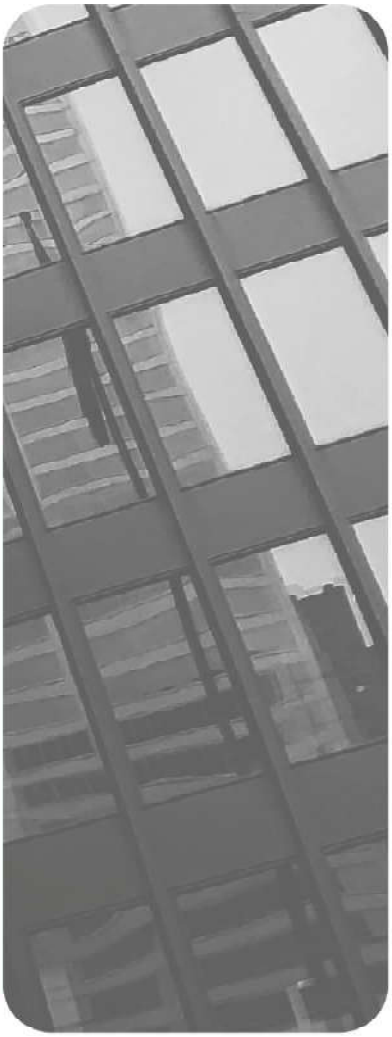

D2.1 Report on implementation of EPC schemes in U-CERT partner countries

U-CERT
User-Centred Energy Performance Assessment and Certification

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06/04/2023	2.0	Pablo Carnero Melero, REHVA	Andrei Vladimir LIȚIU, REHVA	Living overview publicly available online
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[1] Name SURNAME, ORGANIZATION

Executive summary

The U-CERT project has aimed at **facilitating convergence of quality and reliability of national procedures**, leveraging the set of EPB Standards. During the project implementation, the project has mapped and characterised in detail the existing situation regarding EPB Assessments and Certification schemes in 11 Member States [1]. Such analysis revealed that despite the mandate made by Directive 2018/844/EU [2], most of the Member States haven't produced timely or haven't published their respective National Annexes. The mandate reads:

> "*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).*"

The lack of available National Annexes poses, to the view of U-CERT's consortium, as one of the major obstacles hindering cross-country comparison of the EU's building stock energy efficiency. Furthermore, hindering convergence in the level of ambition of national energy efficiency policies, level playing field for financing renovation projects at EU level, and free movement of professionals.

In response to the absence of available National Annexes, the project opted for a bottom-up approach. U-CERT leveraged REHVA's network to circulate a questionnaire among building professional experts across Europe [3]. The questionnaire aimed at identifying the national choices made regarding the overarching EPB Standard (i.e., EN ISO 52000-1). Indeed, the expertise from professionals working on energy efficiency projects in buildings could be leveraged to infer the national choices governing the energy performance assessments. This approach proved effective, and future initiatives may build on it to cover the complete set of EPB Standards.

Once the national status was characterised, U-CERT moved to crafting a proposal for a harmonised calculation methodology for EPB Assessments fully aligned with the complete set of EPB Standards [4]. Markedly 10 standards were carefully analysed, and more than 230 choices provided in these standards were evaluated. U-CERT's ambition has been to lay the foundation for a common European methodology for EPB Assessments. In addition, the project has produced a set of holistic indicators covering complementary-to-energy dimensions, such as smartness, Indoor Environmental Quality (IEQ), and cost [5]. Furthermore, the project has integrated all this information into a template for next-generation Energy Performance Certificates (EPCs) [6] compliant with the latest developments in EU policy (i.e., the upcoming EPBD recast[1]). As a Coordination and Support Action, the project has leveraged previous work from other research initiatives (e.g., ALDREN[2], Triple-A reno[3], CEN-CE[4], among others) and hopes to serve as basis for forthcoming Innovation Actions which may transfer the proposed methodology into a fully-fledged simulation software. Technical recommendations of how to bridge the gap between diverse national procedures and a harmonised European approach were outlined for the partner countries [7].

The U-CERT project has addressed one of the reasons hampering the **widespread acceptance and implementation of EPB Certification Schemes**, the low user-friendliness of EPCs. Leveraging ethnographic research techniques [8], the user perception regarding EPCs was obtained across the value chain stakeholders in 11 countries [9].

Ultimately, U-CERT has strived to giving concrete **support to building professionals** regarding the promotion, use and adoption of holistic innovative technologies and indicators. Consequently, several supporting digital tools have been produced [10].

[1] More information at: https://energy.ec.europa.eu/topics/energy-efficiency/energy-efficient-buildings/energy-performance-buildings-directive_en
[2] More on the project (754159) at: https://aldren.eu/
[3] More on the project at: https://www.rehva.eu/eu-projects/project/triplea-reno
[4] More on the Project (785018) at: https://www.cen-ce.eu/

DISCLAIMER

The deliverable was on purpose foreseen later in the project already at proposal stage to cope with the external developments that might potentially hinder its earlier delivery. As expected, the external developments (e.g. amended EPBD implementation and National Annexes for the EPB standards) suffered a delay due to among other reasons the COVID-19 health crisis that challenged and is still challenging EU, national and local authorities alike. Furthermore, the deliverable's content is not comprehensive, but rather tailored to U-CERT's very specific approach i.e. people-centred, EPB standards, SRI, holistic asset – measured – operational building performance.

With the ongoing earlier EPBD revision process, as part of the Renovation Wave Strategy (EU Green Deal) and the scope related/complementary deliverables available within the Next Gen EPC H2020 & HE cluster, REHVA decided to strive for maximizing the meaningfulness of this workstream. As such a static deliverable is transformed into a public living overview of EPC schemes illustrating the current status across the EU Member States (as covered by the cluster's sister projects) in cooperation with the sister projects to be hosted on an independent website for the Next Gen EPC H2020 & HE cluster (the working assumption/agreement between the sister projects is that it will be hosted on the EPB Center website).

Introduction

This document is focused on outlining the **current implementation of EPB Assessments and Certification Schemes** in the U-CERT partner countries (e.g., Bulgaria, Denmark, Estonia, France, Hungary, Italy, The Netherlands, Romania, Slovenia, Spain, and Sweden) in a comparative manner. The U-CERT project has analysed more than 11 countries' EPC reports, leveraging previous work related to EPC implementation practices across Europe. In addition, the project has produced a structured questionnaire on the use of CEN/ISO set of EPB standards in the national EPB calculation methodologies addressed to national and regional EPBD implementing bodies and expert stakeholders. Therefore, the aim of this document is to contribute to the existing body of knowledge regarding EPC implementation in the Member States, with a view to identify breeding ground for common practices as a start to come to a better convergence in Europe. The remainder of the document is structured as detailed in the following paragraphs. Section 1 outlines the information included in the EPC reports of the 17 case studies considered in the project, while also provides an analysis of their similarities and discrepancies using the 2018 EPBD and EPB Standards as benchmark. Section 2 provides an overview of how aligned the implementation approaches for EPB Certification Schemes in Europe are with the CEN/ISO set of EPB standards and the status of the related national annexes (November 2020). Section 3 includes a brief update on the current situation with regards to building performance assessment and certification in the U-CERT countries at project end (February 2023).

Definitions and conventions

In this document, there are many concepts which are recurrently referred to. Their definitions are obtained from EN ISO 52000-1 [11], unless explicitly indicated otherwise.

- Energy performance certificate (of an assessed object – typically a building or a building unit) is a "*certificate, for instance recognized by a country or by a legal person designated by it, which indicates the energy performance of the assessed object, calculated or measured according to one or more specified methodologies*".
- Energy performance certification is the *"process of providing an energy performance certificate".*
- Energy performance or EPB indicator *"calculated or measured numerical quantity that characterizes an energy feature of an assessed object*.

  Note 1 to entry: EPB indicators are used for the energy performance rating, the energy performance requirements and/or for the certificate. An EPB indicator can for example be expressed in energy performance per unit of floor area or energy performance divided by the energy performance of a specific benchmark or another reference value.

  Note 2 to entry: This covers both overall and partial energy performance."
- Energy performance or EPB rating *"evaluation of the value of an energy performance indicator by comparison against one or more reference values, possibly including a visualization of the position on a continuous or discrete scale"*.

Also, when citing an official document, unless indicated otherwise, the underlined and bold sections are to be understood as made by the author of the present document. Thus, not included in the original document cited.

1. Content of the energy performance certificate

The collection of the EPC reports in the U-CERT countries was coordinated by REHVA with the support of all the relevant project partners responsible for the U-CERT case studies for which the EPCs and accompanying annexes (i.e., containing further information needed for issuing the EPC) were collected and translated to English.

Table 1. Summary of U-CERT case study buildings.

Case study ID[a]	Country	Building category[b]	Image	Case study ID[a]	Country	Building category[b]	Image
9	Bulgaria	Single-family house		10b	France	Single-family house	
11a	Denmark	Single-family house		4a	Hungary	Educational building	
11b		Single-family house		4b		Offices	
3	Estonia	Educational building		8	Italy	Educational building	
10a	France	Educational building		1	The Netherlands	Home for elderly	

7	Romania	Apartment blocks		5a	Spain	Apartment blocks	
6a	Slovenia	Educational building		5b		Educational building	
6b		Educational building		5c		Offices	
				2a	Sweden	Offices	
				2b		Offices	

[a] According to the classification defined in WP4 deliverables.
[b] According to Table B.4 in EN ISO 52000-1's Annex B.

There is a wide variety of EPB Certification Schemes across Europe. For a complete overview of the case studies' EPC reports, refer to Deliverable 4.2's Annex 1 [12].

The 2018 Energy Performance of Buildings Directive (EPBD) recast [13] establishes that the energy performance certificate *"shall include the energy performance of a building and reference values such as minimum energy performance requirements in order to make it possible for owners or tenants of the building or building unit to compare and assess its energy performance"*. Additionally, it indicates that it *"may include additional information such as the annual energy consumption for non-residential buildings and the percentage of energy from renewable sources in the total energy consumption"*. Also, poses that *"shall include recommendations for the cost-optimal or cost-effective improvement of the energy performance of a building or building unit, unless there is no reasonable potential for such improvement compared to the energy performance requirements in force"*. Ultimately, the EPBD states that the energy performance certificate *"shall provide an indication as to where the owner or tenant can receive more detailed information, including as regards the cost-effectiveness of the recommendations made in the energy performance certificate […]. In addition, it shall contain information on the steps to be taken to implement the recommendations. Other information on related topics, such as energy audits or incentives of a financial or other nature and financing possibilities may also be provided to the owner or tenant"*. Thus, according to the EPBD, the following ought to be included in European EPCs.

Table 2. Minimum elements to be included in EPCs. Own elaboration from 2018 EPBD.

Element	Clarification	Mandatory	Building type applicability
Energy performance of a building[a]	-	Yes	All
Reference values	Minimum energy performance requirements	Yes	All
Annual energy consumption	-	No	Non-residential buildings
Percentage of energy from renewable sources in the total energy consumption	-	No	All
Recommendations for the improvement of the energy performance	Only when reasonable potential compared to the energy performance requirements in force	Yes	All (i.e., existing buildings)
Step-by-step implementation plan of the recommendation	-	Yes	
Indication regarding where to receive more information		Yes	All
Information on related topics	Energy audits, incentives, and financial possibilities	No	All

[a] Calculated according to a methodology in accordance with the EPBD's Annex I, which refers to the EPB Standards.

The EN ISO 52003-1 [14] standard deals with the indicators, requirements, ratings, and certificates of energy performance in buildings (see Figure 1). It establishes that an energy performance certificate shall contain a *"concise report of the input, method and* output of the energy certification". Moreover, the EN ISO 52003-2 [15] includes additional suggestions for the content of the energy performance certificate. These are outlined in Table 3.

Table 3. Minimum elements to be included in EPCs. Own elaboration from EN ISO 52003-2 and 2018 EPBD.

Element	Clarification	Related section in present document
Administrative data	Reference to a specific procedure, including its date	1.1
	Name of person responsible for issuing the energy certificate	
	Address of the certified building	
	Date when the energy certificate was issued and its limits of validity	

Technical data	Type and subtype of EPB assessment	1.2
	One overall indicator representing the energy performance	1.3
	Reference values	1.4
	Specific other information on the energy performance of main building and system components	1.5
	Specific additional indicators	1.6
	Recommendations for cost-effective improvements	1.7
	Energy performance rating	1.8
	Specific additional content on the certificate to identify characteristics of the building	0
Graphical representation of the energy rating		**Fout! Verwijzingsbron niet gevonden.**
Additional complementary information		1.11

In the next sections, each of the elements to be included in the energy performance certificates, will be discussed based on the evidence gathered from the U-CERT case studies.

