683	Thermal bridges in building construction – Linear thermal transmittance – Simplified methods and default values	-	-	P	-	S	-
M2	EN ISO 10077-1	Thermal performance of windows, doors and shutters – Calculation of thermal transmittance – Part 1: General	-	-	P	G	-	-
M2	EN ISO 10077-2	Thermal performance of windows, doors and shutters – Calculation of thermal transmittance – Part 2: Numerical method for frames	-	-	P	-	S	-
M2	EN ISO 12631	Thermal performance of curtain walling – Calculation of thermal transmittance	-	-	P	-	S	-
M2	EN ISO 13786	Thermal performance of building components – Dynamic thermal characteristics – Calculation methods	-	-	P	-	S	-
M2	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 daylight characteristics for solar protection devices combined with glazing	-	-	P	-	S	-
M2	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	-	-	P	-	S	-
M3	EN 15316-1	Energy performance of buildings – Method for calculation of system energy requirements and system efficiencies –	E	-	-	G	-	M

M#	Number	Title	Typical user			Hierarchy		
			EPB assessor	System engineer	Prod.supplier	General	Special	May be simplified
		Part 1: General and Energy performance expression, Module M3–1, M3–4, M3–9, M8–1, M8–4						
M3	EN 15316-2 (alt.: ISO 52031)	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	E	-	-	G	-	M
M3	EN 15316-3 (alt.: ISO 52032-1)	**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	**E**	**-**	**-**	**G**	**-**	**M**
M3	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	-	S	-	-	S	-
M3	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	E	-	-	G	-	M
M3	**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**	**E**	**-**	**-**	**G**	**-**	**-**
M3	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	-	S	-	-	S	-
M3	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–	-	S	-	-	S	-

M#	Number	Title	Typical user			Hierarchy		
			EPB assessor	System engineer	Prod.supplier	General	Special	May be simplified
		11-4						
M3	EN 15316-4-5	Energy performance of buildings – Method for calculation of system energy requirements and system efficiencies – Part 4–5: District heating and cooling, Module M3–8-5, M4–8-5, M8–8-5, M11–8-5			-	-	S	-
M3	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	-	S	-	-	S	-
M4	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	-	S	-	G	-	M
M4	EN 16798-15	Energy performance of buildings – Ventilation for buildings – Part 15: Calculation of cooling systems (Module M4–7) – Storage	-	S	-	-	S	-
M4	EN 16798-13	Energy performance of buildings – Ventilation for buildings – Part 13: Calculation of cooling systems (Module M4–8) – Generation	-	S	-	G	-	M
M5+ M6	**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)**	**E**	**-**	**-**	**G**	**-**	**-**
M5+ M7	**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**	**-**	**S**	**-**	**G**	**-**	**-**
M5	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	E	-	-	-	S	-

M#	Number	Title	Typical user			Hierarchy		
			EPB assessor	System engineer	Prod.supplier	General	Special	May be simplified
		generation						
M9	EN 15193-1	Energy performance of buildings – Energy requirements for lighting – Part 1: Specifications, Module M9	E	-	-	G	-	M
M11	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	-	S	-	-	S	-

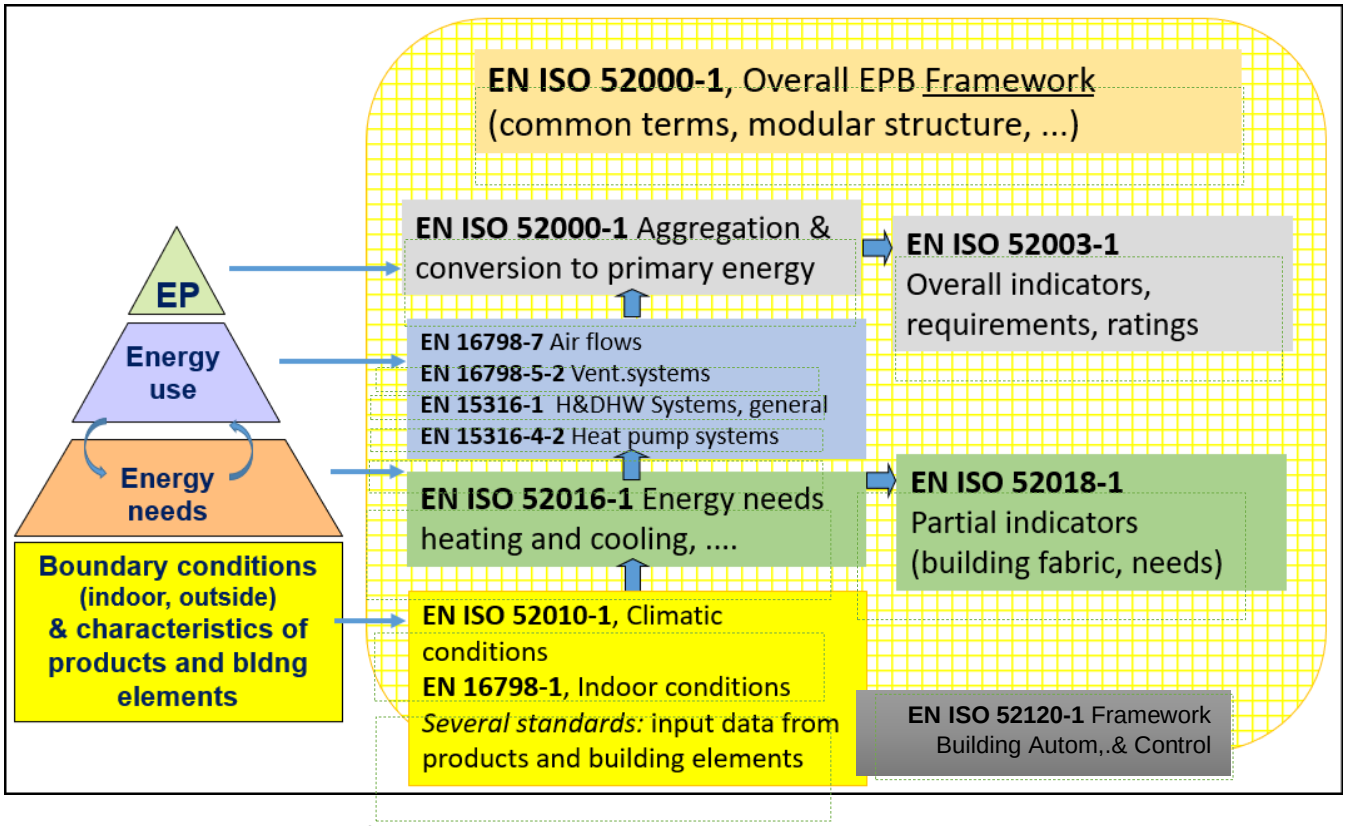
4.3.7 Final selection

So, the following 10 EPB standards (**Table 5**) have been selected for the U-CERT EPB calculation methodology.

