

Technical assessment of national/regional calculation methodologies for the energy performance of buildings

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Executive summary

Introduction - context of project

The purpose of the Service contract is to provide the Commission with structured descriptions of national/regional calculation methodologies under Directive 2010/31/EU on the energy performance of buildings (EPBD).

To fulfill the requirements of this project a consortium of 28 European experts, one for each Member State, covering all 24 languages of EU at national-level has been established. The team has an experience of designing national regulatory framework and European standards in relation to EPBD.

Content of the project

The project contains the following parts:

- **Task 1:** Collection of all relevant legislative / supportive documents at national / regional level describing the calculation methodologies.
Freely available documents have been collected in the native language of the considered Member State.
- **Task 2-1:** Assessment of the methodologies according to Annex I / EPBD.
This task contains two parts:
 - The development of a common assessment framework;
 - The assessment of the methodologies according to the assessment framework.
- **Task 2-2:** Assessment of the methodologies according to Annex A / prEN 15603.
This task contains two parts:
 - The development of a common assessment framework;
 - The assessment of the methodologies according to the assessment framework.
- **Task 3:** Assessment of the methodologies in general.
This task is related to the use of CEN standards, the setting of methodologies at national / regional level, the calculation of primary energy (see section 3.1.3 of the tender).

Outcome of the service contract

Methodologies: The analysis shows that not all Member States have a complete set of calculation methods for evaluating the energy performance of buildings, mainly because some of the 35 methodologies do not cover all building categories or do not cover all building stages (see **table 5**).

The most common omissions relate to non-residential buildings, and especially renovated non-residential buildings.

4 methodologies (11%) do not cover some building categories of non-residential buildings at all and 5 methodologies (14%) only partly cover some building categories (see **table 1**).

In 13 of the 35 methodologies (37%) measured energy can be used to determine the energy performance for residential buildings and in 18 of the 35 methodologies (51%) for non-residential buildings (see **table 6**). The analysis of the answers received (see **table 6**) also indicates that 7 of the 35 methodologies (20%) in the residential sector and 6 of the 35 methodologies (17%) in the non-residential sector are based on measured energy without any correction which is, in this study interpreted as in contradiction with the requirement of Article 2(4) of EPBD referring to the typical use buildings.

National/regional level: 10 of the 35 methodologies (29%) are set at a regional level (see **table 7**). The characteristics of the regional methods within the same country are often very similar.

Methodologies covering building energy performance certification (EPC) and minimum energy performance requirements (MR): In 22 of the 35 methodologies (63%) there are small differences between the calculation methods used for EPC and for checking compliance with MR. 26 of 35 methodologies use the same calculation framework. Some of the differences are related to the energy performance indicator used, the input data or the conditions where energy performance is calculated.

The differences are mostly related to the EP calculations for existing and new / renovated buildings. This is often due to simplifications for existing buildings and use of measured energy. These differences could potentially lead to a different rating after the new building is in use and becomes an existing building.

Compliance with Annex 1 EPBD: For 13 of the 35 methodologies (37%) the authors consider that high priority should be given to investigating the reasons for the omission of aspects (e.g. why DHW installations are not taken into account) that are required by Annex 1 EPBD (see **table 7**).

In particular should be investigated the methodologies that do not:

- address all building categories;
- define a primary energy indicator;
- take into account all technical building systems;

The assessment of the methodologies (see **table 1**) shows that the following aspects are often not taken into account.

- District or block cooling systems (19/35);
- Natural lighting (12/35);
- Other electricity systems based on energy from renewable sources (e.g. on-site wind turbines) (11/35);
- On-site cogeneration (9/35);
- Natural ventilation systems (9/35).

Some of these aspects are related to new technologies and to passive solutions.

As with many general frameworks, some of the elements of Annex I EPBD can be interpreted in different ways. Some examples are indicated in the report.

Use of CEN standards: The authors estimate that 19 of the 35 methodologies (54%) are in line with the CEN standards and refer to them at least partly (see **table 7**).

In some countries any calculation tool or method based on CEN standards may be used.

Reliability of primary energy calculation: The authors consider that only 15 of the 35 methodologies (43%) as fully reliable for the calculation of the primary energy demand (see **table 7**) because the primary energy is not used as EP indicator, the number of primary energy factors is low and not all technical systems are addressed. In the last case the missing technical systems cannot be evaluated in the cost optimum calculation and the methodology is not technically neutral.

Description according to Annex A prEN15603: The purpose of this part of the study was to provide a structured description of the national/regional calculation methodologies by using Annex A prEN15603 in order to:

- give a higher transparency to national / regional choices;
- check if the national/regional choices can be expressed in Annex A prEN 15603;
- address the difficulties Member States could have to work out national / regional Annex B prEN15603.

In order to facilitate the possibility for description of national methodologies, the consortium completed the structure and content of Annex A prEN15603.

To the question *"Do you think that generally your calculation methodologies can be transparently and consistently described, within the framework of Annex A of prEN15603?"* the experts answered "yes" in average by a note of 14.3/20 (without countries with score "0"- see **table 4**).

Annex A of prEN15603 includes topics from the EPBD recast which this study has shown not to be currently addressed by some MS. In these cases Annex A would help these MS to identify missing elements and could be an appreciable help for the MS to implement EPBD-recast.

Some topics in national methodologies are based on a different structure to that assumed by Annex A of prEN15603. In this case, to support comparisons between different procedures a possible solution could be to use the prEN15603 CEN default option for a harmonized calculation (e.g. reference floor area prEN 15603). This would have a consequence that the calculation has to be done twice, once with the national definition and once with the CEN default option in order to get comparable results across EU.