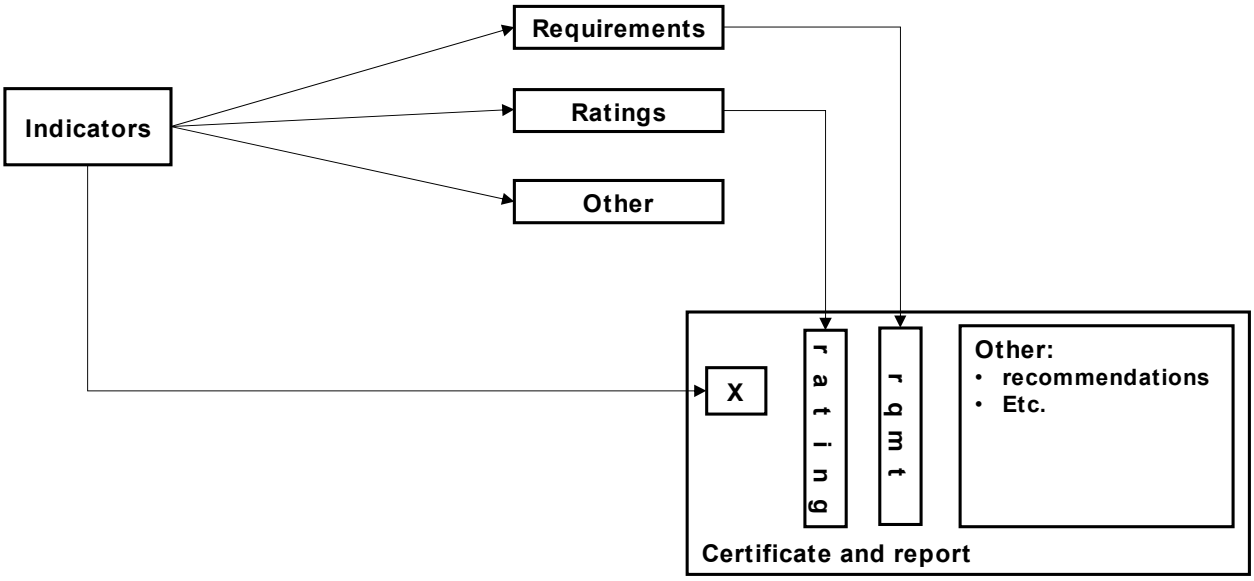


Figure 1. Scope of EN ISO 52003-1. Reproduced from EN ISO 52003-2 [15]

1.1. Administrative data

As indicated in Table 3, there are certain elements related to **administrative data** which shall be included in the content of any energy performance certificate. See Table 4 for an overview of how each case study's EPC in U-CERT respond to the related provision as per EN ISO 52003-1.

Table 4. Administrative data. U-CERT case studies' EPCs..

Case study ID[a]	**Country**	**Administrative data depicted**			
		Reference to a specific procedure, including its date	Name of person responsible for issuing the energy certificate	Address of the certified building	Date when the energy certificate was issued and its limits of validity
9	Bulgaria	No	Yes	Yes	Yes

11a	Denmark	Yes[a]	Yes	Yes	Yes
11b		Yes[a]	Yes	Yes	Yes
3	Estonia	Yes	Yes	Yes	Yes
10a	France	-	-	-	-
10b		Yes	Yes	Yes	Yes
4a	Hungary	Yes	Yes	Yes	Yes[b]
4b		Yes	Yes	Yes	Yes
8	Italy	No	Yes	Yes	Yes
1	The Netherlands	No	No	No	No
7	Romania	Yes	Yes	Yes	Yes
6a	Slovenia	Yes	Yes	Yes	Yes
6b		Yes	Yes	Yes	Yes
5a	Spain	Yes[a]	Yes	Yes	Yes[b]
5b		Yes[a]	Yes	Yes	Yes[b]
5c		Yes[a]	Yes	Yes	Yes[b]
2a	Sweden	Yes[c]	Yes	Yes	Yes
2b		Yes	Yes	Yes	Yes

[a] The date of the procedure is not explicitly included, but the version is.

[b] The limits of validity are not explicitly included in the EPC report.

[c] The specific procedure is not mentioned, rather the general regulatory framework and the year.

Despite certain particularities, most countries abide by the provision made in EN ISO 52003-1 regarding the disclosure of administrative data in the energy performance certificate. Bulgaria and Italy stand out in terms of making "*reference to a specific procedure, including its date*". The Netherlands is the only country among the analysed, which fails to respond to the provision.

1.2. Assessment type and subtype

According to EN ISO 52000-1 [11] standard there are many EPB Assessment options depending on the application (e.g., building permit, certificate under certain conditions, regulation, energy performance certificate, validation, optimisation, retrofit planning, energy audit, monitoring, etc.). Deliverable 4.3 [16] deals with the general aspects of EPB Assessments in the U-CERT partner countries. For the application of "energy performance certificate" the overarching standard indicates the assessment types outlined in Table 5.

Table 5. EPB Assessment type. EN ISO 52000-1

Type	**Subtype**	**Input data**			**Type of application**
		Use	**Climate**	**Building**	
Calculated (asset)	Design	Standard	Standard	Design	EPC
	As built	Standard	Standard	Actual	EPC
Measured (operational)	Standard	Corrected to standard	Corrected to standard	Actual	EPC

As indicated in Table 5, energy performance certificates may be issued according to a *design* or *as built* definition of the assessed object (i.e., a building or a building unit). The EPC application, as it intends to enable cross-comparison between different objects, typically requires using *standard* use and climate. Lastly, it is possible for the assessment to be *calculated* or *measured*; this is, an asset or operational assessment. However, in the latter case, it is not possible to issue a *design* EPC. Logically, what is not yet built can not have its energy performance measured. In any case, the EPB Assessment bound to issue an EPC shall be aligned with EN ISO 52000-1.

EN ISO 52003-1 indicates that the energy performance certificates shall include the specification of the type of EPB assessment used. Furthermore, *"in case of design rating, this includes under what conditions the design rating can be considered as or converted to a calculated energy rating for the actually realised building. In case of measured energy rating, this includes specification of which information on the actual conditions in the building is to be recorded (if any) and whether or not corrections shall be made to correct for deviating periods, weather, and/or indoor conditions".*

The diverse assessment types valid for the EPB Certification Scheme application in each country shall be reported in the corresponding National Annex. Markedly, a country is free from allowing a different EPB assessment type from those included in Table 5. As most U-CERT countries haven't produced or published their respective National Annexes, the experts in the U-CERT consortium managed to retrieve the needed information. See Table 6 for an overview of the assessment types used for the considered EPCs. Notwithstanding, as indicated in Deliverable 2.5, not having access to the National Annexes of the Member States poses as the greatest uncertainty regarding the alignment of the national procedures with the EPB Standards.

Table 6. EPB Assessment type. U-CERT case studies' EPCs..

Case study ID[a]	Country	EPB Assessment for issuing an EPC	
		Valid assessment type[5]	Used in case study
9	Bulgaria	Calculated[a]	Calculated
11a	Denmark	Calculated and measured	Calculated
11b			Calculated
3	Estonia	Calculated and measured	Calculated
10a	France	Calculated and measured[b]	Measured
10b			Calculated
4a	Hungary	Calculated	Calculated
4b		Calculated	Calculated
8	Italy	Calculated	Calculated
1	The Netherlands	Calculated	Calculated
7	Romania	Calculated	Calculated
6a	Slovenia	Calculated and measured	Calculated
6b			Calculated
5a	Spain	Calculated	Calculated
5b		Calculated	Calculated
5c		Calculated	Calculated
2a	Sweden	Calculated and measured[c]	Measured
2b			Measured

[a] A calibration of the building model used for the *as built* assessment's calculations with actual data is requested.

[b] The French EPB Certification Scheme is in the process of being modified, with the EPC based on measurements (i.e., "energy bills method") being put into question with the update of the EPB Assessment methodology[6].

[c] Swedish EPB Certification Schemes ought to be based on metered values if they are available. For the case of new buildings, without availability of measured energy performance, it is allowed to give a calculated EPC, which must be validated with actual measurements no later than two years after the end of the construction, as indicated in U-CERT's Deliverable 4.1[17].

[5] A. Arcipowska, F. Anagnostopoulos, F. Mariottini, and S. Kunkel, Energy Performance Certificates (EPC) across the EU Mapping of national approaches. 2014

[6] Ministère de la Transition Écologique, "RT-TE Bâtiment," rt-batiment.fr, 2021. http://www.rt-batiment.fr/outils-et-guides-pour-le-dpe-a54.html (accessed Apr. 27, 2021).

Usually, Member States which allow in their EPB Certification Schemes both calculated and measured EPB Assessments, use the latter as mandatory for existing buildings under specific conditions (e.g., large public buildings – France, etc.). Consequently, a quick assessments relying on actual data available can be made. Given that for existing buildings the project information is often missing, performing calculated EPB Assessments implies making assumptions which may cause high degrees of uncertainty. Moreover, measured EPB assessments tend to reflect better innovative technologies present in the building, given they directly evaluate the actual energy consumption. In contrast, calculated assessments must include detailed modelling techniques to contemplate, for instance, complex control schemes or HVAC systems, measured assessments always include the impact of the existing devices in the final energy consumption. However, the measured EPB Assessment is not exempt from limitations. As outlined in U-CERT's Deliverable 3.2 [18], quantifying the renovation potential and troubleshooting is not as straightforward as with calculated EPB evaluations. In addition, the correction to standard of the use and climate in measurement based EPB Assessments is often far from trivial.

1.3. One overall EP indicator

The specifics of the main EP indicator are included in section 1.6.1.

1.4. Reference values

According to EN ISO 52003-1 [14], the references for the rating of the overall and partial energy performance shall be expressed in the energy performance certificates. These references may be fixed values or functions. They may be, for example, the requirements for new construction or the average building stock.

Table 7 shows an overview of how each case study's EPC in U-CERT respond to the related provision as per EN ISO 52003-1.

Table 7. Reference values. U-CERT case studies' EPCs..

Case study ID[a]	Country	Reference value(s)	
		Depicted	Detail
9	Bulgaria	Yes	U-value[a]
11a	Denmark	No	-
11b		No	-
3	Estonia	Yes	Requirements for new buildings
10a	France	No	-
10b		No	-
4a	Hungary	Yes	Requirements for new buildings
4b		Yes	-
8	Italy	No	Energy class for requirements for new buildings and building stock
1	The Netherlands	No	-
7	Romania	Yes	Energy class of reference[b], also specific energy consumption and CO_2-equivalent emissions
6a	Slovenia	Yes	Heating energy needs for reference climate
6b		Yes	Requirements for nearly-zero energy buildings
5a	Spain	No	-
5b		No	-
5c		No	-

2a	Sweden	Yes	Requirements for new buildings and statistical range
2b		Yes	Requirements for new buildings, and similar buildings

[a] For the thermal transmittance (i.e., U-value) of walls, windows, doors, roof and floor.
[b] For the main EP indicator, as well as for specific energy consumption of heating, hot water, and artificial lighting.

Most of the analysed EPCs do include some explicit mention any reference values. Only the Italian and Romanian case uses the reference values to showcase the comparison in terms of energy class.

1.5. Specific other elemental information

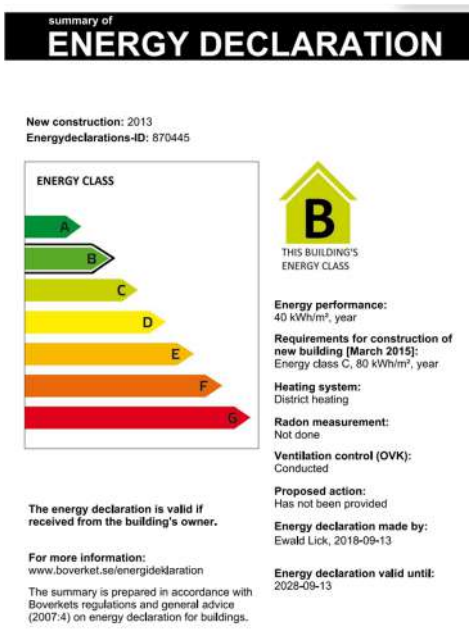
The EN ISO 52003-1 indicates that the energy performance certificates may include a specification of other information on the energy performance of main building and systems. This aspect is rather open, so a converged comparison between the U-CERT case studies is difficult. Next a non-exhaustive description of specific other elemental information found in the analysed EPCs is included.

The Danish EPCs include an explanatory comment regarding the assessed energy performance aimed to facilitate the building owner or prospective owner understanding of the certificate. The statement is reproduced next:

"The property's stated consumption and expenditure are climate-adjusted by the energy consultant, so it expresses consumption and expenditure for an average year in terms of temperature".