Table 5 – The final selection of 10 EPB standards for the U-CERT EPB calculation methodology

M#	Number	Title
M1	EN ISO 52000-1	Energy Performance of Buildings – Overarching EPB assessment – Part 1: General framework and procedures
M1	EN ISO 52003-1	Energy performance of buildings – Indicators, requirements, ratings and certificates – Part 1: General aspects and application to the overall energy performance
M1	EN ISO 52010-1	Energy performance of buildings - External climatic conditions - Part 1: Conversion of climatic data for energy calculations
M1	EN 16798-1 (alt. : ISO 17772-1) (revisions in prep. since 2023.)	Energy performance of buildings – Ventilation of buildings – Part 1: Indoor environmental input parameters for design and assessment of energy performance of buildings addressing indoor air quality, thermal environment, lighting and acoustics (Module M1–6)
M2	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
M2	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
M3	ISO 52032-1	Energy performance of buildings — Energy requirements and efficiencies of heating, cooling and DHW distribution systems — Part 1: Calculation procedures
M3	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
M5+ M6	EN 16798-7	Energy performance of buildings – Ventilation for buildings – Part 7: Calculation methods for the determination of air flow rates in buildings including infiltration (Module M5–5)
M5+	EN 16798-5-1	Energy performance of buildings – Ventilation for buildings – Part 5–1:

M#	Number	Title
M7		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



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. 4 – Similar selection of key EPB standards needed for the overall EPB assessment by calculation *(source: EPB Center website)*

However, this final selection is not cast in stone, as explained in the paragraphs above and also shown in **Figure 4**, copied from the EPB Center website, in which the key EPB BAC standard is added, as well as the general part of the EPB heating standards):

- The subdivision of typical user (**Table 2**) remains arbitrary, for instance because a system engineer may not be needed in case of an **uncomplicated system or** in case a **simplified calculation procedure** is selected/allowed (e.g., selected/allowed as part of the choices in Annex A of that standard) to waive specific complexities.
- The subdivision of position in the hierarchy (**Table 3**: “special application” and “may be simplified”) remains arbitrary, for instance because EPB standards that contain procedures for **innovative technologies** that are applied in case studies may in second instance be added.

About innovative technologies:

Innovation often takes place at the level of **system integration**.

For instance, connecting a heat pump system with a PV system.

And/or some smart control systems also considering storage and grid delivery optimization.

Or a thermal solar system integrating the heating generation function for space and DHW heating.

Or ventilative cooling in connection with evaporative cooling potential or by using ground source coupling.

Such combinations can be handled if the relevant EPB standards are selected and if the interconnection can be handled.

5 Selection of EPB standards for measured energy performance

The discussion on U-CERT procedures for measured EP takes place in U-CERT tasks T2.4, T3.2 and T4.1).

To give an impression of similarities and differences with the selection of EPB standards for calculated energy performance, we briefly introduce the subject in this report.

There is **only one EPB standard** specifically on measured energy performance: **EN 15378-3**:**2017,** *Heating systems and water based cooling systems in buildings — Heating and DHW systems in buildings — Part 3: Measured energy performance*.

Moreover, this standard focuses only on heating and DHW systems.

However, most of the choices in the **overarching EPB standard**, **EN ISO 52000-1**, are relevant both for calculated EP as for EP based on measurements.

In addition to that, also **the "post-processing" EPB standards**, **EN ISO 52003-1** and **EN ISO 52018-1** are relevant for measured energy performance: an overall or partial indicator can be a measured or calculated quantity, or a combination of both, e.g., a measured envelope air tightness that is used as input into the calculation of the overall energy performance.

This is illustrated in 8, the section with more background information on the U-CERT converged set of National Datasheets for measured energy performance.

6 The U-CERT proposed converged set of national datasheets for the main EPB standards (introduction to Annex 2)

6.1 From Annexes A to National Datasheets

Each EPB standard allows for specific choices to be made at national or regional level, specified in a normative Annex A (template). These “Annex A” choices range from policy choices, technical choices and values, but also include choice in references to other (EPB) standards that are referenced as to provide the necessary input data for the standard.

The main step towards a coherent U-CERT EPB calculation methodology is to fill in a National Datasheet for each of the selected EPB standards, in accordance with the template given in the (normative) Annex A of each of these standards. Each EPB standard contains, in addition to Annex A, an informative Annex B with default choices.

Annex 2 contains the U-CERT proposed converged set of National Datasheets for the most relevant EPB standards and includes an explanation and points of attention for each of the 237 “Annex A” choices of the 10 selected EPB standards.

6.2 Why not choose the set of Annexes B?

For completion of the National Annex / National Datasheet the (empty) template of Annex A must be followed. Annex B is a copy of Annex A, with informative default data and choices filled in.

However, it is not correct to simply use the default choices of the Annexes B, because the default choices in the Annexes B:

- were prepared for each EPB standard separately, to enable to demonstrate that the standard is operational; consequently, an overall and mutual consistency is not guaranteed;
- may contain choices that are not relevant, because they are part of a branch of (sub-)choices that is not selected;
- may not always necessarily correspond to the needs in practice.

Nevertheless, the document Annex 2 uses *as starting point* the **Annexes B** with the informative default choices instead of the empty template of Annexes A.
The reasons are:

- The data and choices from Annex B provide a useful example how to fill in Annex A. They can simply be replaced by national data and choices.
- If and where data and choices from Annex B are selected as national data and choices, they are already filled in.
- This facilitates comparison of the national choices with the choices in Annex B and with choices in other countries or regions.
- The colour code as recommended in the EPB Center Guide to fill in an EPB standard’s National Annex or National Datasheet [9] (also) uses the choices in Annex B as starting point for showing the differences with the national data / choices.
- In Annex B the empty template (Annex A) is still clearly visible, because in each Table of Annex A and Annex B, the fixed elements that are part of the template of

Annex A are marked with grey shading. In case of doubt, it is advised to check the EPB standard.