Recommendations

- To increase the compliance of the methodologies with Annex I EPBD the Member States should be informed about existing calculation methods for new technologies and passive solutions available in standards (e.g. via dedicated workshops in Concerted Action).
- To facilitate the possibility for description of national methodologies the structure of Annex A prEN 15603 should be completed.
- To be able to describe the methodologies transparently and consistently within the framework of Annex A prEN15603, training of the Member States experts is needed.

Introduction - context of project

The EPBD-recast promotes the improvement of the energy performance of buildings within the Union, taking into account outdoor climatic and local conditions, as well as indoor climate requirements and cost-effectiveness.

Article 3 of the EPBD-recast requires Member States to apply a methodology for calculating the energy performance of buildings in accordance to a common general framework set out in Annex I of the Directive. The methodology must be adopted at national or regional level.

The calculation methodologies are critical for a good application of the EPBD-recast, in particular to ensure the reliability of the cost-optimal calculations but also for the reliability of national schemes for buildings' energy performance certificates. Given that the EPBD-recast leaves considerable freedom to the Member States in establishing these calculation methodologies, they are set in very different ways, for example mixing national or regional legislation and making reference to national standards and/or international standards. It is therefore difficult to check the compliance of these methodologies with the Directive. At European level, it is also difficult to obtain the necessary background to interpret correctly the numerical values of the energy performance requirements or to interpret and compare data collected at national level.

The Commission gave a mandate to CEN to elaborate and adopt the necessary standards for a methodology calculating the integrated energy performance of buildings, in accordance with the Directive (in particular Article 3 and Annex I of EPBD-recast). The on-going standardisation work is expected to make the CEN standards more usable as direct reference in national legislation and to give a higher transparency to national choices.

Phase 1 of the mandate will establish the overarching standard (prEN15603:2013) together with an accompanying technical report, the underlying basic principles and detailed technical rules for drafting, during a second phase, the set of standards within a coherent modular structure.

The transparency of national choices will be ensured through so-called National Annexes and a default set of choices will be provided in all standards. This will already start with Annex A of the overarching standard (prEN15603:2013).

The purpose of the Service contract is to provide the Commission with structured descriptions of national/regional calculation methodologies under the EPBD recast.

The calculation methodologies are critical for:

- a good application of the EPBD-recast;
- the reliability of national schemes for buildings' energy performance certificates.

Because of different national methods, it is difficult to compare the numerical values of the energy performance requirements and the input data collected at national level.

The objective of this study is to enhance transparency, to identify similarities and differences between the existing national methods at an overarching level.

The results of this study will be useful for updating future CEN standards, for the possible future European convergence of calculation methodologies and for the assessment of some elements of energy performance of buildings procedures.

1. Organisation – The team

The team of 28 European experts, one for each Member State, covering all 24 languages of EU has an experience of designing regulatory framework in relation to EPBD at each national level, and is also experienced or involved in the related European standardization.

A daily management team including the Project leader (CSTB) and TSUS has been established.

2. Task 1: Collection of all relevant legislative documents

National/regional calculation methodologies and relevant, freely available legislative and supportive documents describing the calculation methodologies in force have been collected in their native language. Rules for naming the documents have been developed and agreed by the Commission.

3. Task 2-1: Assessing the methodologies according to Annex I EPBD

3.1. The common assessment framework

The objective of this common assessment framework is to compare the national / regional methodologies for calculating the energy performance of a building (EP) with the general framework in EPBD Annex 1.

The adoption of a methodology for calculating the energy performance of building at national or regional level is required in EPBD Art.3 (Adoption of a methodology for calculating the energy performance of buildings).

The methodology must be used to calculate the energy performance for a building or building unit related to the minimum requirements (EPBD Art. 4).

A methodology must also be used to calculate the energy performance of building included in the energy performance certificate (EPC). This methodology must also be in line with Art. 3 (see Art. 2(4) definitions).

Annex I EPBD stipulates that the energy performance of a building must be determined on the basis of the calculated or actual annual (measured) energy. Also in the case of measured energy rating, it is needed to associate the measured energy with a typical use, reflecting heating, cooling and DHW energy needs.

Description of the common assessment framework (checklist)

Annex 1 EPBD is structured by chapters defining different aspects related to the calculation of the energy performance of building.

The common assessment framework is structured according to Annex I EPBD.

The result of the project provides a mapping of all national / regional calculation methods used:

- for different purposes, EPC and minimum energy performance requirements (see before);
- for all building categories (residential and non-residential buildings);
- for all building stages (new, existing and renovated buildings).

and enables the compliance of these methods with Annex I EPBD to be checked.

For each chapter, paragraph or point of Annex I EPBD several questions were defined depending on the requirements mentioned in Annex I EPBD and depending on the complexity of the topic. The purpose of these questions is to gather information that allows checking the reliability and complexity of the methods. This additional information makes the assessment more transparent and objective.

Particular attention was given to the assessment of measured energy. To verify if the energy performance based on measured energy is associated with a "typical use", as required in Annex I EPBD, several questions have been formulated.

For calculated energy performance values, the questions were focussed on the least detailed method allowed within each MS.

3.2. Assessing the calculation method based on Annex 1 EPBD

The common assessment framework contains additional information about the complexity of the methods, going beyond a check on compliance with the EPBD.

A limited number of questions to be checked has been identified as "priorities" and agreed on after discussion with the Commission.

As for all "general frameworks", some elements in Annex I can have different interpretations.

Hereafter are provided some examples about the potential interpretation.