Additionally, a dedicated section on *"the energy consultant's conclusion and comments"* is included in Danish EPCs, similarly in the French. This item is considered very valuable.

The analysed Swedish EPCs include in the front page of the EPC a detail on the performed radon measurements and ventilation control (see Figure 2). Both features are further described in the body of the EPC report.


summary of
ENERGY DECLARATION

New construction: 2013
Energydeclarations-ID: 870445

ENERGY CLASS
A
B
C
D
E
F
G

B
THIS BUILDING'S ENERGY CLASS

Energy performance:
40 kWh/m², year

Requirements for construction of new building [March 2015]:
Energy class C, 80 kWh/m², year

Heating system:
District heating

Radon measurement:
Not done

Ventilation control (OVK):
Conducted

Proposed action:
Has not been provided

Energy declaration made by:
Ewald Lick, 2018-09-13

Energy declaration valid until:
2028-09-13

The energy declaration is valid if received from the building's owner.

For more information:
www.boverket.se/energideklaration

The summary is prepared in accordance with Boverkets regulations and general advice (2007:4) on energy declaration for buildings.

Figure 2. Front page. Swedish EPC

The Bulgarian EPC explicitly indicates if the assessed object qualifies as nearly-zero energy building, according to the national legislation.

The inclusion of detailed pictures in the EPC report is highly valued. In this regard, the Hungarian EPC for the 4b case study poses as a best practice. In terms of visual charts and graphs, the Slovenian EPCs stand out as valuable examples of clear and detailed presentation of the information. Ultimately, both the Italian and French EPCs include user friendly icons which may make the content of the energy performance certificates more accessible to non-technical building owners or prospective owners.

1.6. Specific additional indicators

The energy efficiency of a given building feature is expressed with indicators. As posed in EN ISO 52003-1, *"when it concerns the building as a whole, including all its fixed technical installations, it is called **overall energy performance indicator**. When it relates to only part of the building (e.g., specific technical (sub)systems, the fabric, or an individual element), it is called a **partial energy performance indicator**"*.

Also indicated in the standard, the indicator may be a measured or calculated quantity, or a combination of both.

1.6.1. Overall energy performance indicators

The EN ISO 52003-1 standard includes that an overall energy performance indicator ought to be used, considering the weighted delivered energy minus the weighted exported energy, determined according to EN ISO 52000-1. For example,

- Total primary energy use;
- Non-renewable and/or renewable primary energy use;
- Renewable energy ratio;
- Greenhouse gas (GHG) emissions;
- Annual energy costs.

These indicators can be normalised to the building size (e.g., reference floor area, etc.). **One of the overall energy performance indicators ought to be used as the main EP indicator**.

Table 8 shows an overview of how each case study's EPC in U-CERT respond to the provision regarding the main EP indicator. The indicators are normalised per building area.

Table 8. Main EP indicator. U-CERT case studies' EPCs..

Case study ID[a]	Country	Main EP indicator depicted
9	Bulgaria	Non-renewable primary energy use
11a	Denmark	Energy costs and delivered energy use
11b		Energy costs and delivered energy use
3	Estonia	Primary energy use[b]
10a	France	Total primary energy use and CO_2 emissions
10b		-
4a	Hungary	Primary energy use[b]
4b		-
8	Italy	Non-renewable primary energy use
1	The Netherlands	No
7	Romania	Primary energy use[b]
6a	Slovenia	Heating energy needs, delivered energy, primary energy, and CO_2 emissions
6b		Heating energy needs, delivered energy, primary energy, and CO_2 emissions

5a	Spain	CO_2 emissions
5b		Non-renewable primary energy use and CO_2 emissions
5c		Non-renewable primary energy use and CO_2 emissions
2a	Sweden	Total primary energy use
2b		Total primary energy use

[a] Including VAT and taxes

[b] Unclear if total or non-renewable primary energy use since it is referred to as "primary energy use".

Most of the analysed case studies' EPCs are in line with the overall energy performance indicators proposed by EN ISO 52003-1. Special remark deserves the Danish case, where delivered energy use and annual costs are used as main EP indicator (see Figure 3). The Dutch case appears to be the only not disclosing the main EP indicator.

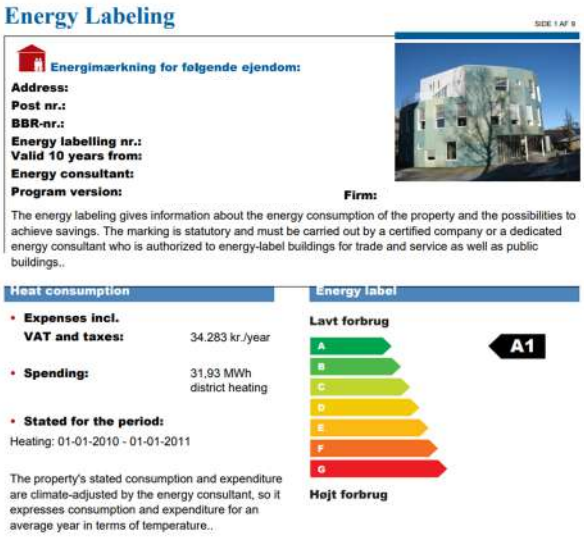


Figure 3. Front page. Danish EPC

Beyond the main EP indicator, the analysed EPCs include additional overall EP indicators. An overview can be found in Deliverable 4.2 [19].

1.6.2. Partial energy performance indicators

As indicated in EN ISO 52003-1, the most used partial energy performance features are those outlined in Table 9.

Table 9. Main partial energy performance indicators. Own elaboration from EN ISO 52003-1

Partial indicator	**Clarification**
Energy use for one specific purpose	e.g., heating, cooling, domestic hot water, lighting, ventilation, humidification, dehumidification
Energy need	For space heating and space cooling
Characteristics of the fabric, as a whole	e.g., heat transfer coefficient of the thermal envelope, etc.
Characteristics of the fabric, as individual elements	e.g., thermal transmittance of walls, etc.
Characteristics of the technical building systems, as a whole	e.g., efficiency of heating, hot water, or cooling systems, etc.
Characteristics of the technical building systems, as individual elements	e.g., efficiency of boilers, insulation of heating and hot water pipes, specific fan power, etc.

An overview of the partial indicators used in each case study, taking those from EN ISO 52018-1 as reference can be found in Deliverable 4.2 [19].

1.7. Recommendations

As indicated by EN ISO 52003-1, the energy performance certificate shall contain, if applicable, recommendations on *"modernisation measures"*, affecting the building fabric and technical building systems, and *"measured of property management"*, spanning the improvement of the operation and control of the building as a whole.

The assessment of the impact of such recommendations shall follow EN ISO 52000-1, and it is recommended that indicators on energy savings and payback time for the investment are included.

Table 10 shows an overview of how each case study's EPC in U-CERT respond to the provision on cost-effective recommendations.

Table 10. Main EP indicator. U-CERT case studies' EPCs..

Case study ID[a]	Country	Cost-effective recommendations	
		Depicted	Detail
9	Bulgaria	Yes	-
11a	Denmark	No	-[b]
11b		Yes	-
3	Estonia	Yes	-
10a	France	Yes	Glazing replacement. Installing a thermostat.
10b		-	-
4a	Hungary	No	-
4b		No	-
8	Italy	No	-
1	The Netherlands	No	-
7	Romania	No	-
6a	Slovenia	Yes	-[c]
6b		Yes	-
5a	Spain	No	-
5b		No	-
5c		No	-
2a	Sweden	Yes	Switch to LED lighting. Install solar cells on the roof[d]
2b		No	-

[a] No quantification is given in terms of energy savings, cost savings and payback time for the investment. The improvement in terms of main EP indicator and energy class is provided.
[b] The following statement is included "*The energy consumption of the building is moderate and / or an inexpensive form of energy is used. At current prices and interest rates, it is not worthwhile to implement energy improvements".*
[c] No quantification is given in terms of energy savings, cost savings and payback time for the investment.
[d] No quantification is given in terms of payback time for the investment. Energy savings and cost savings are provided.

Most of the analysed case studies' EPCs do not include explicit cost-effective recommendations for improvement. Moreover, those who include them, seldomly provide complete and understandable information to the building owner or prospective owner. Special remark deserves the French case, depicted in Figure 4, where user friendly icons are used to better illustrate the potential for improvement.

18. Recommandations d'amélioration énergétique

Sont présentées dans le tableau suivant quelques mesures visant à réduire vos consommations d'énergie.
Les consommations, économies, efforts et retours sur investissement proposés ici sont donnés à titre indicatif et séparément les uns des autres.
Certains coûts d'investissement additionnels éventuels (travaux de finition, etc.) ne sont pas pris en compte.
Ces valeurs devront impérativement être complétées avant réalisation des travaux par des devis d'entreprises.
Enfin, il est à noter que certaines aides fiscales peuvent minimiser les coûts moyens annoncés (subventions, crédit d'impôt, etc.). La TVA est comptée au taux en vigueur.

Mesures d'amélioration	Nouvelle conso. Conventionnelle	Effort d'investissement*	Economies	Rapidité du retour sur investissement*	Crédit d'impôt
Remplacement du vitrage	287,5	CCC	★★	●	30%
Commentaires : Prévoir les entrées d'air afin de garantir le renouvellement d'air minimal. Pour bénéficier du crédit d'impôts, il faut une performance thermique Uw < 1.1 W/ m²K. Le taux de 30% s'applique si les travaux portent sur moins de 50% des fenêtres mais qu'un bouquet est réalisé par ailleurs					
Pose d'un insert / poêle en appoint	289,2	CCC	★★	●●	30%
Commentaires : Choisir des appareils labellisés « flamme verte ». Choisir un combustible sec et non pollué, si possible NF bois.					
Mise en place d'un thermostat d'ambiance programmable	295,5	CC	★	●●●	30%
Commentaires : Choisir un appareil simple d'emploi. Il existe des thermostats à commande radio pour éviter les câbles de liaison et certains ont une commande téléphonique intégrée pour un pilotage à distance.					

* Calculé sans tenir compte d'un éventuel crédit d'impôt

Légende

Economies	Effort d'investissement	Rapidité du retour sur investissement
★ : moins de 100 € TTC/an	€ : moins de 200 € TTC	●●●● : moins de 5 ans
★★ : de 100 à 200 € TTC/an	€€ : de 200 à 1000 € TTC	●●● : de 5 à 10 ans
★★★ : de 200 à 300 € TTC/an	€€€ : de 1000 à 5000 € TTC	●● : de 10 à 15 ans
★★★★ : plus de 300 € TTC/an	€€€€ : plus de 5000 € TTC	● : plus de 15 ans

Figure 4. Recommendations. French EPC

The Danish EPCs include contextual information on the energy savings proposals (i.e., cost-effective recommendations), which may facilitate the understanding of the provided information by a building owner. The statement is reproduced below:

"The proposals are based on the calculated energy consumption. The actual use of the building, including operating hours, etc. has been taken into account. for installations and for the building as a whole. A proposal may save money but not energy - for example if expensive electricity is replaced by cheaper district heating or if water costs are reduced".

None of the analysed EPCs provided a step-by-step implementation plan of the proposed recommendations, as indicated by the 2018 EPBD.

1.8. EP rating

As indicated in EN ISO 52003-1 standard, a numeric indicator of a building feature may not be enough to reveal the energetic quality of such feature. Consequently, the EPB indicator is compared with a reference value to rate such the energetic quality of the building feature under consideration.

The standard describes two rating methods, both with a performance scale ranging from A (i.e., the best energy performance) to G (i.e., the worst), with the possibility of additional subclasses (e.g., expanding A with A+, A++, etc.).

- The *"default energy rating method"* with two reference points. Namely, the *"energy performance regulation reference"*, and the *"building stock reference"*. Each of the references is placed at the boundary of two different classes.
- The *"default energy rating method"* with one reference point. Namely, the *"energy performance regulation reference"*. The reference is placed at the boundary of two classes. The boundaries of the classes are based on a nonlinear scale ($Y = \sqrt{2}^{(n-n_{ref})}$), where n_{ref} refers to the upper-class number in the boundary.

The standard states that additional energy rating methods are possible.

Table 10 shows an overview of how each case study's EPC in U-CERT respond to the provision on EP rating, as indicated in EN ISO 52003-1.

Table 11. EP ratings. U-CERT case studies' EPCs..