6.3 How many "Annex A" choices?

To give a first impression of the number of "Annex A" choices the **Table 6** lists the number of Tables in Annex A (/ Annex B) of the selected EPB standards. Because a few EPB standards offer choices that are not tabulated but in paragraphs, these are counted as well.

Table 6 – Number of tables in Annex A of the selected EPB standards

Core EPB standard		Number of tables in Annex A
EN ISO 52000-1	Energy Performance of Buildings – Overarching EPB assessment – Part 1: General framework and procedures	32
EN ISO 52003-1	Energy performance of buildings – Indicators, requirements, ratings and certificates – Part 1: General aspects and application to the overall energy performance	7
EN ISO 52010-1	Energy performance of buildings – External climatic conditions – Part 1: Conversion of climatic data for energy calculations	9
EN 16798-1	Energy performance of buildings – Ventilation of buildings – Part 1: Indoor environmental input parameters for design and assessment of energy performance of buildings addressing indoor air quality, thermal environment, lighting and acoustics (Module M1–6)	25 (several choices are in text, not in numbered tables)
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	48
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	14
ISO 52032-1	Energy performance of buildings — Energy requirements and efficiencies of heating, cooling and DHW distribution systems — Part 1: Calculation procedures	19
prEN 15316-4-2 (approved as prEN May 2022) *)	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	39
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)	27 (several choices are in text, not in numbered tables)
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	17
*): to replace EN 15316-4-2:2017		**237**

6.4 "Annex A" choices if national methodology deviates from EPB standard

Topics addressed in each EPB standard can be subject to public regulation. Public regulation on the same topics can, for certain applications, override the use of the EPB standard(s). In that case, the national methodology will not be fully in line with the EPB standard(s).

When an EPB standard is not adopted in full by a Member State, Annex A of the **EPB standard** should (still) be used as a template to describe the **national** calculation methodology and national choices. This helps to make the national methodologies more transparent and helps to increase overall consistency. In Annex I to the EPBD this is even required, at least for the five 'overarching' EPB standards.

NOTE If the EPB standard is not adopted in full, a formal National Annex to the EPB standard is not applicable. So the national calculation methodology and national "Annex A" choices should be published as a National Datasheet.

More detailed explanations and many examples (do's and don'ts) are presented in the EPB Center Guide to fill in an EPB standard's National Annex or National Datasheet [9]

6.5 Colour codes for the choices

The EPB Center Guide [9] recommends the use of different font colours when preparing a National Annex or National Datasheet, to facilitate comparison with the default choices in Annex B and comparison with other regions and countries. These recommended colour codes are also applied in Annex 2.

- Black font = from Annex A (in the tables these elements are usually grey shaded)
- Black font = National data/choices that are following the data/choices of Annex B
- ~~Blue font, strike through~~ = Data/choices of Annex B that are not used as national data/choices
- Blue font = National data/choices that are not found as data/choices in Annex B, but that are in agreement with Annex A (so: in agreement with the standard)

In case the National Datasheet is used to describe a national methodology using the Annexes A of certain EPB standards, the recommended colour code also enables a clear overview where the national method deviates from the EPB standard:

- ~~Red font, strike through~~ = (fixed) elements of Annex A that are not adopted (→ **not** in agreement with the standard)
- Red font = Elements or national data/choices that are not in agreement with Annex A (→ **not** in agreement with the standard)

6.6 Explanation and justification of each proposed choice

In Annex 2, a yellow text block is inserted above each Table with choices, with some explanation and justification of the proposed choice. It may also include points of attention and question marks for discussion or for further investigation during the project or issues that require a broader or longer discussion, managed by the EPB Center.

An example is shown in **Figure 5**:

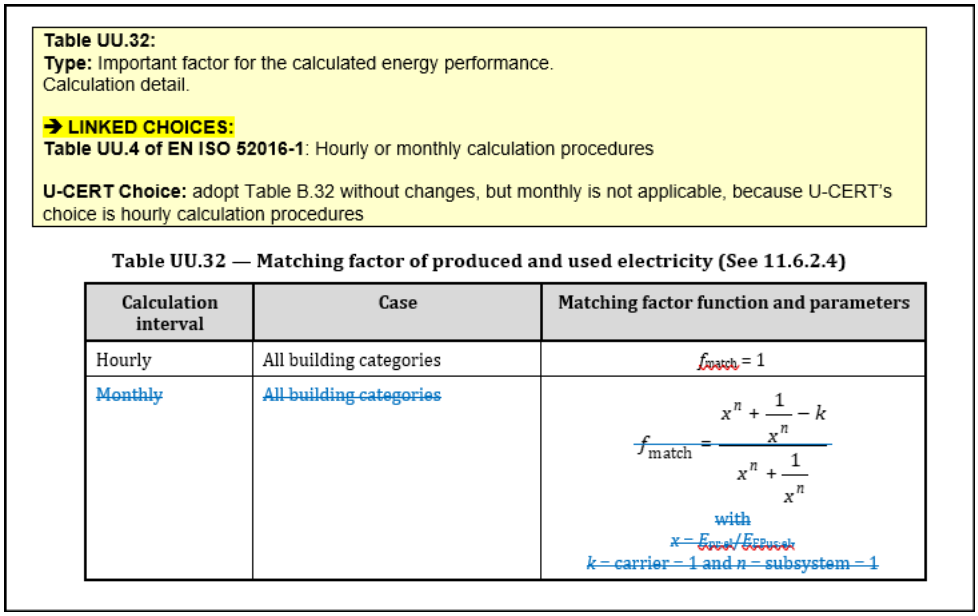


Table UU.32:
Type: Important factor for the calculated energy performance.
Calculation detail.