- Has cooling need to be considered for residential buildings for the EPC? (Q:1.3¹)
Some countries do not include cooling in the EP calculation for residential buildings and therefore do not provide a methodology taking into consideration cooling systems (Q:3c.1¹).
Note: In this study it is considered that if overheating is checked then there is no need to take into account cooling needs (but it still can). In any case the methodology should include HVAC systems.
- What is a "typical use" (Q:1.4¹)?
In some methodologies the energy consumption is measured during 3 years and then the average is calculated. Other methodologies correct measured energy by occupancy patterns to standard

¹⁾ see Question numbering in **table 1**

use. It could also be questioned if the typical use is related to the evaluated building or to the standard use of the building type (e.g. standard use patterns for all office buildings). *Note: In this study a simple correction for standard climate is not considered as sufficient (correction for standard use is required to avoid a better rating for buildings with low measured energy due to failure to maintain required indoor conditions).*

- What is "built-in lighting"? Has built-in lighting to be considered in residential buildings (Q:3e.1)? In the EPBD definition of energy performance (Art.2(4)) lighting is included (inter alia). In EPBD Annex I, chapter 1, lighting is not explicitly mentioned and in chapter 3.e only the non-residential sector is mentioned.

Note: This study reflects the EPBD in that lighting does not need to be taken into account in the considered services for residential buildings (Q:1.3) but lighting installations (Q:3e.1) and natural lighting (Q:4d.1) should be considered in residential buildings and in the Energy Performance Certificate (EPC) for all buildings.

- Some aspects of Annex I EPBD are impacting the aspects in other chapters. For example the energy performance (EP) of a building can be based on measured energy. In this case can it be considered that chapter 3 of Annex I EPBD (e.g. heating installation) is covered because the measured energy includes all aspects?

Note: In this study the compliance to chapter 3 of Annex I is focussed only on calculation.

These few examples show how the possibility of different interpretations of the Directive contributes to the complexity of the assessment of calculation methodologies.

Overview of the missing aspects in national / regional methodologies related to Annex I EPBD.

Table 1 provides an overview of the missing aspects in national / regional methods related to Annex I EPBD.

The number of questions considered as priorities for compliance by the Commission are indicated in the table using the nomenclature below. The numbering of the questions reflects the different chapters in Annex I EPBD.

The overview has been structured as following:

- "n" indicates that the authors consider that there are missing aspects related to Annex I EPBD; additional information or explanation from building authorities is needed;
- "p" indicates that the authors consider that some aspects are absent, but not for all cases or for all building types. Additional information or explanation from building authorities would be helpful;
- "y" indicates that the authors consider that all aspects are sufficiently covered related to Annex I EPBD and there is no need for additional information.
- "0" means that the aspect is not relevant for country.

The columns in **table 1** inform about the assessment per methodologies and the rows inform about the assessment per questions related to each topic in Annex I EPBD.

The quality of the methodology or the level of detail is not evaluated.

The overview informs about the priority of actions for further explanation on missing aspects in the methodologies related to Annex I EPBD.

- **Assessment per aspect indicated in Annex I EPBD**

The analysis of the rows of **table 1** shows that the following aspects are not well taken into account by the methodologies:

- District or block cooling systems (Q:4c.2);
- Natural lighting (Q:4d.1);
- Other electricity systems based on energy from renewable sources (e.g. on-site wind turbines, on-site biofuel cogeneration systems) (Q:4a.4);
- On-site cogeneration (Q:4b.1);
- Natural ventilation systems (Q: 3d.2).

These aspects are related to new technologies (perhaps not always relevant in the different countries) and to passive solutions.

- **Assessment per methodology**

The analysis of the columns shows that several methodologies (e.g. methodology Nr. 7, 8, 9, 10, 11 see **table 1**) are addressing mostly all aspects mentioned in Annex I EPBD. It could be noticed that these methodologies are set up by countries which often have small budgets. Very often the methodology of these countries is based on CEN standards.

At the opposite, several methodologies (e.g. methodology Nr. 6, 13, 18, 32, 33) seem to not address all aspects mentioned in Annex I EPBD.

Especially they

- do not address all building categories (Q:5.1)
- do not define a primary energy indicator (Q:2.3);
- do not take into account several building technical systems (Q:3 all)

In some methodologies the compliance to the minimum requirements set in the building code is based on the actual / measured energy consumption. Therefore no calculation methodology has been defined.

For some of the methodologies actions have been already started at the national / regional level to improve the methodologies.

