D3.4 Report on the operationalization to the involved Member States

U-CERT
User-Centred Energy Performance Assessment and Certification

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1. 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].

[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/

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].

2. Introduction

This document is focused on providing recommendations to the national and regional EPBD implementing authorities in the Member States with regards to **improving the EPB Assessment methodology**. The U-CERT project has analysed more than 11 countries' EN ISO 52000-1 choices. In addition, the project has analysed Spain's and Italy's National Annexes in detail [3]. Furthermore, the project has produced a converged set of National Datasheets for the main EPB Standards [4], and a set of user-centred and effective overall and partial indicators [6]. Therefore, the project counts on a proposal for a harmonised EPB Assessment methodology. Next, a series of considerations aiming to the operationalisation of the EPB Standards to the Member States will be put forward. The remainder of the document is structured as follows. Section 3 briefly illustrates the current situation regarding EPB Standards' implementation. Section 4 poses the strategy towards national operationalisation to EU's Member States. Section 5 presents some policy recommendations. Lastly, Section 6 points to improvements regarding future work.

For a detailed approach on how to support the uptake of next-generation holistic indicators into EPB Assessments and Certification Schemes, as well as regarding a harmonised approach into EPCs, refer to [11].

3. EPB Standards' implementation

The EPB standards are guides covering all required parts of the assessment procedure. Its modular structure enables and facilitates a step-by-step implementation in any national or regional context. Each EPB standard allows for specific choices to be made at national or regional level, specified in a normative template (i.e., Annex A). The main step towards a coherent EPB Assessment methodology is to fill the template for each EPB standard.

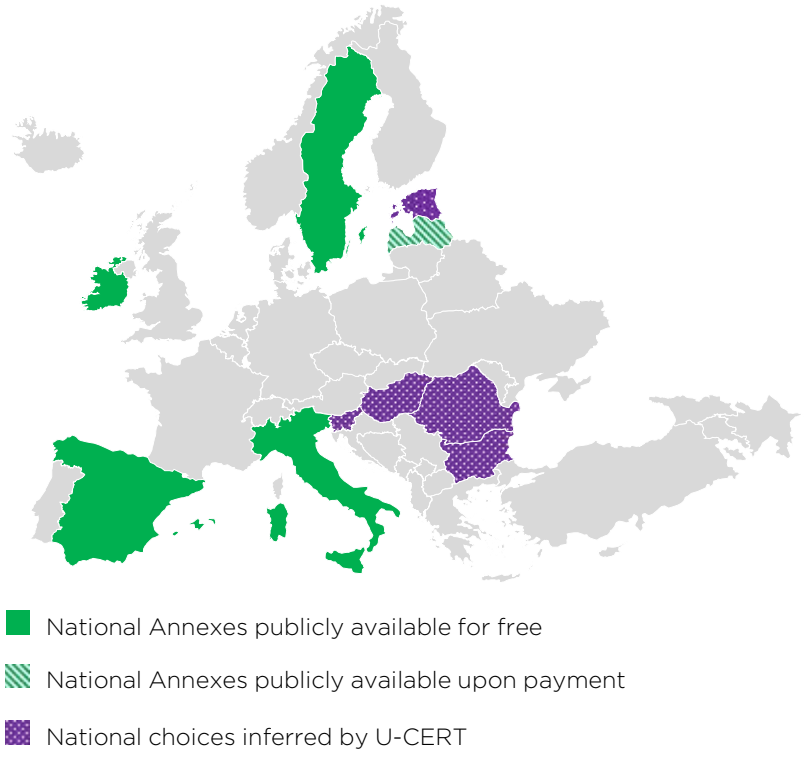

Figure 1. EPB Standards' implementation. Europe

As previously introduced, the publication of the overarching standard's National Annexes is limited and uneven across Europe. As indicated in Figure 1, only 6 Member States have produced the National Annexes on EN ISO 52000-1, 52003-1, 52010-1, 52016-1, and 52018-1 standards. Among those who have produced them, only 5 of them have published the documentation.

U-CERT has contributed to a transparent description of national EPB Assessment methodologies by inferring the choices on EN ISO 52000-1 in a comparable manner via an expert questionnaire.

During the project implementation, it has been found that most Member States have failed and are failing to produce their National Annexes. U-CERT identifies the lack of support and technical guidance in EPB Standard implementation as one of the main obstacles preventing Member States from producing the mandated National Annexes. National and regional EPBD implementing bodies may benefit from expert advice capable of analysing the existing procedures and translating disaggregated assessment methodologies into the structured EPB Standards' templates. The project has explored the bottom-up strategy of turning to EPB experts, both local and at European level, to infer the national choices at Member State level. During the project implementation, 11 Member States have been involved and only EN ISO 52000-1 has been covered. Such bottom-up approach may be useful when approaching other Member States and/or other EPB Standards.