➔ **LINKED CHOICES:**
Table UU.4 of EN ISO 52016-1: Hourly or monthly calculation procedures

U-CERT Choice: adopt Table B.32 without changes, but monthly is not applicable, because U-CERT's choice is hourly calculation procedures

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

Calculation interval	Case	Matching factor function and parameters
Hourly	All building categories	~~f_{match}~~ = 1
~~Monthly~~	~~All building categories~~	~~$f_{match} = \frac{x^n + \frac{1}{x^n} - k}{x^n + \frac{1}{x^n}}$~~ ~~with~~ ~~$x = E_{prod}/E_{used}$~~ ~~$k$ = carrier − 1 and n = subsystem − 1~~

Fig. 5 – Example of explanation and justification on a specific choice, in this case Table UU.32 from "Annex A" choices of EN ISO 52000-1

In total, for the 10 selected EPB standards the number of choices (Tables and sometimes paragraphs) counts to 237.

6.7 U-CERT *National* Datasheets: contradiction of terms?

U-CERT aims at pan-European converged set of Datasheets, so why are the converged set of U-CERT Datasheets called U-CERT National Datasheets? Isn't this a contradiction of terms?

As explained in chapter 3 (Objectives), the U-CERT converged set of National Datasheets are proposed choices to be implemented at national level in the participating U-CERT countries, at national or regional level, as National Annexes or as National Datasheets. Therefore it makes sense to call it the U-CERT converged set of National Datasheets.

Numbering:
In a National Annex or National Datasheet the Annexes and Tables are numbered as "NA" (instead of "A" or "B"). If there are more than one National Annexes (e.g. one N.A. per type of application), they may be numbered "NA", resp. "NB", etc. (see details in the Guide [9]).

For practical reasons, for the U-CERT converged National Datasheets the Annexes and Tables are numbered as "**UU**"[2]: **Annex UU**, **Table UU.1**, etc.

[2] "UC" might have been better, but "UC" is not a readily provided option in MS Word.

6.8 Template of Annex A not always 100% clear

In each Annex A it must be clear what elements are part of the normative template (that are not allowed to be changed) and what are the fields where (national) choices are allowed.

To make such distinction the tables in Annex A contain grey shaded fields. These shaded fields are part of the template and consequently not open for input.

In addition, the introductory Clause A.1 ('*General*') shall not be changed. Only additional national texts are allowed and these shall be clearly marked.

Consequently, in Annex B the introductory Clause B.1 ('*General*') is identical to the introductory Clause A.1 ('*General*') and for each Table in Annex B the grey shaded fields are still grey shaded and identical to the grey shaded fields in the corresponding Table in Annex A.

The same also goes for the U-CERT National Datasheets (see for **example Figure 5** above).

Ideally, the text in between the tables is neutral and does not implicitly or explicitly contain a choice.

Unfortunately, some of the EPB standards do not follow these rules completely:

- In some EPB standards (for instance EN 16798-1, EN 16798-7, EN 16798-5-1, EN 15316-4-2) neither the Tables in Annex A, nor the Tables in Annex B have grey shaded fields.
  In the Annex 2 document the grey shading has been added to the Tables of Annex UU, on the basis of comparison of each Table in Annex A with each Table in Annex B.
  See the example in **Figure 6** below.
  Disclaimer: It was not always fully clear whether the texts in the Tables of Annex A are examples or normative texts.
- In for instance EN 16798-1 and EN 16798-7 (and a few in EN 16798-5-1) also some of the texts between the tables is (mis-)used for providing national choices. By comparing Annex A and Annex B it has been reconstructed what belongs to the normative template of Annex A and what has been changed or added in Annex B.
  Subsequently, in the Annex 2 document the text parts have been grey shaded, when it is part of the explanation given in Annex A. See the example in **Figure 6** below.
  Disclaimer: because in EN 16798-1 the explanation in Annex B differs here and there from the explanation in Annex A, it was not always fully clear whether the texts in the tables itself are examples or normative texts

Without such grey shading it is not clear what is allowed to be changed and what not.

Example:

$h_{pdu;st}$ =

A.3.3.12 Distribution of vents

The distribution of vents is given by Table A.11.

Table A.11 — Distribution of vents

Air flow path height	Windward facade	Leeward facade	...
	Cvent;path =	Cvent;path =	Cvent;path =
	Cvent;path =	Cvent;path =	Cvent;path =
...			

Fig.6a: Part from Annex A, no grey shading

$$h_{pdu;st} = h_z + 2 \quad \text{(B.2)}$$

B.3.3.12 Distribution of vents

The distribution is based on a vent coefficient for the ventilation zone estimated with:

$$C_{vent} = \sum_{\text{all vents}} C_{vent;path,i} \quad \text{(B.3)}$$

The distribution of vents is given by Table B.11.

Table B.11 — Distribution of vents

Air flow path height	Windward facade	Leeward facade
0,25 hz	$C_{vent;path} = 0,25\ C_{vent}$	$C_{vent;path} = 0,25\ C_{vent}$
0,75 hz	$C_{vent;path} = 0,25\ C_{vent}$	$C_{vent;path} = 0,25\ C_{vent}$

Fig.6b: Same part, from Annex B: no grey shading, so it is unclear what is part of the template and what may be changed

$$h_{pdu;st} = h_z + 2 \quad \text{(B.2)}$$

B.3.3.12 Distribution of vents

The distribution is based on a vent coefficient for the ventilation zone estimated with:

$$C_{vent} = \sum_{\text{all vents}} C_{vent;path,i} \quad \text{(B.3)}$$

The distribution of vents is given by Table UU.11.

Table UU.11 — Distribution of vents

Air flow path height	Windward facade	Leeward facade
0,25 hz	$C_{vent;path} = 0,25\ C_{vent}$	$C_{vent;path} = 0,25\ C_{vent}$
0,75 hz	$C_{vent;path} = 0,25\ C_{vent}$	$C_{vent;path} = 0,25\ C_{vent}$
...		

Fig.6c: Same part, from the Annex 2 to the underlying D3.1 report. The grey shading missing in Annex A and Annex B has been added, based on the comparison of Annex A and Annex B, to make clear what is open for national choice: the non-grey shaded elements.

Fig. 6 – Example from EN 16798-7: missing grey shading and choices outside the Tables

So only the non-shaded elements are allowed to be edited to stay in line with the standard (in casu: in line with the normative template of Annex A).