Question	Methodology	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	N%		
5.1	All building cat. covered?	y	n	n	n	y	y	y	y	y	y	y	y	n	p	y	y	y	p	p	y	y	y	p	y	y	y	y	y	y	y	y	p	y	y	y		11	
1.1	Does building definition fit?	y	p	p	p	y	y	y	y	y	y	y	y	p	y	y	y	y	p	p	p	y	y	y	p	y	y	y	y	y	y	y	y	y	y	y		0	
1.2	Is the EP determined?	y	y	y	y	y	y	y	y	y	y	y	y	p	y	y	y	y	p	p	y	y	y	p	y	y	y	y	y	y	y	y	y	y	y	y		0	
1.3	Are all building services included?	y	p	p	p	y	p	y	y	y	y	y	p	p	y	y	y	y	p	p	p	y	y	p	y	y	y	y	y	p	y	y	p	y	y	y		0	
1.4	Is typical use addressed?	y	y	y	y	p	y	y	p	p	p	y	p	n	p	y	p	y	y	y	y	p	y	p	y	y	p	y	y	p	p	n	p	y	y		6		
2.1	Can EP be compared?	y	n	n	n	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y		9	
2.2	Is EP indicator defined?	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	n	y	y	y	y	y	y	y	y	y	y	y		3	
2.3	Is PE indicator defined?	y	y	y	y	y	n	y	y	y	y	y	n	y	y	y	y	y	y	y	y	y	p	n	p	y	y	n	y	y	y	n	n	n	n	n		23	
3a.1	Are thermal charact. consid?	y	p	p	p	y	y	y	y	y	y	y	p	y	y	y	p	y	y	y	y	y	p	p	y	p	p	y	p	p	y	p	p	y	p	p		0	
3b.1	Are heating inst. considered?	y	y	y	y	y	n	y	y	y	y	y	0	y	y	y	y	y	y	y	y	y	y	p	y	y	y	y	y	y	y	y	p	y	y	y		3	
3b.2	Are DHW inst. Considered?	y	n	n	n	y	n	y	y	y	y	y	n	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	n	p	y	y	y		17			
3c.1	Are HVAC inst. considered?	p	y	y	y	p	n	y	y	y	y	y	p	y	y	y	n	n	n	p	y	y	p	y	y	y	y	y	p	y	y	p	y	y	y		11		
3d.2	Are Natural vent. syst. considered?	y	y	y	y	p	y	y	y	y	y	y	y	y	y	y	n	n	n	y	y	n	y	y	y	y	y	n	y	n	p	n	n	n		26			
3d.3	Are mech. vent. syst. considered?	y	y	y	y	p	y	y	y	y	y	y	n	y	y	y	y	n	n	p	y	y	p	y	y	y	y	p	y	y	p	y	y	y		9			
3e.1	Is Built in lighting inst. considered?	p	p	p	p	y	n	y	y	y	y	p	p	y	y	p	y	n	p	p	y	y	p	y	p	p	p	y	p	y	p	p	y	y	y		6		
3f.1	Is Building Design considered?	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	p	y	y	y		0	
3f.2	Is build. position considered?	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	p	y	y	y		0	
3f.3	Outdoor climate?	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	p	y	y	y		0	
3g.1	Are Passive sol. Sys. Considered?	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	n	y	y	y		3	
3g.2	Solar protection?	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	n	y	y	y		3	
3h.1	Indoor climate?	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	p	y	y	y	y	y	y	y	y	y	y	p	y	y	y		0	
3i.1	Internal loads	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	n	y	y	y		3		
4a.1	Is local solar expos. consid?	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	p	y	y	y		0	
4a.2	Are active solar syst. Considered?	y	y	y	y	p	n	y	y	y	y	y	p	y	y	y	y	y	y	n	y	y	y	p	y	p	y	p	y	y	y	p	y	y	y		6		
4a.3	Other renew. heat. syst. Considered?	y	y	y	y	p	n	y	y	y	y	y	0	y	y	y	y	y	y	p	y	y	y	y	y	y	y	y	y	y	y	p	y	y	y		3		
4a.4	Other renew. elect. syst. considered?	n	y	y	y	p	n	y	y	y	y	y	0	y	n	n	y	y	y	n	y	p	y	n	n	y	n	y	n	n	n	n	n	n	y	y		29	
4b.1	Cogeneration?	n	y	y	y	p	p	y	y	y	y	y	n	y	y	y	y	y	n	n	y	n	y	n	n	n	n	n	n	y	n	p	n	y	y	y		26	
4c.1	District or block heating systems?	y	y	y	y	y	p	y	y	y	y	y	0	y	y	y	y	y	y	n	y	y	n	y	n	n	n	n	n	n	n	n	n	p	p	p		17	
4c.2	District or block cooling systems?	n	p	p	p	y	n	n	y	y	y	p	n	y	n	y	n	n	n	n	n	n	p	n	y	n	n	n	n	n	n	n	n	n	p	p	p		54
4d.1	Natural lighting?	y	p	p	p	p	n	y	y	y	p	p	n	p	p	p	p	n	p	p	n	n	p	y	n	n	n	n	p	n	n	n	n	y	y	y		34	
Missing aspects – n (%)		3	10	10	10	0	33	3	0	0	0	0	27	0	7	3	7	20	13	7	20	10	3	17	7	13	13	20	7	13	20	33	7	7	7				

Table 1: Overview of missing aspects in the methodologies related to Annex 1 EPBD

4. Task 2-2: Assessing the methodologies according to Annex A prEN 15603

4.1. Description of the common assessment framework

The purpose of this part of the study is to provide a structured description of national/regional calculation methodologies under the EPBD recast by using the Annex A prEN15603 in order to:

- give a higher transparency to national / regional choices;
- check if the national/regional choices can be expressed in Annex A prEN15603 to make the direct reference in the national regulations to prEN15603 possible;
- address the difficulties Members States could have to work out a national / regional Annex B.

This common assessment framework is based on updated Annex A prEN15603 (document CEN/TC371 N342). Tables from document N342 were adapted, merged and the text completed based on the comments from the team of selected national experts.

For a better comprehension the tables are clustered by topics:

- General information (prEN15603 table B1)
- Building description - Categorization of buildings and spaces
Boundary conditions (prEN15603 tables B2, B8, B3, B4, B5, B6, B7)
- Calculation of energy performance
Primary Energy factors (prEN15603 tables B11, B12)
Share of renewable (prEN15603 table B9)
Energy balance (prEN15603 table B18)
- General calculation rules

As the objective of this common assessment framework is also to address the difficulties Members States could have to work out a national / regional Annex B prEN15603, an appreciation has been asked about

- the difficulties to fill in the table;
- the reasons for the difficulties;
- a scoring (sub score, general appreciation).