Case study ID[a]	Country	EP rating	
		Depicted	Detail
9	Bulgaria	Yes	A+-G[a]
11a	Denmark	Yes	A-G
11b		Yes	A-G
3	Estonia	Yes	A-H[a]
10a	France	Yes	A-G[a]
10b		-	-
4a	Hungary	Yes	AA++-JJ
4b		Yes	AA++-JJ
8	Italy	Yes	A4-G
1	The Netherlands	No	-
7	Romania	Yes	A-G[c]
6a	Slovenia	Yes	A1-G[b, c]
6b		Yes	A1-G[b, c]
5a	Spain	Yes	A-G[c]
5b		Yes	A-G[a, c]
5c		Yes	A-G[a, c]
2a	Sweden	Yes	A-G
2b		Yes	A-G

[a] The rating of each of the classes' boundaries is also indicated.

[b] EP rating for overall indicators is also provided (e.g., delivered energy, CO_2 emissions, etc.).

[c] EP rating for partial indicators is also provided (e.g., heating needs, cooling needs, domestic hot water production needs).

All of the analysed countries, except for The Netherlands, depict EP ratings in a scale ranging from A to G, at the minimum. Some countries define additional subclasses for the maximum rating – A+, AA++, A1, Bulgaria, Hungary, and Slovenia, respectively. Additionally, Estonia and Hungary, include additional classes below G, down to H and JJ respectively.

1.9. Specific additional content

The EN ISO 52003-1 indicates that the energy performance certificates may include additional content to identify characteristics of the building. As this item is rather open, a converged comparison between national EPCs is complicated. However, there are some common aspects among the national procedures. A non-exhaustive outline is indicated in Table 12.

Table 12. Specific additional content. U-CERT case studies' EPCs..

Case study ID[a]	Country	Specific additional content		
		Previously assessed	Protected building (i.e., heritage)	Purpose of issue
9	Bulgaria	No	No	No
11a	Denmark	Yes	No	No
11b		Yes	No	No
3	Estonia	No	No	No
10a	France	No	No	No
10b		No	No	No
4a	Hungary	No	Yes	No

4b		No	Yes	No
8	Italy	No	No	Yes[a]
1	The Netherlands	No	No	No
7	Romania	No	No	Yes[a]
6a	Slovenia	No	No	No
6b		No	No	No
5a	Spain	No	No	No
5b		No	No	No
5c		No	No	No
2a	Sweden	Yes	Yes	No
2b		Yes	Yes	No

[a] The purpose of the EPC issued is explicitly expressed (e.g., sale, rent, new building, reassessment, renovation, etc.).

Most of the analysed EPCs did not include explicit mention to whether the assessed building was under any kind of architectural protection (i.e., heritage), nor indicated whether the object had been assessed previously in the past.

1.10. Graphical representation of the EP rating

As indicated in the EN ISO 52003-1 standard, one of the key elements is the energy label, which constitutes the graphical representation of the energy rating. In the standard's Annex E three examples of energy label models are given. They are reproduced below.

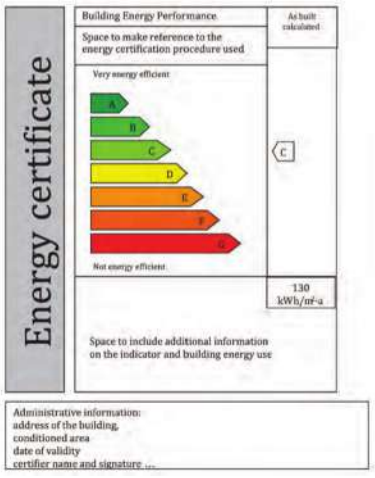


Figure 5. Ex. 1 of energy label.

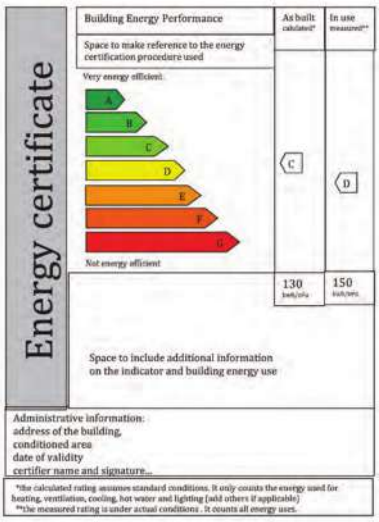


Figure 6. Ex. 2 of energy label.

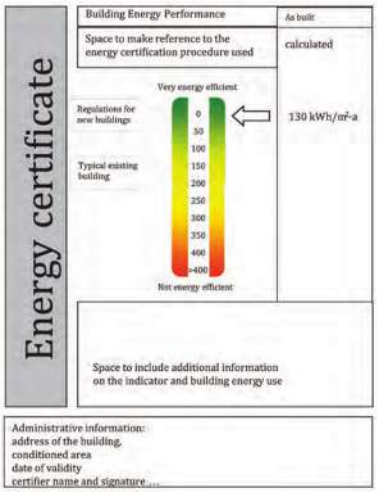


Figure 7. Ex. 3 of energy label.

A reduced overview of the energy labels from U-CERT's case studies can be seen in Figure 8.

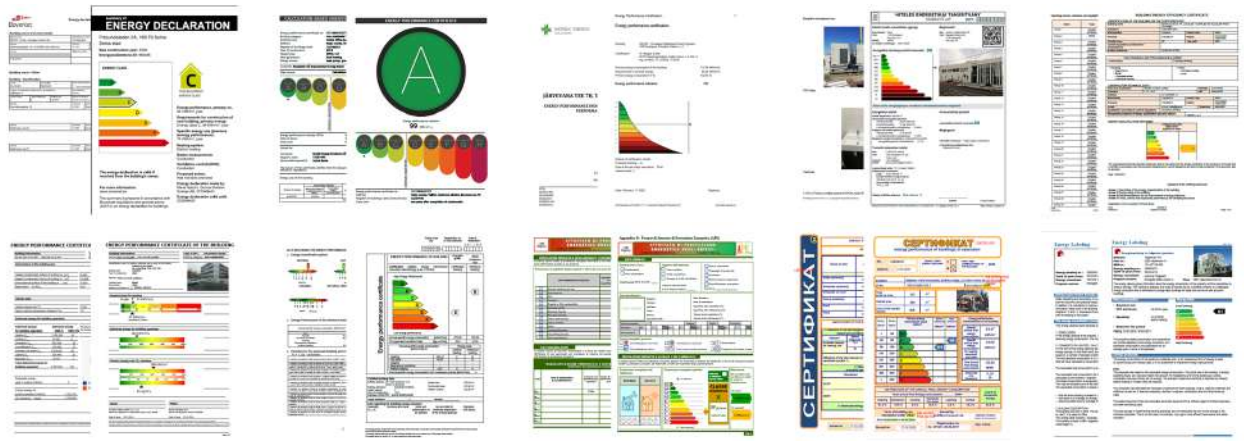


Figure 8. EPC implementation. Europe

Table 13 shows an overview of how each case study's EPC in U-CERT respond to the related provision. An explicit link is made with the suggested designs from Figure 5 to Figure 7.

Table 13. Graphical representation EP ratings. U-CERT case studies' EPCs..

Case study ID[a]	Country	Graphical EP rating	
		Depicted	Detail
9	Bulgaria	Yes	Ex. 2
11a	Denmark	Yes	Ex. 1
11b		Yes	Ex. 1
3	Estonia	Yes	Ex. 2, with modifications
10a	France	Yes	Ex. 1
10b		-	-
4a	Hungary	Yes	Ex. 1, with modifications
4b		Yes	Ex. 1, with modifications
8	Italy	Yes	Ex. 2
1	The Netherlands	No	-
7	Romania	Yes	Ex. 2
6a	Slovenia	Yes	Ex. 3
6b		Yes	Ex. 3
5a	Spain	Yes	Ex. 1
5b		Yes	Ex. 1
5c		Yes	Ex. 1
2a	Sweden	Yes	Ex. 1
2b		Yes	Ex. 1

[a] The rating of each of the classes' boundaries is also indicated.

[b] EP rating for partial indicators is also provided (e.g., heating needs, cooling needs, domestic hot water production needs).

Among the analysed cases, there is a predominance of one of the default graphical representations of the energy rating given by EN ISO 52003-1, with minor variations in some countries.

1.11. Complementary information

As indicated in Table 2, the 2018 EPBD indicates that the energy performance certificates shall include indications on where to receive more information. Moreover, it indicates that information on related topics (e.g., energy audits,

financial incentives and instruments, etc.) may be also provided. In Table 14 those two elements are discussed in relation to the analysed EPCs.

Table 14. Complementary information. U-CERT case studies' EPCs..

Case study ID[a]	Country	Complementary information	
		Included	Detail
9	Bulgaria	Yes	Link to generic official EPC website, and mention of financing opportunities
11a	Denmark	Yes	Dedicated sections to disclose the reason and added value of energy efficiency and energy performance assessments.
11b		Yes	Dedicated sections to disclose the reason and added value of energy efficiency and energy performance assessments.
3	Estonia	No	-
10a	France	Yes	Dedicated sections to disclose the reason and added value of energy efficiency and energy performance assessments. Link to generic official EPC website and to public funding online resources
10b		-	-
4a	Hungary	No	-
4b		No	-
8	Italy	Yes	A detailed description on the content of each page of the EPC report (e.g., definitions, taxonomy, etc.)
1	The Netherlands	No	-
7	Romania	No	-
6a	Slovenia	No	-
6b		Yes	Link to generic official EPC website
5a	Spain	No	-
5b		No	-
5c		No	-
2a	Sweden	Yes	Link to generic official EPC website
2b		Yes	Link to generic official EPC website

[a] The rating of each of the classes' boundaries is also indicated.

[b] EP rating for partial indicators is also provided (e.g., heating needs, cooling needs)

2. Structured questionnaire to NSBs and national authority responsible of EPCs

The structured questionnaire, investigating how aligned the national calculation methodology is with the CEN/ISO set of EPB standards, was defined by REHVA and EPB Center experts, with the help of IRI UL. It can still be accessed via the following link **https://m19.mailplus.nl/wpcRWZKWkRgh-1035-111888-test-1** and screenshots are included here below.

U-CERT

User-Centred Energy Performance Assessment and Certification

Webinar on Guidance and examples ...

New European Commission

Questionnaire

The first question will help U-CERT team to focus more on current or near future expected national calculation methodologies, especially related to the Energy Performance Certification scheme.
The first question will tell U-CERT team whether we should focus on the description of your current national method or - if your country is planning to replace the current national method in the near future - on the (future) description of this new or revised method.

1. Are you in the process of developing a new or revised national calculation methodology that will be more in line with the set of EPB standards?

- ☐ 1. My country has already finished developing a new or revised national calculation methodology that is (more) in line with the EPB standards
- ☐ 2. Yes, my country is currently in such process
- ☐ 3. My country is not yet in such process, but is considering doing so within the next two years
- ☐ 4. My country has currently no intentions in this direction

Other (optional)

The questions below are about the 5 EPB standards mentioned in the revised EPBD and the related National Annexes.

revised EPBD, Annex I, 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."

2. The description of the national calculation methodology following the National Annexes of EN ISO 52000-1, 52003-1, 52010-1, 52016-1, and 52018-1 in my country/region is:

- ☐ 1. (almost) finished
- ☐ 2. in progress
- ☐ 3. not started, but intention to start
- ☐ 4. not planned yet
- ☐ 5. unknown to me

Other (optional)

In case you chose 1 or 2, please continue with the questions below.

In case you chose 3, 4 or 5, you may skip questions 3 and 4 if you lack the necessary information.

3. In the process of describing the national calculation methodology following the National Annexes of EN ISO 52000-1, 52003-1, 52010-1, 52016-1, and 52018-1, which tables of the Annexes cause specific difficulties? And why? (example: "Table A.33 because ...")