Another point that in many cases appeared to be unclear is the use of the term “default” (e.g., “default values”) in Annex B:

- Does this mean a proposal for use at national level as *default values* (that may be used in absence of actual (e.g., measured, or certified values).
- Or does this mean a *default proposal* for mandatory national values (that at national or regional level may be replaced by other values that are intended for mandatory use).

At each occurrence of the term “default”, it has been investigated which of these two meanings seems to be the case and the choice has been formulated accordingly.

7 Categorized overview of all Annex A/B choices in 10 selected EPB standards

7.1 Comprehensive subdivision

To cluster and prioritize the discussion it is needed to categorize each of the "Annex A" choices according to the nature of the choices:

NOTE Any subdivision is to some extent arbitrary. Therefore, it should only be regarded as a rough impression for practical use.

1) Choice of **references to other (EPB) standards**:
   The first choice in each EPB standard (Table A.1) is the choice which other standards it refers to as the (normative) source to obtain the input data. If the input data can be obtained from another standard in the set of EPB standards, the default choice in Annex B (Table B.1) is "of course" that particular EPB standard.
   This choice makes it possible for a country to gradually (step by step) implement the whole set of EPB standards.
2) Choices related to the **preparation** of the calculations, e.g.
   a. Assessment boundaries.
   b. Categorization of buildings, spaces, services, and assessment types.
   c. Building partitioning (thermal zones, system service areas)

   NOTE 1 Most of these choices have a strong impact on the level of complexity of the calculation.
   NOTE 2 a. and b. are typically **policy related** choices.
3) Choices on the **indoor environment conditions**, e.g.:
   a. Required or assumed conditions of use, per building or space category.
   b. Assumed indoor boundary conditions (e.g., internal heat gain, non-EPB (e.g. "plug in") electricity use)

   NOTE These choices depend on choices made under 1).
4) Choices on the **outdoor environment conditions**:
   a. Climatic data
5) Choices on the **calculation methodology** (including operation and control):
   a. Different options
   b. Calculation simplifications
   c. Parameter values (physical values, correlation factors, default values, etc.)

   NOTE With distinction between choices with expected **significant** impact on the assessed energy performance and choices with **minor** impact.
6) Choices on **properties of building or system components, products, or assemblies** as input data for the calculation:
   a. References to product standards
   b. Simplifications
   c. Default values

   NOTE Simplifications may have a serious impact on the assessed energy performance, e.g., if it implies that the influence of interactions is disregarded.

7) Choices that are related to the **post-processing** of the calculation results:
   a. EPB indicators (overall and partial)
   b. Requirements
   c. Rating

   NOTE 1 This concerns all choices in EN ISO 52003-1 and EN ISO 52018-1.
   NOTE 2 These are typically **policy related** choices.

8) Choices on the **methodology** for **measured** energy performance
   a. Different options
   b. Parameter values

   NOTE Many choices are applicable for both the calculated EP and for measured EP. In this category we concentrate on the choices that are only relevant for measured EP.

In addition, **interactions** between the choices may occur that need to be identified; some have already been mentioned above.

Attention ad 7: U-CERT Task 3.2, *Development of a set of user-centred and effective overall and partial indicators, including SRI*, focused on the EPB indicators and ratings. Therefore, the choices for the EPB standards EN ISO 52003-1 and EN ISO 52018-1 have been prepared in consultation with Task 3.2 or refer to the Task 3.2 report [D3.2].

Attention ad 8: is outside the scope of this report (which focuses on the calculated energy performance.

7.2 Simplified subdivision

For the purpose of the clustering and prioritization of the discussion a **simplified subdivision** is sufficient and better suited.

The following subdivision is applied in **Annex 2**, see **Table 7**:

Table 7 – Simplified subdivision of "Annex A" choices

Type of choice *)		**Explanation**
A	Important factor for the calculated energy performance	incl. pre-processing (e.g., zoning) and/or indoor/outdoor conditions
B	Critical for calculation tool development	Significant impact on the configuration of software tool that is based on the calculation procedures
C	Less crucial detail for calculation methodology	incl. pre-processing (e.g., zoning) and/or indoor/outdoor conditions
D	Policy choice	
E	Categorization	of buildings, spaces, services, etc.
F	Post-processing	Indicators, rating, etc.; indicators may also be important factor!
G	References to other (EPB) standards	If one or more EPB standards are replaced by other references, it can have serious impact on the methodology
H	Measured energy performance	
I	Other	No (direct) impact on EP calculation methodology
**): More than one choice possible. But category A excludes C and vice versa. Categories E to I: only single choice*		

7.3 Excel file

The EPB Center prepared and published the result in the form of an Excel file that enables sorting per standard and table or sorting per theme.

Example:

	C	D	E	F	G	H	I	J	K	L	M
1		EPB Center & U-CERT-(WP3)	See sheet Explanation *(including disclaimer)*								
2			Sort on Types (A-H) / Sort on Table numbers: Table (number and subject)	LINKED CHOICES (future option)	Standard titles	Important factor for the calculated energy performance	Critical for calculation tool development	Less crudial detail for calculation methodology	Policy choice	Categorization	Post-p
3	OrderSt	EPB standard			-	A	B	C	D	E	F
4				Order of sorting types (0 = ignore; higher = more dominant)	0	9	0	0	3	0	0
16	11	EN ISO 52000-1	Table A/B.11 — Electricity use types							1	
17	12	EN ISO 52000-1	Table A/B.12 — Electricity generation types							1	
18	13	EN ISO 52000-1	Table A/B.13 — Gross calorific value of some common solid fuels								
19	14	EN ISO 52000-1	Table A/B.14 — Gross calorific value of some common liquid fuels								
20	15	EN ISO 52000-1	Table A/B.15 — Gross calorific values of some gaseous energy carriers								
21	16	EN ISO 52000-1	Table A/B.16 — Weighting factors (based on gross or net calorific value)			1			1		
22	17	EN ISO 52000-1	Table A/B.17 — kexp-factor			1			1		
23	18	EN ISO 52000-1	Table A/B.18 — Building services considered in the energy performance calculation			1			1		
24	19	EN ISO 52000-1	Table A/B.19 — Principle assumed presence of systems			1	1		1		
25	20	EN ISO 52000-1	Table A/B.20 — Specification of the useful floor area			1			1		
26	21	EN ISO 52000-1	Table A/B.21 — Type or types of metric for the building size			1			1		
27	22	EN ISO 52000-1	Table A/B.22 — Which space categories are contributing to the reference size			1			1		
28	23	EN ISO 52000-1	Table A/B.23 — Perimeter specification			1			1		
29	24	EN ISO 52000-1	Table A/B.24 — Perimeter choice			1			1		
30	25	EN ISO 52000-1	Table A/B.25 — Conversion factors for net to gross calorific values for energy carriers								