4.2. Assessing the calculation method based on Annex A prEN15603

General appreciation of Annex AprEN 15603.

To the question (mentioned as an outcome of the study in the tender)

"Do you think that generally your calculation methodologies can be transparently and consistently described, within the framework of Annex A of prEN15603?"

The experts answered average **note of 14.3 / 20** (without countries with sub score "0"). (see **table 2**).

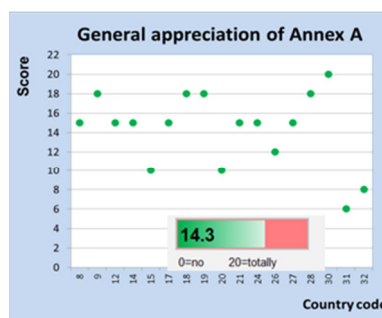


Table 2: General appreciation of the usability of Annex A (without countries with sub score 0).

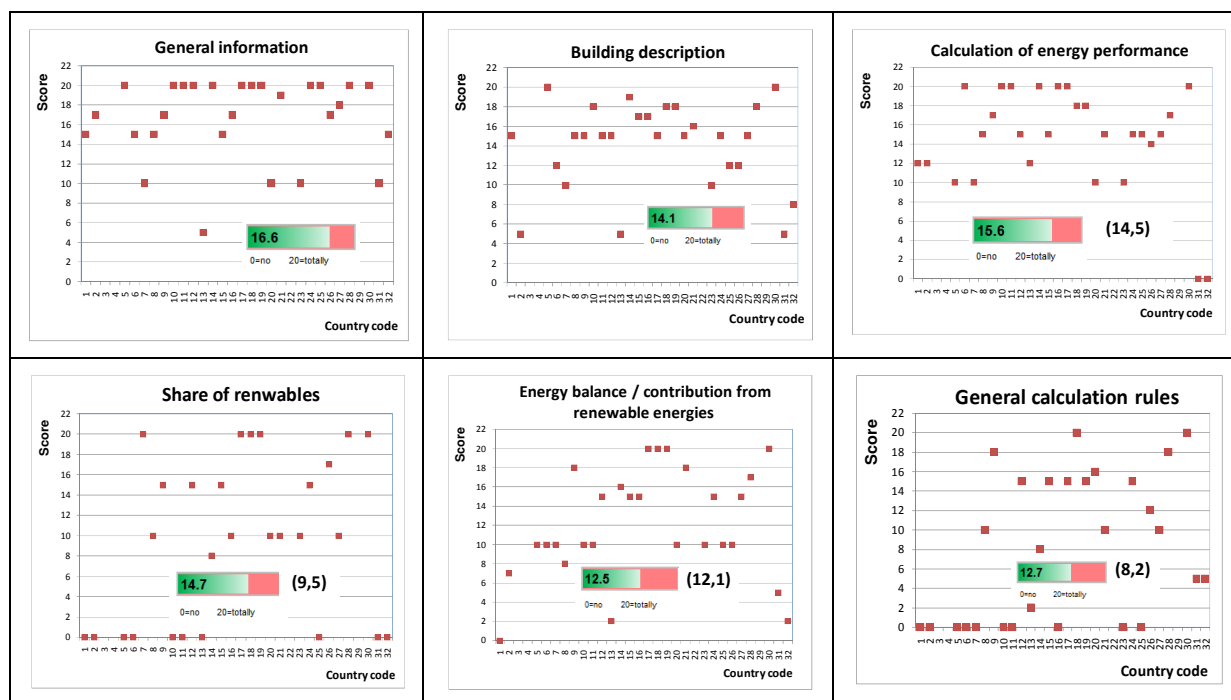
Note: The final scores are calculated as an average without scores "0". The score "0" often indicates the case when the topic is not addressed in the national context.

This score can be explained as follows:

- Annex A addresses already topics of EPBD recast which are not addressed yet by the MS. In these cases Annex A could be an appreciable help for the MS to implement EPBD-recast,
- National methodologies are based on a different structure in comparison to Annex A prEN15603.

The analysis of the comments shows that in general the existing choices made by the MS can be expressed by the tables of Annex AprEN15603 in order to make the national / regional choices transparent and the results understandable.

Table 3 provides the scores per country to the main topics (clusters) in Annex A prEN15603.



Note: The score within the brackets takes into account the scores "0", not presented if there is no significant difference).

Table 3: Detailed scores per country to the main topics (cluster) in Annex A prEN 15603

Where are the difficulties?

To identify the tables where the experts had difficulties with, the analysis focussed on the pre-defined answers: "difficult", "very difficult", "impossible".

The tables where the experts had difficulties are listed hereafter (see also **tables 4a, 4b**).

B. Building description, Categories of buildings and spaces – Boundary conditions

- Annex A-Table B.4 prEN15603 – Criteria for inclusion or exclusion of spaces from Table B.3 prEN15603 inside the thermal envelope.

C. Calculation of the energy performance (EP)

- Annex A-Table B.9 prEN15603 — Perimeter choice: renewable energy contribution included in the RER (share of renewable energy).
- Annex A-Table B.18 prEN15603 (including B.16+B.19)— Energy flows, delivered and exported energy, taken into account in the EP indicator (building balance).

D. General calculation rules

- Annex A-Table B.20 prEN15603 (including B.21+B.25) - Distribution criteria for building units (e.g. flat) and sub-division criteria

What are the difficulties?

To structure and classify the difficulties to fill in the table of Annex A prEN 15603 predefined answers were proposed, among them e.g.: "different structure", "not addressed", "not addressed in such detail in national methodology".