4. The main issues/problems with describing the national calculation methodology following the National Annexes of these 5 EPB standards are:

- ☐ 1. No issues/problems
- ☐ 2. Not sure where to begin
- ☐ 3. Lack of examples

Other (optional)

5. What kind of help would benefit you most concerning the National Annexes and/or the EPB standards in general?: (more than one answer possible)

- ☐ 1. No help necessary
- ☐ 2. Examples and case studies on the EPB Standards
- ☐ 3. Guidance on step by step transition from our current national methods to the EPB Standards
- ☐ 4. FAQ's about the completion of the National Annexes
- ☐ 5. Tips & tricks on the completion of the National Annexes
- ☐ 6. A contact address for questions
- ☐ 7. FAQ's about the set of EPB Standards
- ☐ 8. Practical information shared during workshops/conferences
- ☐ 9. Organization of webinars/online courses

Other (optional)

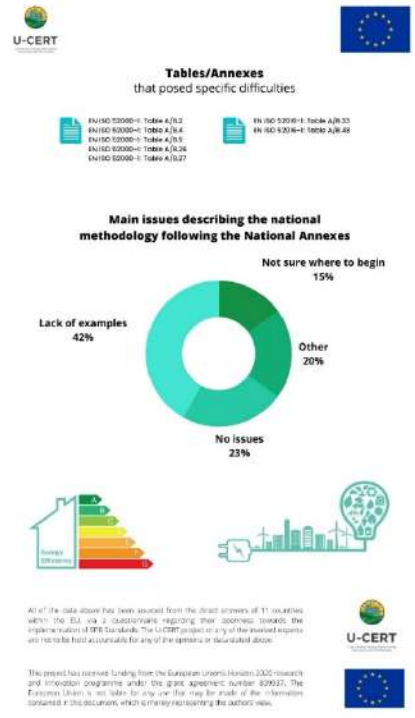
6. Do you have any other feedback about the set of EPB standards and the related National Annexes in your country especially considering the Energy Performance Certficiation scheme that you would like to share with U-CERT team? (optional)

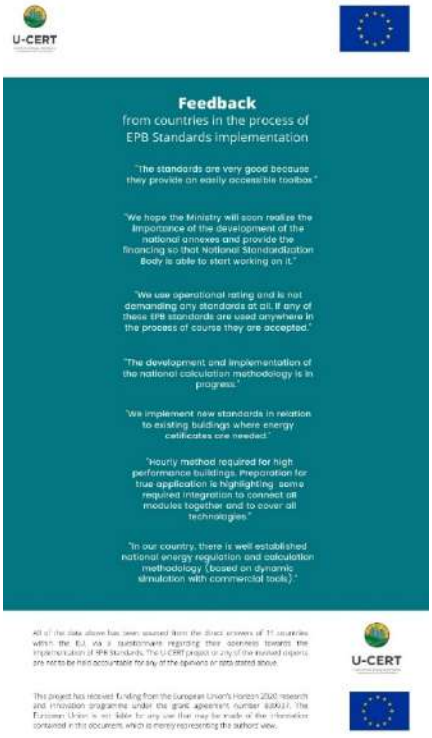
U-CERT team thanks you very much for having taken the time to fill in this questionnaire!

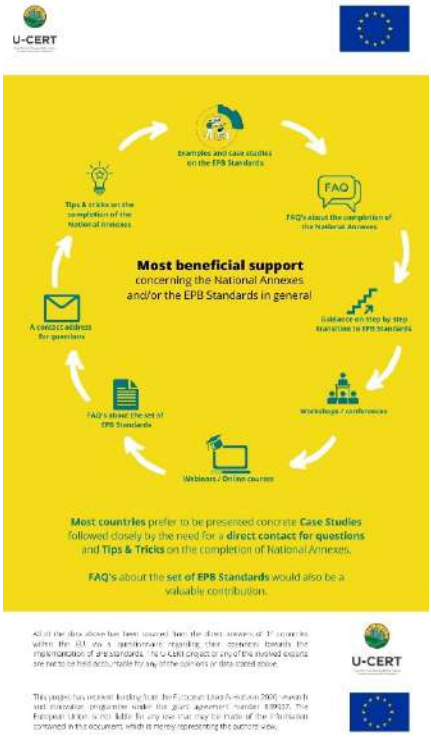
Under REHVA's coordination it was disseminated at national level by U-CERT partners to their key contacts (some also U-CERT Letter of Support signatories) at the National Standards Body and/or the national authority responsible of the EPC scheme and/or any other equivalent in knowledge national experts enquiring about the use of the EPB-standards in national assessment and certification processes. Although foreseen to commence in April 2020, due to objective reasons the process could take place only with a slight delay during June – November 2020.

For public communication and dissemination purposes the results of the questionnaire have been shaped in a visually attractive manner as infographics, while ensuring GDPR compliance with regards to the questionnaire

respondents. The infographics can be found in the **U-CERT proceedings available on U-CERT website** and are inserted as well here below.







3. Status of EPC schemes in U-CERT countries February 2023

3.1. Bulgaria

Responsible authority: Sustainable Energy Development Agency (SEDA), an executive agency under the umbrella of the Ministry of Energy

EPC website: There is not any official site for the Energy Performance Certification scheme or the Energy Performance of Buildings Directive in Bulgaria. SEDA keeps a list of regulations related to sustainable energy issues on its site. The links to the directives related to sustainable energy issues are available here: https://www.seea.government.bg/bg/dokumenti#normativna-baza-na-es, and the links to all laws and secondary legislation are here: https://www.seea.government.bg/bg/dokumenti#normativna-baza-na-republika-balgariya.

EPC related laws and regulations:

- Energy Efficiency Act of 12 March 2021
- ORDINANCE No RD-02-20-3 of 9 November 2022 on the technical requirements for the energy performance of buildings
- Ordinance No E-RD-04-2 of 16 December 2022 on Energy Efficiency Audit, Certification and Evaluation of Energy Savings in Buildings
- Official templates and national calculation software (EPC for new & existing buildings, summary of energy auditing report for an existing building combined with EPC or not combined with EPC)

The Energy Efficiency Act is the main normative document that regulates the certification of the energy performance of buildings in Bulgaria, as well as all other issues related to energy efficiency.

Certification of the energy performance of buildings is mandatory for all existing buildings used by public authorities with an area of more than 250 m^2, as well as for all newly built buildings, regardless of their ownership and purpose, with the exception of only a few types of buildings, such as production buildings, prayer temples, etc.

An energy performance certificate of an existing building is issued only after an energy audit has been carried out. The energy audit process, the mandatory documents, the type and content of the certificates are regulated by Ordinance No E-RD-04-2 of 16 December 2022 on Energy Efficiency Audit, Certification and Evaluation of Energy Savings in Buildings. The minimum requirements for the energy efficiency of buildings, energy performance indicators, energy class scales for 10 building types and the methodology for calculating energy performance are regulated with Ordinance No RD-02-20-3 of 9 November 2022 on the technical requirements for the energy performance of buildings, which repeals two previous regulations that regulated these issues. The methodology for calculation of the energy performance in this new regulation is in line with the requirements of the EN ISO 52000 family of standards. Numerous changes have been introduced compared to the old ordinance, such as indicators for the use of renewable energy, introducing new primary energy factors and new emission factors, etc. As in the previous regulations, the energy performance is determined by calculation, after which a calibration of the result is carried out against the actual measured annual energy consumption in the building, which is previously adjusted to standard climatic conditions. The calibrated results are normalized to the regulatory requirements for the respective building type and the new calculated results are used to determine the energy performance of the building and the energy class against the corresponding scale.

There are two national software for calculating the energy performance of buildings which are free of charge. Both can be used with the current calculation methodology, but it will be necessary for the energy auditors to perform numerous additional calculations outside the software. So far, there has been no software in Bulgaria to automatically generate the certificate after the completion of the energy model.

Only accredited companies that have a minimum number of specialists from specific specialties who have successfully completed specialized training and passed an exam have the right to carry out energy audits and energy performance certification. For buildings with a total built-up area below 500 m^2, the inspection and certification is allowed to be carried out by individuals who have been successfully trained and accredited. Accreditation is carried out by SEDA according to the rules described in ORDINANCE No E-RD-04-1 of 3.01.2018 for the circumstances subject to entry in the registers under the Energy Efficiency Act, the entry and receipt of information from these registers, the terms and conditions for acquiring qualification by energy efficiency consultants.

3.2. Denmark

Responsible authority: **Danish Energy Agency (DEA)**

EPC website: **Energy labelling of buildings**

EPC related laws and regulations:

- **Ordinance BEK nr. 1018 of 22/10/2008** on publication of energy labelling of buildings and inspection reports on boiler and heating systems, etc.
- **Ordinance BEK nr. 1651 of 18/11/2020** on energy labelling of buildings
- **LBK nr. 1923 of 08/10/2021** Promulgation of the Act on the Promotion of Energy Savings in Buildings
- **Ordinance BEK nr. 939 of 19/05/2021** on Handbook for Energy Consultants

The Act on the Promotion of Energy Savings in Buildings is the main normative document that regulates the certification of the energy performance of buildings in Denmark, as well as all other issues related to energy efficiency.

Certification of the energy performance of buildings is mandatory for (1) Sale or rent of a property, (2) all newly built buildings, and (3) all existing buildings used by public authorities with an area of more than 250 m2. When a building is to be energy labelled, the building must be inspected by an energy consultant. The consultant assesses the building's energy status and places it on a scale from A to G. The energy label also contains a description of the options for saving energy. An energy label is valid for 10 years. If the building is sold several times within the validity period, the same energy label can be used.

The energy label is based on a calculated consumption, which is an indicator of the building's energy quality. Energy labelling is carried out by an energy consultant, who measures the building and examines the quality of insulation, windows and doors, heating installation, etc. On this basis, the building's energy consumption is calculated under standard conditions for weather, family size, operating hours, consumption habits, etc. The Danish Energy Agency controls the quality of a selection of the energy labels prepared by the energy labelling companies. This is done to ensure that the energy labels are carried out according to the rules and the quality of the reports is high. At the same time, the inspection must provide knowledge about the scheme, which can help to increase the quality of the energy labelling scheme in the future. The energy labels are checked in several different ways: (1) Digital, automatic control during the preparation of energy labels, where data entry is validated in the reporting program. (2) Automatic comparison with other building data when reporting energy labelling data. (3) Ongoing analysis of error types using data.

Changes since 2020:

- Legislative Decree No. 1923 of 8 October 2021 on the promotion of energy savings in buildings https://www.retsinformation.dk/eli/lta/2021/1923
- Handbook for Energy Consultants (HB2021) https://www.retsinformation.dk/eli/lta/2021/939

3.3. Estonia

Responsible authority: **Ministry of Economic Affairs and Communications**

EPC website: The Ministry of Economic Affairs and Communications website's has an overview of the certification scheme and requirements for the energy performance of buildings: **Energy efficiency and indoor climate**, **Energy label**.

EPC related laws and regulations:

- **Overarching building code** (Entry into force of the revision 17.03.2023, Expiry of revision 30.06.2023)
- **Energy performance calculation methodology** (Entry into force of the revision 10.07.2020, Expiry of revision: Currently valid)
- **Energy performance minimum requirements** (Entry into force of the revision 10.07.2020, Expiry of revision: Currently valid)
- **Requirements for issuing and display of EPCs** (Entry into force of the revision 10.07.2020, Expiry of revision: Currently valid)

In Estonia, EPCs are set up in force and implemented as nZEB requirements. For compliance assessment, detailed procedures are described in the regulation. In Estonia, there are two calculation methodologies:

- A methodology based only on calculated energy consumption (asset rating) –f or a new building, dynamic energy simulation with validated commercial software.
- A methodology that uses actual energy consumption data (operational rating) for existing buildings. Climate dependent part of metered energy is estimated, and climate is normalized with heating degree days. It is allowed to reduce non-EPBD uses if equipped with separate energy meters (however, appliances and lighting are included in Estonia in EPCs).

Requirements are also set for summer thermal comfort in buildings:

- For residential buildings, this requirement is defined as the hourly mean indoor temperature is more than the maximum limit of 150 degree-hours (ºCh) over +27°C during the summertime period (from 1 June to 31 August).
- For non-residential buildings, this requirement is defined as the hourly mean indoor temperature above the maximum limit of 100 degree-hours (ºCh) over +25°C (+27°C for warehouses, industrial buildings) during the summertime period (from 1 June to 31 August, educational buildings from 1 May to 15 June, and from 15 August to 30 September).

Temperature simulations are needed for typical living rooms and bedrooms that are most likely to encounter overheating. Temperature calculations for non-residential buildings are needed for typical room types. The verification is to be conducted by considering rooms as single zones, and by using dynamic simulation software.

New buildings must achieve EPC class A (nZEB) and major renovation of existing buildings EPC class C (may also be called major renovation nZEB) which both are seen as cost-optimal performance levels.

It is also important to note that the validity time of EPCs in Estonia is different: 2 years for new buildings and 10 years for existing buildings. For new buildings, the main issue for EPC would be the updated/recalculated for a use permit and for existing buildings as required in EPBD.

In the Estonian EPC the main indicators are:

- Key performance indicators: primary energy indicator.
- Other indicator(s) used for energy rating and sustainability rating: delivered, exported, and on-site generated energy.
- EN reference standards for the indicators: generally, follows EPB standards.
- Energy saving measures: included in the existing building EPC, so that recommendations can be selected from the drop-down menu. EPC is not a renovation passport with detailed recommendations.
- Building description: basic data in EPC and more detailed in a digital logbook.
- Additional information: input data and energy calculation result data tables and energy performance design documentation as a required part of the design documentation.

For new buildings, the main issues with EPCs would be:

- to establish a requirement to update/recalculate EPC issued in the building permit stage so that it would be recalculated by using as-built data in the use permit stage
- to establish a requirement that input data and results tables would be uploaded together with EPC, to provide an easy option for quality control – to assess the validity of the results

For existing buildings: there are no issues and performance gaps seen because actual energy consumption data is used in EPC calculation, and the system is very robust.