Fig.7a: sorted per standard

	A	B	C	D	E	F	G	H	I	J	K	L	M	N
1				EPB Center & U-CERT-(WP3)	See sheet Explanation *(including disclaimer)*									
2		283			Sort on Types (A-H) / Sort on Table numbers: Table (number and subject)	LINKED CHOICES (future option)	Standard titles	Important factor for the calculated energy performance	Critical for calculation tool development	Less crudial detail for calculation methodology	Policy choice	Categorization	Post-proce	
3		OrderAll	OrderSt	EPB standard			-	A	B	C	D	E	F	G
4						Order of sorting types (0 = ignore; higher = more dominant)	0	9	0	0	3	0	0	0
17		31	30	EN ISO 52000-1	Table A/B.30 — Energy flows taken into account in the building balance			1			1			
18		32	31	EN ISO 52000-1	Table A/B.31 — Electrical uses not satisfied by on-site electricity production			1			1			
19		37	2	EN ISO 52003-1	Table A/B.2 — Default choices with respect to the overall EPB requirements			1			1		1	
20		38	3	EN ISO 52003-1	Table A/B.3 — Numeric indicator used for the requirement on the total primary energy use			1			1		1	
21		39	4	EN ISO 52003-1	Table A/B.4 — Numeric indicator used for the requirement on the non-renewable primary energy use			1			1		1	
22		40	5	EN ISO 52003-1	Table A/B.5 — Numeric indicator used for the requirement on the renewable primary energy use			1			1		1	
23		41	6	EN ISO 52003-1	Table A/B.6 — Energy rating methods			1			1		1	
24		46	2	EN ISO 52010-1	Table A/B.2 — Weather station and climatic data set			1			1			
25		134	2	EN ISO 52018-1	Table A/B.2 — Choices with respect to the mix of partial EPB requirements related to thermal energy balance and fabric features			1			1		1	
26		135	3	EN ISO 52018-1	Table A/B.3 — Numeric indicator used for the requirement on the summer thermal comfort			1			1		1	
					Table A/B.4 — Numeric indicator used for the requirement on									

Fig.7b: sorted per type

Fig. 7 – Example of the Excel file pu blished at the EPB Center with all 200+ choices of the 10 selected EPB standards, categorized in 8 types

For the 10 selected EPB standards, the number of choices (Tables, sometimes paragraph without table) amounts 237, see Table 6 in 6.3.

The types have also copied into each explanation box of **Annex 2**; see example in **Figure 5**.

8 About National Datasheets for measured energy performance

Attention: The proposal for a measured energy performance is part of Task 3.2. More details can be found in the D3.2 report [5]. In the underlying documentmeasured energy is only introduced in this chapter to show how and where the choices needed for calculated EP and EP based on measured energy flows are linked.

For U-CERT, the main links between EP assessment based on calculation procedures ('asset rating'[3]) and EP assessment based on measured data ('operational rating'[2]) are shown in **Figure 8**.

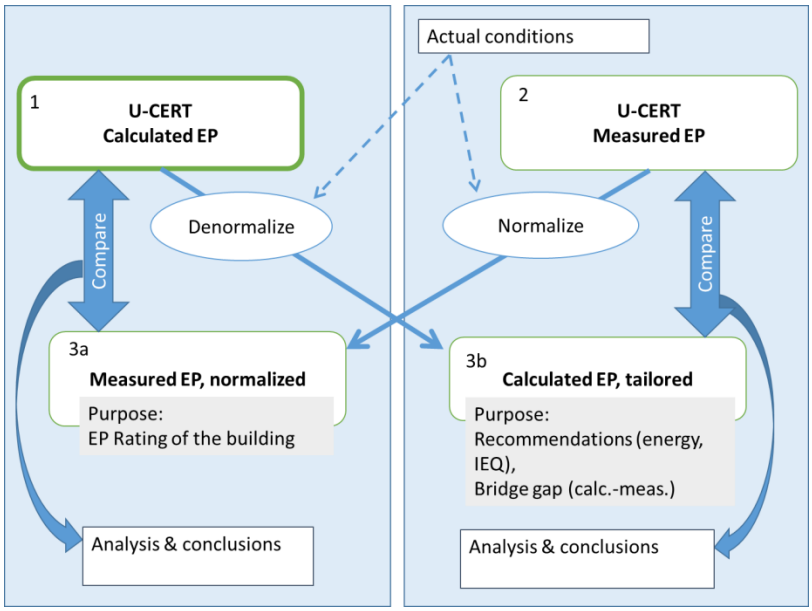


Fig. 8 - Main links between EP assessment based on calculation procedures and EP assessment based on measured data

In principle, a similar annex to fill in the U-CERT proposed "Annex A" choices for the EPB standards dealing with the assessment of the energy performance by **measured** energy can be made as done for the EPB standards dealing with the **calculated** energy performance.

But there are a few differences:

1) There is **only one EPB standard** specifically on measured energy performance: **EN 15378-3**:**2017,** *Heating systems and water based cooling systems in buildings — Heating and DHW systems in buildings — Part 3: Measured energy performance*. Moreover, this standard focuses only on heating and DHW systems[4].
2) However, most of the choices in the **overarching EPB standard**, **EN ISO 52000-1**, are relevant both for calculated EP as for EP based on measurements. This is

[3] The terms "asset rating" and "operational rating" are actually incorrect and need to be avoided, because assessing the energy performance is not the same as EP rating. Rating is part of the post-processing: comparison of the assessed EP against specific benchmarks.

[4] Early 2023, to fill in this gap, work started in CEN/TC 371 to develop a standard on "Requirements for assessing operational rating".

illustrated by **Table 8** and **Table 9** below.