- the predefined answer "different structure" indicates the cases where the effort should be put onto harmonise the MS choices and the tables in Annex A.
- the predefined answer "not addressed" identifies the cases where Annex A proposes already solutions to express the choices according to EPBD recast but which are not transposed yet (or not in such details) at the national / regional level.

Annex A-Table B.4 prEN15603 "Criteria for inclusion or exclusion of spaces" is one of the tables the experts had most difficulties to fill in, because the definitions of spaces are country specific.

It is the same for Annex A-Table B.20 prEN15603 (+ B.21 + B.25) "Distribution criteria for building units (e.g. flat) and sub-division criteria".

These tables are related to the specific calculation rules (e.g. limits for iteration, sub-division criteria) where it is unlikely to reach harmonisation (e.g. characterisation of spaces). For these topics, the easiest solution could be to use the prEN15603 CEN default option in Annex B prEN15603 for a harmonized calculation (e.g. reference floor area prEN 15603). This means that the calculation has to be done twice, one with the national definition and once with the CEN default option in order to get comparable results across EU.

The difficulties for Annex A-Table B.9 prEN15603 "Perimeter choice: renewable energy contribution" and Annex A-Table B.18 prEN15603 (+ B.16 + B.19) "Energy flows, delivered and exported energy" are related to new features of EPBD recast which are not yet, or not in such details, addressed by the national / regional methodologies.

For these features Annex A prEN 15603 could be very useful help for the MS in order to prevent different definitions and transposition of these choices and to limit the possibility of misinterpretations.

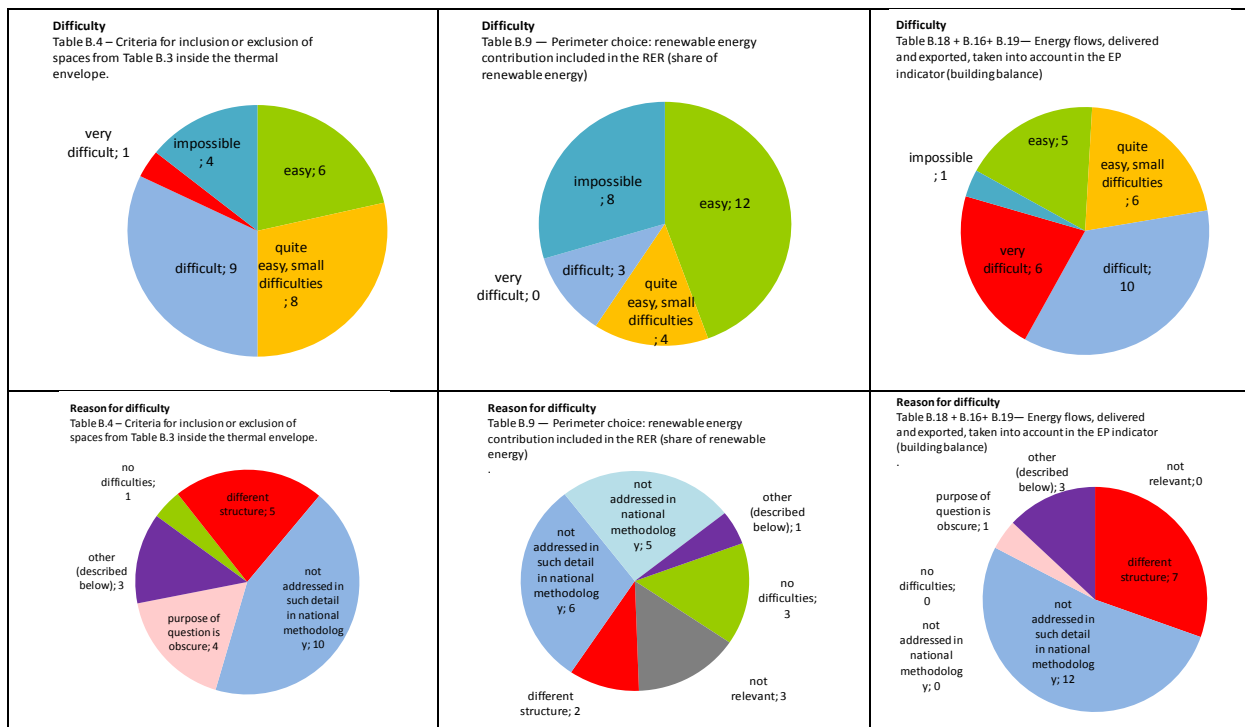


Figure 1: Difficulties and reason for difficulties for most problematic tables

Difficulty	General information	Building description - Categories of buildings and spaces - Boundary conditions						
	Table B.1	Table B.2	Table B.8	Table B.3	Table B.4	Table B.5	Table B.6	Table B.7
	Type of energy performance ratings according to building type and assessment purpose	Building categories	Building services to be considered in the energy performance calculation at building level	Space categories that for the calculation can be either inside or outside the considered thermal envelope.	Criteria for inclusion or exclusion of spaces from Table B.3 inside the thermal envelope.	Criteria and exceptions on the simplification rules	Dimensions used to determine the reference area	Space categories and contribution to reference area (only some examples)
easy	16	9	18	14	6	10	24	10
quite easy, small difficulties	9	8	9	5	8	2	4	10
difficult	1	8	1	7	9	6	0	4
very difficult	1	2	0	1	1	2	0	1
impossible	0	0	0	1	4	5	0	3
Total answers	27	27	28	28	28	25	28	28