The best practice ongoing would be the official position in Estonia (responsible ministry) stating that EPC must stay as a simple and short document, reporting energy use /generation in an easy-to-understand fashion to the end customer. In the longer run, it is planned to automate the existing EPC calculation in the building registry, based on real-time main energy meters data already available today in the cloud data store.

3.4. France

Responsible authority: Ministry for Energy Transition

EPC website: Energy Performance Diagnosis (DPE)

EPC related laws and regulations:

- Arrêté du 15 septembre 2006 relatif au diagnostic de performance énergétique pour les bâtiments ou parties de bâtiment autres que d'habitation existants proposés à la vente en France métropolitaine
- Arrêté du 21 septembre 2007 relatif au diagnostic de performance énergétique pour les bâtiments ou parties de bâtiment à usage autre que d'habitation neufs en France métropolitaine
- Décret n° 2020-1609 du 17 décembre 2020 relatif au diagnostic de performance énergétique et à l'affichage des informations relatives à la consommation d'énergie des logements dans les annonces et les baux immobiliers
- Décret n° 2020-1610 du 17 décembre 2020 relatif à la durée de validité des diagnostics de performance énergétique
- Arrêté du 31 mars 2021 relatif aux méthodes et procédures applicables au diagnostic de performance énergétique et aux logiciels l'établissant
- Arrêté du 31 mars 2021 relatif au diagnostic de performance énergétique pour les bâtiments ou parties de bâtiments à usage d'habitation en France métropolitaine
- Arrêté du 31 mars 2021 modifiant diverses dispositions relatives au diagnostic de performance énergétique
- Arrêté du 8 octobre 2021 modifiant la méthode de calcul et les modalités d'établissement du diagnostic de performance énergétique

The Energy Performance Diagnosis (EPD) provides information on the energy and climate performance of a home or building (labels A to G), by assessing its energy consumption and its impact in terms of greenhouse gas emissions. It is part of the energy policy defined at European level in order to reduce the energy consumption of buildings and to limit greenhouse gas emissions and is used in particular to identify energy strainers (ECD O&M labels, i.e. homes that consume the most energy and/or emit the most greenhouse gases). Its purpose is to inform the purchaser or lessee about the "green value", to recommend work to be done to improve it and to estimate its energy costs.

Since its creation in France in 2006, this mechanism has been made reliable and strengthened for the first time through a major reform in 2013.

A second reform has been in effect since July 1, 2021, when the DPE lost its informational character and became fully enforceable. This overhaul of the "housing" ECD is part of a broader context to accelerate the energy retrofit of buildings, of which ECD is one of the key tools (information of potential purchasers of a property, support of financial assistance and bonds, etc.).

3.5. Hungary

Responsible authority: **Ministry of Building and Transportation**

EPC website: There isn't any official website for the Energy Performance Certification scheme or the Energy Performance of Buildings Directive in Hungary. In the Governmental decree the mandatory content of the certification is described. There is no free of charge national software for calculating the energy performance of buildings. In Hungary, 90% of certifiers use the same software (not mandatory, not free of charge).

EPC related laws and regulations:

- **7/2006 TNM Ministerial decree** on determining the energetic characteristics of buildings
- **168/2008 Governmental decree** on the certification of the energetic characteristics of buildings
- **19/2021 ITM Ministerial decree** on energy efficiency. on the implementation of certain rules of the Act concerning energy audits

Based on the EPBD "recast" 2018/844/EU the draft of the ministerial decree has been ready for over 2 years, but this has not yet entered into force, because the responsible ministry has changed. Hence, the current situation with regards to the EPC didn't change in practice in Hungary since 2020.

3.6. Italy

Responsible authority: **Ministry of the Environment and Energy Security (MiASE)** and **Italian National Agency for New Technologies, Energy and Sustainable Economic Development (ENEA)**

Nevertheless, in Italy, the legislative competence for energy certification of buildings lies within the Regions, which are subjected to compliance with the principles established by national provisions but can choose to adopt the national scheme or can directly transpose the European Directive by defining its own regulation, which must not be in contradiction with the national law, but that can be more restrictive.

- **National EPC Scheme**: Abruzzo, Basilicata, Calabria, Campania, Friuli-Venezia Giulia, Lazio, Liguria, Marche, Molise, Piemonte, Puglia, Sardegna, Sicilia, Toscana, Umbria, Valle d'Aosta, Veneto
- **National/Regional EPC Scheme**: Bolzano
- **Regional EPC Scheme**: Emilia-Romagna, Lombardia, Trento

EPC website: At national level, there is not one website for the Energy Performance Certification scheme or the Energy Performance of Buildings Directive, but there are:

- a website containing all the national law: **https://www.gazzettaufficiale.it/**
- a web site exposing the "Sistema Informativo sugli Attestati di Prestazione Energetica (APE)" (SIAPE), which is the national tool for collecting Energy Performance Certificates (EPC) of buildings and building units: **https://siape.enea.it/**.

Established by Interministerial Decree 26/06/2015, SIAPE was created and is managed by ENEA with the primary purpose of providing a detailed picture of the state of the art of energy requalification of the national building stock. As imposed by the Art 6, comma 2 of the Interministerial Decree 26/06/2015, the regions and autonomous provinces, by 31st March each year, feed the SIAPE with their data regarding the EPCs for the past year.

To date, the majority of the Regions implemented the connection to SIAPE, except for some still missing (Campania and Sicilia). Some has asked ENEA to implement on their behalf, their regional cadastre, some has implemented their own cadastre by themselves, but all of them (except the two missing) feed the SIAPE conformingly to the legislation.

Here follows the website reference for the Regions that have an informative website concerning the EPC, containing also its own legislation ("NORMATIVA") and a website for its own cadastre (*warning: in some cases the access to the data contained in the regional cadastre is reserved to a registered user*).

Region	Information websites on energy certification of buildings	Regional/provincial website concerning the EPC database
Abruzzo	https://www.apeabruzzo.enea.it/	https://apeabruzzo.enea.it/statistiche.php
Basilicata	http://portalebandi.regione.basilicata.it/PortaleBandi/detail-istanzeonline.jsp?id=339568 https://www.apebasilicata.enea.it/	https://www.apebasilicata.enea.it/accesso-agli-atti
Bolzano	https://www.agenziacasaclima.it/it/certificazione-edifici-1405.html	https://siape.bz.it/it/ape-attestato-di-prestazione-energetica-1.html
Calabria	https://www.regione.calabria.it/website/organizzazione/dipartimento19/ https://www.apecalabria.enea.it	https://www.apecalabria.enea.it/statistiche.php
Campania	http://sid.sviluppocampania.it/WebAccesso/Login.aspx	http://sid.sviluppocampania.it/WebAccesso/Login.aspx

Emilia-Romagna	http://energia.regione.emilia-romagna.it/certificazione-energetica/certificazione-energetica-degli-edifici	https://sace.regione.emilia-romagna.it/Login.aspx?ReturnUrl=%2f
Friuli-Venezia Giulia	https://energia.regione.fvg.it/	https://energia.regione.fvg.it/dati-energetici-sul-territorio.html https://energia.regione.fvg.it/cenedfvg
Lazio	https://www.apelazio.enea.it	https://www.apelazio.enea.it/pdf/statistiche.pdf
Liguria	https://servizi.regione.liguria.it/page/welcome/CERTIFICAZIONE_ENERGETICA_CITTADINI	https://servizi.regione.liguria.it/page/welcome/CERTIFICAZIONE_ENERGETICA_PROFESSIONISTI https://servizi.regione.liguria.it/page/welcome/CERTIFICAZIONE_ENERGETICA_CITTADINI
Lombardia	www.cened.it	https://www.cened.it/dati-cened
Marche	http://www.regione.marche.it/Regione-Utile/Energia/Attestati-di-Prestazione-Energetica-APE	https://www.apemarche.enea.it/accesso-agli-atti
Molise	http://www3.regione.molise.it/flex/cm/pages/ServeBLOB.php/L/IT/IDPagina/15303 https://www.regione.molise.it/flex/cm/pages/ServeBLOB.php/L/IT/IDPagina/15702	https://www.apemolise.enea.it/
Piemonte	https://www.regione.piemonte.it/web/temi/sviluppo/sviluppo-energetico-sostenibile/sistema-informativo-per-prestazione-energetica-degli-edifici-sipee	https://secure.sistemapiemonte.it/siceefree/secure/goToMnuRicercaAceFromMenu.do
Puglia	https://www.apepuglia.enea.it/	https://www.apepuglia.enea.it/statistiche.php
Sardegna	http://www.regione.sardegna.it/j/v/2419?s=1&v=9&c=93219&es=6603&na=1&n=10&tb=15028 https://www.regione.sardegna.it/j/v/2420?s=1&v=9&c=15032&esp=1&tb=15028	----------
Sicilia	https://www.apesicilia.enea.it/ http://cefa.catastoenergetico.regione.sicilia.it/	https://www.apesicilia.enea.it/accesso-agli-atti
Toscana	https://siert.regione.toscana.it/ https://www.regione.toscana.it/certificazione-energetica-in-toscana	www.siert.regione.toscana.it
Trento	http://www.energia.provincia.tn.it/certificazione_edifici/	www.ace.provincia.tn.it
Umbria	http://ape.regione.umbria.it/	https://ape.regione.umbria.it/Home/Statistiche
Valle d'Aosta	http://www.regione.vda.it/energia/certificazione energetica/default_i.aspx	http://energia.partout.it/CatastoEnergetico/Welcome2FreeArea.do
Veneto	http://www.regione.veneto.it/web/energia/prestazione-energetica-degli-edifici	https://venet-energia-edifici.regione.veneto.it/index.php

EPC related laws and regulations:

Here follows a summary mirror of the transposition in the Italian legislation of the European Directives related to energy (EPBD, EED, RED) and a short list, with a link to their most updated version, of laws and formal explanation concerning the EPC procedure:

2021 **DECRETO LEGISLATIVO 8 novembre 2021, n. 199** "Attuazione della direttiva (UE) 2018/2001 del Parlamento europeo e del Consiglio, dell'11 dicembre 2018, sulla promozione dell'uso dell'energia da fonti rinnovabili"

2020 **DECRETO LEGISLATIVO 10 giugno 2020, n. 48** Attuazione della direttiva (UE) 2018/844 del Parlamento europeo e del Consiglio, del 30 maggio 2018, che modifica la direttiva 2010/31/UE sulla prestazione energetica nell'edilizia e la direttiva 2012/27/UE sull'efficienza energetica. (20G00066) (GU Serie Generale n.146 del 10-06-2020) note: Entrata in vigore del provvedimento: 11/06/2020

2018 **CHIARIMENTI IN MATERIA DI EFFICIENZA ENERGETICA IN EDILIZIA (Raccolta n.3 FAQ del MISE)**
Decreto 26 giugno 2015 cosiddetto "Decreto requisiti minimi",
Decreto 26 giugno 2015 cosiddetto "Decreto Linee guida APE"

2016 **CHIARIMENTI IN MATERIA DI EFFICIENZA ENERGETICA IN EDILIZIA (Raccolta n.2 FAQ del MISE)**
Decreto 26 giugno 2015 cosiddetto "Decreto requisiti minimi",
Decreto 26 giugno 2015 cosiddetto "Decreto Linee guida APE"

2016 **Decreto legislativo 18 luglio 2016, n. 141** "Disposizioni integrative al decreto legislativo 4 luglio 2014, n. 102, di attuazione della direttiva 2012/27/UE sull'efficienza energetica, che modifica le direttive 2009/125/CE e 2010/30/UE e abroga le direttive 2004/8/CE e 2006/32/CE" (Transversal Legislative Act)

2015 **CHIARIMENTI IN MATERIA DI EFFICIENZA ENERGETICA IN EDILIZIA (Raccolta n.1 FAQ del MISE)**
Decreto 26 giugno 2015 cosiddetto "Decreto requisiti minimi",
Decreto 26 giugno 2015 cosiddetto "Decreto Linee guida APE"

2015 Decreto interministeriale 26 giugno 2015 "Applicazione delle metodologie di calcolo delle prestazioni energetiche e definizione delle prescrizioni e dei requisiti minimi degli edifici", Pubblicato nel Supplemento ordinario n. 39 alla "Gazzetta Ufficiale" n. 162 del 15 luglio 2015.

2015 Decreto interministeriale 26 giugno 2015 "Schemi e modalità di riferimento per la compilazione della relazione tecnica di progetto ai fini dell'applicazione delle prescrizioni e dei requisiti minimi di prestazione energetica negli edifici", Pubblicato nel Supplemento ordinario n. 39 alla "Gazzetta Ufficiale" n. 162 del 15 luglio 2015.