3) In addition to that, also **the "post-processing" EPB standards**, **EN ISO 52003-1** and **EN ISO 52018-1** are relevant for measured energy performance: an overall or partial indicator can be a measured or calculated quantity, or a combination of both, e.g., a measured envelope air tightness that is used as input into the calculation of the overall energy performance.

Table 8 — Relevance of the successive clauses in EN ISO 52000-1 for different applications

Copied from EN ISO 52000-1; highlighting added

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

[a] See ISO/TR 52000 2 [6] for further explanation.

Table 9 – Which "Annex A" Tables in EN ISO 52000-1 are only for calculated EP and which are only for measured EP

All other Tables are for both calculated and measured EP

Annex A Tables only for calculated EP:	**Comments**
Table UU.11 — Electricity use types	*Could be debated* [a)]
Table UU.12 — Electricity generation types	*Could be debated* [a)]
Table UU.19 — Principle assumed presence of systems	
Table UU.22 — Which space categories are contributing to the reference size	
Table UU.23 — Perimeter specification	*Could be debated* [a)]
Table UU.24 — Perimeter choice	
Table UU.28 — Priority for generation system, export	
Table UU.29 — Subdivision rules	
Table UU.30 — Energy flows taken into account in the building balance	*Could be debated* [a)]
Table UU.31 — Electrical uses not satisfied by on-site electricity production	*Could be debated* [a)]
Table UU.32 — Matching factor of produced and used electricity	
[a)]: *Could also be applicable for measured EP in case of detailed measurements*	
Annex A Tables only for measured EP:	**Comments**
Table UU.13 — Gross calorific value of some common solid fuels	
Table UU.14 — Gross calorific value of some common liquid fuels	
Table UU.15 — Gross calorific values of some gaseous energy carriers	
Table UU.25 — Conversion factors for net to gross calorific values for energy carriers	

9 References

[1] European Parliament and Council of the European Union, *Directive (EU) 2018/844,* Brussels, 2018 (EPBD).

[2] Mandate M/480, *Mandate to CEN, CENELEC and ETSI for the elaboration and adoption of standards for a methodology calculating the integrated energy performance of buildings and promoting the energy efficiency of buildings, in accordance with the terms set in the recast of the Directive on the energy performance of buildings (2010/31/EU) of 14th December 2010*

[3] EPB Center, service center for information and technical support on the set of EPB standards
https://epb.center/
Specific information on National Annexes:
https://epb.center/epb-standards/implementation/national-annexes/

[4] Andrei Vladimir Litiu, *U-CERT, D2.1 Report on implementation of EPC schemes in UCERT partner countries*, 2021.

[5] Carnero Melero, Pablo, *U-CERT. D3.2 Proposed set of user-centred and effective overall and partial indicators, including SRI*, June 28, 2022

[6] Pablo Carnero, Dick van Dijk, Niccolò Mignani, Gabriela Ana, *A common European EPB Assessment and Certification scheme. U-CERT's proposal*, REHVA Journal, Volume 59, Issue 4, August 2022
https://www.rehva.eu/rehva-journal/chapter/a-common-european-epb-assessment-and-certification-scheme-u-certs-proposal

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[9] van Dijk, Dick, in cooperation with Annet van der Horn, *Guide to fill in an EPB standard's National Annex or National Datasheet*, EPB Center, Nov. 4, 2019
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Spreadsheet tool, available at EPB Center website

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https://aldren.eu/wp-content/uploads/2021/11/D2_2.pdf

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https://aldren.eu/wp-content/uploads/2021/04/ALDREN_D2-2-ANNEX-C-EVC_template_2020.pdf

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[14] Dick van Dijk and Jarek Kurnitski, *The EPBD recast: how to come to a transparent and fair ZEB definition*, REHVA Journal, Volume 59, Issue 4, August 2022 https://www.rehva.eu/rehva-journal/chapter/the-epbd-recast-how-to-come-to-a-transparent-and-fair-zeb-definition

[15] Carnero Melero, Pablo, *U-CERT. D3.4 Report on the operationalization to the involved Member States*, February 28, 2023

Annex 1, Overview of all EPB standards

See: https://epb.center/support/documents/?title=&group=2

NOTES:

- To keep the table manageable the accompanying **technical reports** are not included in the table.
- The **modules** (M1, M2, ..) correspond to the modular system of the EPB standards. At the EPB Center website these are called "**Topics**"
- The **themes** may slightly deviate from the "Themes" at the EPB Center website
- Some document titles and scopes are **duplicate**, e.g. because some standards are (temporarily) different between CEN and ISO.

Number	Title	Theme
M1, EPB - Overarching EPB Assessment Procedures, ……		
EN ISO 52000-1	Energy Performance of Buildings – Overarching EPB assessment – Part 1: General framework and procedures	(EP) Calculation procedures
EN 17423	Energy performance of buildings - Determination and reporting of Primary Energy Factors (PEF) and CO2 emission coefficient - General Principles, Module M1-7	Other (background information)
EN ISO 52000-3	Energy Performance of Buildings – Determination and reporting of Primary Energy factors (PEF) and CO2 emission factors (in preparation)	Other (background information)
EN ISO 52003-1	Energy performance of buildings – Indicators, requirements, ratings and certificates – Part 1: General aspects and application to the overall energy performance	EP post-processing (EP indicators, requirements or ratings)
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	EP pre-processing (indoor environment)
EN 16798-1	Energy performance of buildings – Ventilation of buildings – Part 1: Indoor environmental input parameters for design and assessment of energy performance of buildings addressing indoor air quality, thermal environment, lighting and acoustics (Module M1–6)	(EP) Calculation procedures
EN ISO 52007-1	Energy performance of buildings — Indoor environmental quality — Part 1: Indoor	EP pre-processing (indoor environment)