Reason for difficulty	Table B.1	Table B.2	Table B.8	Table B.3	Table B.4	Table B.5	Table B.6	Table B.7
	Type of energy performance ratings according to building type and assessment purpose	Building categories	Building services to be considered in the energy performance calculation at building level	Space categories that for the calculation can be either inside or outside the considered thermal envelope.	Criteria for inclusion or exclusion of spaces from Table B.3 inside the thermal envelope.	Criteria and exceptions on the simplification rules	Dimensions used to determine the reference area	Space categories and contribution to reference area (only some examples)
no difficulties	11	8	11	9	1	7	14	6
not relevant	1	1	1	0	0	1	2	1
not addressed in methodology	1	0	0	1	0	5	0	2
not addressed in such detail in national methodology	3	2	1	5	10	3	0	3
different structure	2	5	3	3	5	4	1	5
purpose of question is obscure	1	3	0	2	4	0	0	0
other (described below)	3	7	5	3	3	3	1	5
Total answers	22	26	21	23	23	23	18	22

Table 4a: Overview of difficulties to fill in Annex A prEN 15603 (Cluster: General information / Categories of buildings and spaces - Boundary conditions).

Difficulty	Calculation energy performance				General calculation rules
	Table B.11	Table B.12	Table B.9	Table B.18 + B.16+ B.19	Table B.20 + B.21 + B.25
	Energy performance indicator of buildings	Primary energy factors (EP) and CO2 content (based on net calorific value).	Perimeter choice: renewable energy contribution included in the RER (share of renewable energy)	Energy flows, delivered and exported, taken into account in the EP indicator (building balance)	Distribution criteria for building units (e.g. flat) and sub-division criteria
easy	19	10	12	5	6
quite easy, small difficulties	4	9	4	6	6
difficult	1	5	3	10	6
very difficult	0	0	0	6	1
impossible	3	3	8	1	8
Total answers	27	27	27	28	27

Reason for difficulty	Table B.11	Table B.12	Table B.9	Table B.18 + B.16+ B.19	Table B.20 + B.21 + B.25
	Energy performance indicator of buildings	Primary energy factors (EP) and CO2 content (based on net calorific value).	Perimeter choice: renewable energy contribution included in the RER (share of renewable energy)	Energy flows, delivered and exported, taken into account in the EP indicator (building balance)	- Distribution criteria for building units (e.g. flat) and sub-division criteria
no difficulties	8	6	3	0	2
not relevant	0	0	3	0	2
not addressed in methodology	2	2	5	0	3
not addressed in such detail in national methodology	2	4	6	12	7
different structure	5	9	2	7	7
purpose of question is obscure	0	0	0	1	1
other (described below)	0	0	1	3	2
Total answers	17	21	20	23	24

Table 4b: Overview of difficulties to fill in Annex A prEN 15603 (Cluster: Calculation energy performance /General calculation rules).

5. Task 3: Assessing the methodologies in general

The outcome of the service contract is answering the seven questions listed in section 3.1.3 of the tender. In **table 7** shows an overview of the general assessment of methodologies, answering the seven questions indicated before, is provided.

Q1: All 28 Member States are applying calculation methodologies for calculating the energy performance of buildings (EP methodology):

Not all Member States have a complete set of calculation methods evaluating the energy performance of buildings, mainly because the 35 methodologies do not cover all building categories or building stages (see **table 5**).

Mostly non-residential buildings, and especially renovated non-residential buildings, are not covered by the methodologies.

Q:5.1 Which building categories are not covered by a methodology?	Energy certification (global indicator, energy class) (EPBD Art. 11)						Minimum requirements for Energy Performance at building level (EPBD Art. 4)			
	residential build.			non-residential build.			residential build.		non-residential build.	
	Existing	New	Renovated	Existing	New	Renovated	New	Renovated	New	Renovated
Single-family houses	0	0	1				0	4		
Apartment blocks	0	0	1				0	4		
Offices				3	0	1			0	4
Educational buildings				-	1	1			1	4
Hospitals				-	4	4			4	7
Hotels and restaurants;				-	4	4			4	7
Sports facilities;				-	4	4			4	7
Wholesale and retail trade services buildings;				-	3	4			3	7

Table 5: Number of methodologies not covering building categories (from total 35 methodologies)

In 13 of the 35 methodologies (37%) measured energy is used to determine the energy performance for residential buildings and in 18 of the 35 methodologies (51%) for non-residential buildings (see **table 6**).

Q:1.4 How the typical use is addressed ?		Energy certification (global indicator, energy class) (EPBD Art. 11)	
		residential build.	non-residential build.
		Existing	Existing
1.4.2	Can the <u>measured</u> energy be used to determine the energy performance? If yes, please specify if	13	18
	- without any correction	7	6
	- with correction for typical / standard climate	6	12
	- with correction for typical / standard use	1	5

Table 6: Number of methodologies where measured energy can be used as the basis to determine the energy performance

Table 6 also indicates that 7 of the 35 methodologies (20%) in the residential sector and 6 of the 35 methodologies (17%) in the non-residential sector are based on the measured energy without any correction.

Q2: These calculation methodologies are set at national or regional level?

10 of the 35 methodologies (29%) are set at regional level (see **table 7**). The characteristics of the regional methods within the same country are often close.

Q3: Calculation methodologies are covering the purposes of energy performance **certification** and compliance-check with the minimum **energy performance requirements** (EPC + MR);

If the scales related to the building energy performance certification (EPC) and the level set up for the energy requirements (MR) should be coherent, the same methodologies should be used, otherwise the differences could potentially lead to a different rating (e.g. after the building is in use).