2015 **Decreto interministeriale 26 giugno 2015** "Adeguamento linee guida nazionali per la certificazione energetica degli edifici", Pubblicato nel Supplemento ordinario n. 39 alla "Gazzetta Ufficiale" n. 162 del 15 luglio 2015.

2014 **Decreto Legislativo 4 luglio 2014, n. 102** "Attuazione della Direttiva 2012/27/UE sull'efficienza energetica, che modifica le direttive 2009/125/CE e 2010/30/UE e abroga le direttive 2004/8/CE e 2006/32/CE. (Transversal Legislative Act)

2014 Chiarimenti in Ordine al regime giuridico degli APE con riferimento ai contratti di vendita, agli atti di trasferimento di immobili a titolo gratuito o nuovi contratti di locazione. Testo dell'Interrogazione e risposta del Ministro Cancellieri. *(non legislative act it's a clarification)*

2013 **Schema di procedura**, del Ministero dello Sviluppo Economico, per il rilascio dell'autorizzazione allo svolgimento dei corsi di formazione per la certificazione energetica degli edifici a livello nazionale

2013 **Circolare del 7 agosto 2013**, Chiarimenti in merito all'applicazione delle disposizioni di cui al decreto legge 4 giugno 2013, n.63 come convertito, con modificazioni, dalla legge 3 agosto 2013, n. 90, in materia di attestazione della prestazione energetica degli edifici

2013 Circolare n. 12976 del 25 giugno 2013 "Chiarimenti in merito all'applicazione delle disposizioni di cui al decreto legge 4 giugno 2013, n.63 in materia di attestazione della prestazione energetica degli edifici"

2013 D.P.R. 16 aprile 2013, n. 75 "Regolamento recante disciplina dei criteri di accreditamento per assicurare la qualificazione e l'indipendenza degli esperti e degli organismi a cui affidare la certificazione energetica degli edifici, a norma dell'articolo 4, comma 1, lettera c), del decreto legislativo 19 agosto 2005, n. 192".

2011 Decreto Legislativo 3 marzo 2011, n. 28**,** Attuazione della direttiva 2009/28/CE sulla promozione dell'uso dell'energia da fonti rinnovabili, recante modifica e successiva abrogazione delle direttive 2001/77/CE e 2003/30/CE, Pubblicato sulla "Gazzetta Ufficiale " n. 81 del 28 marzo 2011 - supplemento ordinario.

2005 Decreto legislativo 19 agosto 2005, n. 192, attuazione la Direttiva 2002/91/CE sul rendimento energetico nell'edilizia integrato con il Decreto legislativo 29 dicembre 2006, n. 311, "Disposizioni correttive ed integrative al Decreto legislativo 19 agosto 2005, n. 192, recante attuazione della Direttiva 2002/91/CE, relativa al rendimento energetico in edilizia".

1991 LEGGE 9 gennaio 1991, n. 10 "Norme per l'attuazione del Piano energetico nazionale in materia di uso razionale dell'energia, di risparmio energetico e di sviluppo delle fonti rinnovabili di energia". (GU n.13 del 16-1-1991 - Suppl. Ordinario n. 6)

3.7. Netherlands

Responsible authority: Ministry of the Interior and Kingdom Relations (BZK) has delegated the responsibility for the EPC scheme to **The Netherlands Enterprise Agency (RVO).**

EPC website: **Energy label buildings**

EPC related laws and regulations:

- **Decree on energy performance of buildings** (Valid from 01-01-2021 to the present)
- **Regulations on the energy performance of buildings** (Valid from 01-01-2021 to 10-02-2021)
- **Regulations on the energy performance of buildings** (Valid from 01-06-2022 to the present)

The NTA 8800 is the Netherlands EPB assessment procedure as indicated in the building regulation **https://www.nen.nl/nta-8800-2022-nl-290717**

To assure the quality of the produced EP Certificates the INSTALLQ organisation, an quality scheme operator acknowledged by the Netherlands Council of Accreditation (**https://installq.nl/brl**) upholds the BRL 9500 schemes related to the EP Certification of buildings. The BRL 9500 describes the process certification for EPC's. The referred ISSO publications provide essential information how to survey buildings and retrieve building data as input for the EP assessment procedure and the BRL's describe how a 3rd party accredited Certification Institute has to asses the professional quality of the EP Certifying party. End qualifications has been determined to test the personal competence of the experts involved. EPC experts need to pass exams on a regular basis.

To assure the quality of the used software tools ISSO publication 54 'Energy diagnosis reference' has been developed and maintained. BRL 9501 'Methods for calculation of the energy performance of buildings' describes how a 3rd party accredited certifier can asses the quality of the accredited software that EP certifiers are allowed to use.

These publications (the NTA, the BRL's and ISSO publications) are regularly updated and the newest version are expected to become in force by mid-2023. The following link **https://installq.nl/brl** gives access to these publication, in Dutch.

3.8. Romania

Responsible authority: Ministry of Regional Development and Public Administration (MDLAP)

EPC website: The same as for the responsible authority.

EPC related laws and regulations:

- Mc001/2022-Metodologie de calcul al performantei energetice a cladirilor
- Normativ privind calculul termotehnic al elementelor de construcţie ale clădirilor. Indicativ: C107/2005, cu modificările si completările ulterioare
- Legea nr. 372/2005, republicată, privind performanţa energetică a clădirilor, cu modificările şi completările ulterioare
- OG nr. 13/2016 - modificarea şi completarea Legii nr. 372/2005 privind performanţa energetică a clădirilor
- Legea nr. 159/2013 pentru modificarea si completarea Legii nr. 372/2005 privind performanța energetică a clădirilor
- Legea nr. 10/1995 republicată, privind calitatea în construcţii, cu modificările şi completările ulterioare
- Legea nr. 163/2016 pentru modificarea şi completarea Legii nr. 10/1995 privind calitatea în construcţii
- Hotărârea Guvernului nr. 907/2016 privind etapele de elaborare şi conţinutul-cadru al documentaţiilor tehnico-economice aferente obiectivelor/proiectelor de investiţii finanţate din fonduri publice
- Ordonanţa de Urgență a Guvernului 18/2009 privind creşterea performanței energetice a blocurilor de locuinţe, republicată, cu modificări şi completările ulterioare;
- Ordinul nr. 163/540/23 din 17 martie 2009 pentru aprobarea Normelor metodologice de aplicare a Ordonanţei de urgenţă a Guvernului nr. 18/2009 privind creşterea performanţei energetice a blocurilor de locuinţe
- Hotararea Guvernului nr. 622/2004 privind stabilirea condițiilor de introducere pe piață a produselor pentru construcții , republicată , cu modificările și completările ulterioare
- Ghid Național pentru Analiza Cost–Beneficiu a Proiectelor Finanțate din Instrumentele Structurale elaborat de Ministerul Economiei și Finanțelor
- Legea nr. 158/11 iulie 2011 pentru aprobarea Ordonanței de Urgență a Guvernului nr. 18/2009 privind creșterea performanței energetice a blocurilor de locuințe
- Ordonanța de Urgentă nr. 63 pentru modificarea și completarea Ordonanței de Urgentă a Guvernului nr. 18/2009 privind creșterea performanței energetice a blocurilor de locuințe
- Hotărârea Guvernului nr. 1.034/2020 pentru aprobarea Strategiei naţionale de renovare pe termen lung pentru sprijinirea renovării parcului naţional de clădiri rezidenţiale şi nerezidenţiale, atât publice, cât şi private, şi transformarea sa treptată într-un parc imobiliar cu un nivel ridicat de eficienţă energetică şi decarbonat până în 2050, din 27.11.2020
- Hotărârea nr. 10/2023 privind modificarea şi completarea Strategiei naţionale de renovare pe termen lung pentru sprijinirea renovării parcului naţional de clădiri rezidenţiale şi nerezidenţiale, atât publice, cât şi private, şi transformarea sa treptată într-un parc imobiliar cu un nivel ridicat de eficienţă energetică şi decarbonat până în 2050, aprobată prin Hotărârea Guvernului nr. 1.034/2020
- Ordinul nr. 3568/2022 pentru aprobarea Metodologiei de intervenţie pentru abordarea noninvazivă a eficienţei energetice în clădiri cu valoare istorică şi arhitecturală
- Ordinul nr. 2818/2022 pentru aprobarea reglementării tehnice "Ghid privind implementarea măsurilor de creştere a performanţei energetice aplicabile clădirilor noi, în etapele de proiectare, execuţie şi recepţie, exploatare şi urmărire a comportării în timp pentru îndeplinirea cerinţelor nZEB, Indicativ RTC 4 - 2022"
- Ordinul nr. 2819/2022 pentru aprobarea reglementării tehnice "Ghid privind implementarea măsurilor de creştere a performanţei energetice aplicabile clădirilor existente, în etapele de proiectare, execuţie şi

recepţie, exploatare şi urmărire a comportării în timp pentru îndeplinirea cerinţelor nZEB, Indicativ RTC 3 - 2022"

- Ordinul ministrului dezvoltării, lucrărilor publice și administrației nr. 3.230/2022 privind aprobarea reglementării tehnice „Ghid pentru realizarea de lucrări de intervenții integrate la clădirile rezidențiale multifamiliale și la clădirile publice, indicativ RTC 1 — 2022”

Other important resources:

- I13 Normativ pentru proiectarea, executarea şi exploatarea instalaţiilor de încălzire central
- I5 Normativ pentru proiectarea, executarea și exploatarea instalațiilor de ventilare și climatizare
- I9 – Normativ pentru proiectarea și execuția instalațiilor sanitare
- I7 Normativul pentru proiectarea, execuţia şi exploatarea instalaţiilor electrice aferente clădirilor
- SC 007 "Soluții-cadru privind reabilitarea termo-higro-energetică a anvelopei clădirilor de locuit existente
- GP 123 Ghid privind proiectarea și executarea lucrărilor de reabilitare termică a blocurilor de locuințe
- GEx 009 Ghid privind inspecția sistemelor de climatizare din clădiri
- GEx 010 Ghid privind inspecția energetică a cazanelor și a sistemelor de încălzire din clădiri
- GEx 011 Ghid de bună practică pentru proiectarea instalațiilor de ventilare/climatizare în clădiri
- GEx 012 Ghid de bună practică pentru proiectarea instalaţiilor de iluminat/protecţie în clădiri
- Gex 013 Ghid privind utilizarea surselor regenerabile de energie la clădirile noi și existente
- NP 008 Normativ privind igiena compoziţiei aerului în spaţii cu diverse destinaţii, în funcţie de activităţile desfăşurate în regim de iarnă-vară
- MP 022 Metodologie pentru evaluarea performanţelor termotehnice ale materialelor şi produselor pentru construcţii
- MP013 Metodologie privind stabilirea ordinii de prioritate a măsurilor de reabilitare termică a clădirilor şi instalaţiilor aferente. Program cadru al programului naţional anual de reabilitare şi modernizare termică a clădirilor şi instalaţiilor aferente
- GT 036 Ghid pentru efectuarea expertizei termice şi energetice a clădirilor existente şi a instalaţiilor de încălzire şi preparare a apei calde de consum aferente acestora
- GT 032 Ghid privind proceduri de efectuare a măsurărilor necesare analizării termoenergetice a construcţiilor şi instalaţiilor aferente
- GT 040 Ghid de evaluare a gradului de izolare termică al elementelor de construcţie la clădiri existente în vederea renovării termice
- GT 041 Ghid privind reabilitarea finisajelor pereţilor şi pardoselilor clădirilor civile.
- GT 043 Ghid privind îmbunătăţirea calităţilor termoizolatoare ale ferestrelor la clădirile civile existente
- NP 121 Normativ privind reabilitarea hidroizolațiilor bituminoase ale acoperișurilor clădirilor
- GT 058 Ghid privind criteriile de performanță ale cerințelor de calitate conform legii nr. 10/1995 privind calitatea în construcții pentru Instalații de Ventilare-Climatizare
- GT 060 Ghid privind criteriile de performanță ale cerințelor de calitate conform legii nr. 10/1995 privind calitatea în construcții pentru instalațiile de încălzire centrală
- SC 007 Soluţii cadru pentru reabilitarea termo-hidro-energetică a anvelopei clădirilor de locuit existente, indicativ cu completările si modificările ulterioare
- NP 040 Normativ privind proiectarea, executarea şi exploatarea hidroizolaţiilor la clădiri,
- NP 068 Normativ privind proiectarea clădirilor civile din punct de vedere al cerinţei de siguranţa în exploatare, Indicativ
- P 118 Normativ de siguranţă la foc a construcţiilor
- Noua generaţie de standarde europene elaborate în aplicarea Directivei 2010/31/UE privind creşterea performanţei energetice a clădirilor, inclusiv a sistemelor tehnice ale acestora

- Legea nr. 50/1991 privind autorizarea executării lucrărilor de construcţii, republicată, cu modificările şi completările ulterioare
- Regulamentul privind clasificarea şi încadrarea produselor pentru construcţii pe baza performanţelor de comportare la foc aprobat cu ordinul MTCT-MAI nr. 1822/394/2004, cu modificările şi completările ulterioare
- SR EN 13499 - Produse termoizolante pentru clădiri. Sisteme compozite de izolare termică la exterior pe bază de polistiren expandat. Specificaţie
- SR EN 13500 - Produse termoizolante pentru clădiri. Sisteme compozite de izolare termică la exterior pe bază de vată minerală. Specificaţie
- SR EN 14351-1 - Ferestre şi uşi. Standard de produs, caracteristici de performanţă. Partea 1: Ferestre și uși exterioare pentru pietoni
- SR EN 13501-1 - Clasificare la foc a produselor şi elementelor de construcţie. Partea 1: Clasificare folosind rezultatele încercărilor de reacție la foc.
- Programul Operaţional Regional 2014-2020, Condiții Specifice de accesare a fondurilor în cadrul apelului de proiecte nr. POR/AP/2015/3/3.1/A - axa prioritara 3, prioritatea de investitii 3.1, operațiunea A – clădiri rezidențiale
- Programul Operaţional Regional 2014-2020 (și ulterior 2021-2027), Condiții Specifice de accesare a fondurilor în cadrul apelurilor de proiecte cu titlu POR/2016/3/3.1/B/1/7 regiuni și POR/2016/3/3.1/B/1/BI axa prioritară 3, prioritatea de investiții 3.1, operațiunea B – clădiri publice.