	environmental input parameters for the design and assessment of energy performance of buildings (in preparation)	
EN ISO 52010-1	Energy performance of buildings - External climatic conditions - Part 1: Conversion of climatic data for energy calculations	EP pre-processing (outdoor environment)
EN 15459-1	Energy performance of buildings – Economic evaluation procedure for energy systems in buildings – Part 1: Calculation procedures, Module M1–14	Other (Economic procedures)
EN ISO 52011-1	Energy performance of buildings – Economic evaluation procedure for energy systems in buildings – Part 1: Calculation procedures, Module M1–14 (in preparation)	Other (Economic procedures)
M2, EPB - Building and Building Elements, ……		
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	(EP) Calculation procedures
EN ISO 52016-3	Energy performance of buildings – Energy needs for heating and cooling, internal temperatures and sensible and latent heat loads - Part 3: Calculation procedures regarding adaptive building envelope elements (in preparation)	(EP) Calculation procedures
EN ISO 52016-5	Energy performance of buildings – Energy needs for heating and cooling, internal temperatures and sensible and latent heat loads - Part 5: Specific criteria and validation procedures (in preparation)	(EP) Calculation procedures
EN ISO 52017-1	Energy performance of buildings - Sensible and latent heat loads and internal temperatures – Part 1: Generic calculation procedures	Other (reference calculation procedures)
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	EP post-processing (EP indicators, requirements or ratings)
EN ISO 13789	Thermal performance of buildings - Transmission and ventilation heat transfer coefficients - Calculation method	(EP) Calculation procedures
EN ISO 13370	Thermal performance of buildings – Heat transfer via the ground – Calculation methods	(EP) Calculation procedures
EN ISO 6946	Building components and building elements – Thermal resistance and thermal transmittance – Calculation method	(EP) Calculation procedures
EN ISO 10211	Thermal bridges in building construction - Heat flows and surface temperatures - Detailed calculations	(EP) Calculation procedures

EN ISO 14683	Thermal bridges in building construction – Linear thermal transmittance – Simplified methods and default values	(EP) Calculation procedures
EN ISO 10077-1	Thermal performance of windows, doors and shutters – Calculation of thermal transmittance – Part 1: General	(EP) Calculation procedures
EN ISO 10077-2	Thermal performance of windows, doors and shutters – Calculation of thermal transmittance – Part 2: Numerical method for frames	(EP) Calculation procedures
EN ISO 12631	Thermal performance of curtain walling – Calculation of thermal transmittance	(EP) Calculation procedures
EN ISO 13786	Thermal performance of building components – Dynamic thermal characteristics – Calculation methods	(EP) Calculation procedures
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 daylight characteristics for solar protection devices combined with glazing	(EP) Calculation procedures
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	(EP) Calculation procedures
M3, EPB - Heating Systems and water based cooling systems in buildings		
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	(EP) Calculation procedures
EN 12831-1	Energy performance of buildings – Method for calculation of the design heat load – Part 1: Space heating load, Module M3–3	Building, system or component design procedures
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	(EP) Calculation procedures
ISO 52031	Energy performance of buildings – Method for calculation of system energy requirements and system efficiencies – -- Space emission systems (heating and cooling)	(EP) Calculation procedures
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	(EP) Calculation procedures
ISO 52032-1	Energy performance of buildings — Energy	(EP) Calculation

	requirements and efficiencies of heating, cooling and domestic hot water (DHW) distribution systems — Part 1: Calculation procedures	procedures
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	(EP) Calculation procedures
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	(EP) Calculation procedures
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	(EP) Calculation procedures
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	(EP) Calculation procedures
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	(EP) Calculation procedures
EN 15316-4-5	Energy performance of buildings – Method for calculation of system energy requirements and system efficiencies – Part 4–5: District heating and cooling, Module M3–8-5, M4–8-5, M8–8-5, M11–8-5	(EP) Calculation procedures
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	(EP) Calculation procedures
EN 15378-3	Energy performance of buildings –Heating and DHW systems in buildings – Part 3: Measured energy performance, Module M3–10 and M8–10	(EP) Measurement procedures
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	Inspection procedures
M4, EPB - Cooling Systems, ……		

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	(EP) Calculation procedures
EN 16798-15	Energy performance of buildings – Ventilation for buildings – Part 15: Calculation of cooling systems (Module M4–7) – Storage	(EP) Calculation procedures
EN 16798-13	Energy performance of buildings – Ventilation for buildings – Part 13: Calculation of cooling systems (Module M4–8) – Generation	(EP) Calculation procedures
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)	Inspection procedures
M5, EPB - Ventilation and Ventilation Systems, ……		
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)	Building, system or component design procedures
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)	(EP) Calculation procedures
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	(EP) Calculation procedures
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	(EP) Calculation procedures
M6, EPB - Humidification Systems, ……		
See M3, Heating		
M7, EPB - Dehumidification Systems, ……		
See M4, Cooling		
M8, EPB - Domestic Hot Water Systems, ……		
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	Building, system or component design procedures

See also M3, Heating		
M9, EPB - Lighting and Lighting Systems, ……		
EN 15193-1	Energy performance of buildings – Energy requirements for lighting – Part 1: Specifications, Module M9	(EP) Calculation procedures
M10, EPB - Building Automation and Control, ……		
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	Building, system or component design procedures
EN ISO 52120-1	Energy performance of buildings – Contribution of Building Automation and Controls and Building Management – Part 1: Modules M10-4,5,6,7,8,9,10	Building, system or component design procedures
EN 16946-1	Energy Performance of Buildings – Inspection of Automation, Controls and Technical Building Management – Part 1: Module M10–11	Inspection procedures
EN 16947-1	Energy Performance of Buildings – Building Management System – Part 1: Module M10–12	Building, system or component design procedures
EN ISO 52127-1	Energy performance of buildings - Building Automation, Controls and Building Management - Part 1: Building Management System - Module M10-12 (in preparation)	Building, system or component design procedures
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	Building, system or component design procedures
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	Building, system or component design procedures
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	Building, system or component design procedures
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	Building, system or component design procedures
M11, EPB - PV and wind power, ……		
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	(EP) Calculation procedures
M12, EPB - Transport, ……		
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M13, EPB - Appliances and other equipment, ……		
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Annex 2, U-CERT converged set of national datasheets for the main EPB standards

U-CERT
User-Centred Energy Performance Assessment and Certification

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This project has received funding from the European Union's Horizon 2020 research and innovation programme under the grant agreement number 839937. The European Union is not liable for any use that may be made of the information contained in this document, which is merely representing the authors' view.