It is not easy to answer question 3 in a simply way because there could be different methodologies for different purposes. For example in one country

- there is a method for all new buildings for **EPC** and minimum EP requirements (**MR**);
- there is another method only for some residential buildings for **EPC**;
- there is measured energy for residential and/or for non-residential buildings for **EPC**.

In 22 of the 35 methodologies (63%) are small differences between the calculation methods for building energy performance certification (EPC) and for compliance-check with the minimum energy performance requirements (MR). 26 of 35 methodologies (74%) use the same calculation framework. Some of the differences are related to the services included, the energy performance indicator used, the input data and the conditions where energy performance is calculated.

The differences are mostly in the EP calculation between existing and new / renovated buildings. This is often due to simplifications and measured energy used for existing buildings.

Q4: These calculation methodologies are complying with the general framework of Annex I of the EPBD-recast.

Detailed answers to question 4 (complying with the general framework of Annex I of the EPBD-recast) have been given in the previous chapters of this document (**table 1** reports the general appreciation of the authors of the methodologies related to Annex I EPBD).

Q5: These calculation methodologies are in line with (or rely on) the relevant **CEN standards**;

Table 7 shows the estimation of the consortium about the use of CEN standards in the methodologies. 19 of the 35 methodologies (454%) reference CEN standards in legislation or in other mandatory document (e.g. guidelines, software tool) at least partly.

Even when the standards are not referenced in the legislation, the calculation methodologies are often in line with the general calculation structure of the CEN standards (from the needs to primary energy use).

NOTE: Rules for evaluation of question 5 – national methodologies rely on CEN standards:

Y the building envelope standards (EN ISO 13790) and also the standards related to building technical systems (EN 15316, and/or EN 15603) are directly mentioned in the legislation or in other mandatory document.

P the building envelope standards (EN ISO 13790) are directly mentioned in the legislation or in other mandatory document, but not the standards related to building technical systems (EN 15316, and/or 15603). Or vice versa.

N no reference to CEN standards.

Q6: The calculation of **primary energy demand** undertaken by the Member States for the cost-optimal calculation could be considered as **reliable** (primary energy calculation is considered reliable).

The authors consider that the primary energy calculation is not reliable if:

- the primary energy is not used as the EP indicator;
- the number of primary energy factors is low;
- not all systems are addressed.

The authors consider only 15 of the 35 methodologies (43%) as reliable for the calculation of the primary energy demand which potentially affects the reliability of the cost-optimal calculations performed using these methodologies.

No.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	
Q1: EP methodology is applied	Y	P	P	P	Y	Y	Y	Y	Y	Y	Y	Y	P	Y	Y	Y	Y	P	P	Y	Y	Y	Y	P	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	
Q2: nat. /reg. level	Nt	Rg	Rg	Rg	Nt	Nt	Nt	Nt	Nt	Nt	Nt	Nt	Rg	Nt	Nt	Nt	Nt	Nt/Rg	Nt/Rg	Nt/Rg	Nt	Nt	Nt	Nt	Nt	Nt	Nt	Nt	Nt	Nt	Nt	Nt	Nt	Nt/Rg	Nt/Rg	Nt/Rg
Q3: covering EPC + EP requirement	Y	P	P	P	Y	P	Y	Y	Y	Y	Y	Y	P	Y	Y	Y	Y	P	P	P	Y	Y	P	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	
Q4: complying Annex I EPBD	Y	N	N	N	Y	N	Y	Y	Y	P	Y	P	N	Y	Y	P	P	N	N	P	P	P	P	N	Y	P	P	N	P	P	P	N	N	N	N	
Q5: in line with (or rely on) CEN	Y	P	P	P	Y	P	Y	Y	P	P	P	N	N	Y	Y	Y	N	Y	N	N	Y	Y	Y	N	P	P	P	P	Y	Y	P	N	Y	Y	Y	
Q6: PE calculation considered reliable	Y	P	P	P	P	P	Y	Y	Y	Y	Y	P	P	Y	Y	Y	Y	P	P	Y	P	P	Y	P	P	Y	P	P	Y	Y	P	N	P	P	P	
Q7: Described by Annex AprEN15603.	10/20	5/20	-	-	10/20	12/20	10/20	15/20	18/20	10/20	10/20	15/20	-	3/20	15/20	10/20	18/20	15/20	18/20	18/20	10/20	15/20	-	10/20	15/20	10/20	12/20	15/20	18/20	-	20/20	6/20	8/20	-	-	

Table 7: Overview of the general assessment of methodologies

Q7: These calculation methodologies could be transparently and consistently described, in particular within the framework of Annex A of prEN15603.

Detailed answers to question 7 have been given in the previous chapters (see **table 4**).

The "possibility to describe the national / regional methodologies transparently and consistently within the framework of Annex A prEN15603" is quoted. The experts gave an average score of 12,5 (including the score 0) and 14.3 (excluding the score 0, which often indicates the cases when the topic is not addressed in the national context).

The consortium noticed a correlation between the score for rating Annex A prEN15603 and the experience of experts with prEN15603. Scores are higher from experts who are more familiar with prEN15603.

This confirms the need for training of Member States experts during the development of Annex B / prEN15603 at national / regional level.

Recommendations

As an outcome of the study the authors made the following recommendations:

- To increase the compliance of the methodologies with Annex I EPBD the Member States should be informed about existing calculation methods for new technologies and passive solutions. The Member States should also be informed how to correct the measured energies for typical use.
- To facilitate the possibility for description of national methodologies the structure of Annex A prEN 15603 should be completed.
- To be able to describe the methodologies transparently and consistently within the framework of Annex A prEN15603, training of the Member States experts is needed.