Presently, nobody (public or private organisations) talks about the EPBD II Recast in Romania. Romanian authorities still have many issues with the implementation of the EPBD I recast provisions. The topic (EPBD II Recast) will be addressed for the first time in Romania during the Romanian Conference on Energy Performance of Buildings on 8-9 of June 2023, co-organized by AIIR.

According to the new Romanian regulation in the field (code Mc001 recast version from 2022), the minimum energy performance requirements are two-folded:

A. for NZE building, according to the table here below.

Climatic zone	Starting with	Office buildings		Education buildings		Residential multifamily buildings		Individual residential buildings (houses)	
		Total primary energy [kWh/m^2,an]	Equiv CO_2 emissions [kg/m^2,an]	Total primary energy [kWh/m^2,an]	Equiv CO_2 emissions [kg/m^2,an]	Total primary energy [kWh/m^2,an]	Equiv CO_2 emissions [kg/m^2,an]	Total primary energy [kWh/m^2,an]	Equiv CO_2 emissions [kg/m^2,an]
I	2022	94.7	10.1	61.6	7.3	99.1	12.0	120.1	14.7
II	2022	98.4	10.9	66.8	8.1	103.7	12.8	127.9	16.0
III	2022	98.9	11.5	71.0	8.8	105.9	13.5	133.3	17.1
IV	2022	100.6	12.2	76.5	9.7	109.5	14.3	140.6	18.5
V	2022	102.6	13.0	82.0	10.6	113.1	15.1	147.9	19.9

Climatic zone	Starting with	Health buildings		HORECA buildings		Commercial buildings (shops …)		Sport buildings	
		Total primary energy [kWh/m^2,an]	Equiv CO_2 emissions [kg/m^2,an]	Total primary energy [kWh/m^2,an]	Equiv CO_2 emissions [kg/m^2,an]	Total primary energy [kWh/m^2,an]	Equiv CO_2 emissions [kg/m^2,an]	Total primary energy [kWh/m^2,an]	Equiv CO_2 emissions [kg/m^2,an]
I	2022	162.5	19.0	96.5	11.7	95.5	11.0	93.4	10.4
II	2022	168.8	20.2	101.0	12.5	102.9	12.2	98.2	11.3
III	2022	170.9	21.1	103.7	13.1	107.7	13.3	100.3	12.0
IV	2022	174.8	22.3	107.4	13.9	114.5	14.6	103.8	12.9
V	2022	179.3	23.5	111.6	14.7	121.4	16.0	107.5	13.7

B. for refurbished buildings, according to the table here below.

Climatic zone	Starting with	Office buildings		Education buildings		Residential multifamily buildings		Individual residential buildings (houses)	
		Total primary energy [kWh/m^2,an]	Equiv CO_2 emissions [kg/m^2,an]	Total primary energy [kWh/m^2,an]	Equiv CO_2 emissions [kg/m^2,an]	Total primary energy [kWh/m^2,an]	Equiv CO_2 emissions [kg/m^2,an]	Total primary energy [kWh/m^2,an]	Equiv CO_2 emissions [kg/m^2,an]
I	2022	113.5	15.4	72.5	10.9	116.4	17.9	143.2	22.1
II	2022	117.3	16.5	78.2	12.0	121.2	19.1	149.1	26.3
III	2022	116.9	17.2	82.7	13.1	123.1	19.9	156.8	25.5
IV	2022	117.7	18.2	88.6	14.4	126.4	21.1	164.1	27.5
V	2022	119.3	19.2	94.4	15.6	130.0	22.3	171.6	29.5

Climatic zone	Starting with	Health buildings		HORECA buildings		Commercial buildings (shops …)		Sport buildings	
		Total primary energy [kWh/m^2,an]	Equiv CO_2 emissions [kg/m^2,an]	Total primary energy [kWh/m^2,an]	Equiv CO_2 emissions [kg/m^2,an]	Total primary energy [kWh/m^2,an]	Equiv CO_2 emissions [kg/m^2,an]	Total primary energy [kWh/m^2,an]	Equiv CO_2 emissions [kg/m^2,an]
I	2022	191.9	28.4	113.0	17.4	113.1	16.5	111.2	15.7
II	2022	198.4	30.1	117.8	18.5	121.1	18.3	116.2	16.9
III	2022	199.6	31.3	120.4	19.4	125.8	19.7	117.9	17.9
IV	2022	202.9	32.9	124.3	20.6	132.7	21.6	121.3	19.1
V	2022	206.8	34.5	128.4	21.7	139.8	23.5	124.6	20.3

In the new Romanian EPC described by the new regulation Mc001 (recast version from the former Mc001 from 2006), the first annex to the EPC includes data about the total estimated value of the investment and the estimated simple payback period.

In Romania an EPC is issued: for new buildings, at the reception time of construction works, for refurbished buildings which requires a construction permit, at the reception time of construction works, for sales/purchases of buildings/building units (including apartments), for renting buildings/ building units (including apartments).

The calculation methodology is based only on calculated energy consumption (asset rating), using around 32 references form the CEN/ISO set of EPB standards.

The main gaps/issues within the Romanian EPC in terms of EPC assessment results are as follows:

- Total primary energy consumption is not close to the real (measured) consumption of the building/building unit.
- Very complex calculation methodology based on EPB standards; it can be used only with the help of a digital tool.
- Calculation based on monthly climatic data, no hourly data available for Romania (except 9 main cities).
- There are no security elements integrated in the EPC form (calculated values can be very approximative, not really calculated based on the official methodology); the authority in charge to check the EPCs doesn't have options to do it properly, they check only the EPC format and if the EPC author (the energy assessor) has sent the EPC to the national data base of the ministry in charge.
- The building owner doesn't react after the reception of the EPC in the sense of implementing some of the renovation measures indicated by the energy assessor.
- There is no official procedure regarding how to send the EPCs for the national data base, there is no study made with data from EPCs recorded in that database.

The new Romanian EPC can indicate on a voluntary basis the SRI value for the building assessed (see the annex 2 to the EPC). Additionally, if a building is not cooled, a comfort indicator (i.e. the number of hours in a year when the inside temperature exceeds the reference value of 26° C) must be computed. The Romanian EPC indicates as well in its annex 1 the approx. total value of the investment needed for the implementation of the renovating solutions, and the approx. simple return on investment.

3.9. Slovenia

Responsible authority: Ministry of the Environment, Climate and Energy

EPC website: The same as for the responsible authority.

EPC related laws and regulations:

- *Act on Energy Efficiency* from 21.10.2020 (official gazette **158/20**)
- *Rules on efficient use of energy in buildings* from 9.5.2022 (official gazette **70/22** and **161/22**)
- **Technical guide on energy efficiency in buildings** from 10.5.2022
- *Decree determining the maximum prices for issuing energy performance certificates from* 27.02.2014 (official gazette **15/14**)
- *Rules on the training, accreditation and register of accredited independent experts for energy performance certificate production* from 23.04.2018 (official gazette **30/18** and **158/20**)
- *Rules on the methodology for the production and issuance of energy performance certificates for buildings* from 13.01.2023 (official gazette **4/23**)
    - **Calculated EPC**
    - **Measured EPC**
- Training institution for EPC issuers based on public tender
    - Building and civil engineering institute: **https://energetskaizkaznica.si/usposabljanje/#izkaznica**
    - **Chamber of arhitects** and **lab for enironmental building technology: http://www.ee.fs.uni-lj.si/ZAPS-LOTZ/index.html**
    - **National software for calculation of energy performance of buildings** with regular trainings available.
- **Registry of issuers and licenses of independent experts**
- **Registry of issued EPCs**
    - Access to **GIS environment** that has also EPC

In May 2022 new rules for energy efficiency were issue, that will fully come in force in December 2022. There were some exceptions for KPIs calculations of simple buildings until January 2023. There were issues addressed from the chamber of architects and engineers, that there are no software tools, but in January 2023 new freely available software tool was presented and trainings for engineers are taking place. All the latest info can be found via the following link **https://www.energetika-portal.si/podrocja/energetika/energetske-izkaznice-stavb/**.

3.10. Spain

Responsible authority: **Ministry for the Ecological Transition and the Demographic Challenge and Competent Bodies of each of the Autonomous Communities and Autonomous Cities**

EPC website: **Energy efficiency**

Although there is a national regulation about EPCs in Spain, the scheme is decentralised. Each of the 19 autonomic divisions, which Spain is split into, has its procedures and websites for registering the results of the EPC. A brief document resuming all the related websites in a list, can be downloaded at the following **link**.

EPC related laws and regulations:

- **Royal Decree 178/2021, of March 23, which modifies Royal Decree 1027/2007, of July 20, which approves the Regulation of Thermal Installations in Buildings**
- **Royal Decree 450/2022, of June 14, which modifies the Technical Building Code, approved by Royal Decree 314/2006, of March 17**
- **Basic procedure to the EPC** (Entry into force: 06/03/2021)

- **Technical conditions for the EPC procedure**
- **Energy efficiency rating of buildings**
- Other mandatory official documents:
  - **EPC Model report**
  - **Energy efficiency rating label**
- There are several authorised software packages for EPCs in Spain. All of them can be consulted at the following **link**.

A brief explanation about the current situation about the EPC scheme can be founded at the following link **https://www.idae.es/tecnologias/eficiencia-energetica/edificacion/calificacion-energetica-de-edificios**

In July 2021, the Spanish government approved a new **Royal Decree 390/2021** regarding the EPC scheme in Spain. The detailed changes that this new regulation arose can be read in the following **document**.

The main changes are the following:

1. The EPC will affect new constructions and many renovations: when more than 10% of the surface area is extended, more than 25% of the envelope is affected, or the thermal installations are modified.
2. Regarding existing buildings, all public administration buildings over 250 m^2 and all private buildings over 500 m^2 that are not dwellings must be certified, regardless of whether they are sold or rented.
3. Validity of the new energy performance certificate: G-rated energy certificates (the lowest one) will only be valid for 5 years instead of 10.
4. It will be compulsory for the technician to visit the property during the completion of the energy certificate.
5. In the evaluation process, the production of electrical energy produced in situ by renewable sources is taken into account in the final balance of primary energy.
6. The total annual primary energy consumption per square meter of useful and reference floor area is incorporated as an indicator of energy performance. Previously, only total non-renewable primary energy was considered.

3.11. Sweden

Responsible authority: **Swedish National Board of Building, Housing and Planning (Boverket)**

EPC website: **Energy declaration**

EPC related laws and regulations:

- **Act (2006:985) on energy declaration for buildings on the Riksdag's website**
- **Ordinance (2006:1592) on energy declaration for buildings on the Riksdag's website**
- **The Housing Authority's regulations and general advice (2007:4) on energy declaration for buildings**
- **The Housing Authority's regulations and general advice (2007:5) for certification of energy experts**
- **The Housing Authority's regulations and general advice (BFS 2016:12) on determining the building's energy use during normal use and a normal year**

The latest information about the EPCs in Sweden can be transparently found in the well structured and continuously updated **EPC handbook by Boverket**.

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