4. National operationalisation

U-CERT analysed the ten main EPB Standards and proposes a coherent set of Annex A choices[4], resulting in the first attempt to produce a common-EU EPB Assessment calculation methodology. Moreover, the project has put forward a list of overall and partial energy performance indicators, together with IEQ parameters and the SRI [6]. This is a significant contribution to the European harmonisation.

Through the analysis of the national regulatory specificities [12], and public authorities' perspective [9] it's been found that EPBD implementing bodies are often reluctant to introduce modification in EPB Assessment methodologies. Markedly, the biggest challenge identified is to persuade policy implementors and experts working in the construction field to agree and adopt new approaches which could reboot usefulness and relevance of EPB Assessments and Certification Schemes.

To support national implementation of EPB Standards, the project ideated an incremental procedure to illustrate the impact certain choices would have in the national EPB Assessment calculation methodology. This approach aimed at giving concrete evidence to EPBD implementing bodies with a view to increase confidence when approaching a methodological modification. This approach may be regarded as the steppingstone in developing a technical service by which various stakeholders could estimate the impact a given methodological change may have on the overall results.

The procedure proposed by U-CERT is dependent on the quality of the available information defining the baseline national calculation methodology. Therefore, two extreme situations are identified vis-à-vis the availability of the National Annexes, when they are accessible and when they are not. Both approaches have been validated during the project implementation [13].

a. When National Annexes are not available

The absence of the National Annexes in a certain context impedes having access to the most complete, accurate, and trustworthy description of the EPB Assessment methodology. Therefore, the procedure is applied to a particular choice or a limited concatenation of choices, rather than on the complete framework.

The impact of the choices is assessed via several supporting spreadsheets prepared by EPB experts and available at EPB Center's website[5]. The logic behind these spreadsheets is to perform hourly calculation for a given default building under certain weather conditions. Each spreadsheet allows to modify some calculation parameters, obtaining certain output indicators. By preparing diverse use cases, the impact of a given action (i.e., methodological choice) can be assessed on a comparative basis.

This approach has the advantage of being generalisable, cost-effective, and very fast for a certain national choice (e.g., weighting factors, k_{exp} factor, etc.). Nevertheless, it is limited to the available spreadsheets on the choices, so interdependencies with other choices can't be assessed. Moreover, a global view on the EPB Assessment methodology can't be obtained, as each choice is treated individually.

During the project implementation, the following EN ISO 52000-1 choices were assessed, with the A. number referring to the corresponding table in Annex A:

- A.16 – Weighting factors (based on gross or net calorific value);
  (for non-renewable, renewable and total primary energy and for CO2)
- A.17 – k_{exp} factor;
  (factor that is used to control which part of the exported energy is included in the energy performance of the building)
- A.24 – Perimeter choice;
  (on-site only, or also nearby and distant)
- A.27 – Basis for the energy performance of buildings.
  (Total or non-renewable primary energy; for which purpose)

The countries of Estonia, Hungary, Spain, Slovenia, Romania, Italy, Bulgaria, and Ireland were analysed.

b. When National Annexes are available

When National Annexes are available, the limitations of the approach outlined in the previous section can be overcome.

The impact of a given choice or choices is assessed via dynamic simulation software, which can be tailored to reflect many EPB Assessment arrangements. During the implementation of U-CERT, the software developed by Cype Ingenieros S.A. was used. Thus, any building (e.g., geometry, construction, technical building systems, etc.) can be simulated under any weather condition and user-behaviour. The weather file used can be regarded as a variable to be modified according to EN ISO 52010-1.

This approach has the advantage of being very precise and comprehensive. Notwithstanding, its assessment takes time and requires high familiarity with dynamic simulation tools.

During the project implementation, the following choices were assessed:

- EN ISO 52010-1 – Weather data file.
  - U-CERT's choice (i.e., TMY generator), versus the official national weather file.
- EN 16798-1 – A.5 and A.8 – Occupation parameters and thermostatic setpoints.
  - U-CERT's choice (i.e., corresponding annex B), versus the official national settings. An additional tailored schedule for residential and office buildings was included in the comparison.
- EN ISO 52000-1 – A.16 - Weighting factors (based on gross or net calorific value).
  - U-CERT's choice (i.e., corresponding annex B), versus the official national settings. An additional tailored hourly grid electricity weighting factor was included in the comparison.

[5] More information at: https://epb.center/support/documents/

- EN ISO 52000-1 – A.17 – k_{exp} factor.
  - U-CERT's choice (i.e., k_{exp}=1), versus the official national settings. Incremental 0,25 k_{exp} factor were included in the comparison to cover the range between 0 and 1.
- EN ISO 52000-1 – A.32 – Matching factor.
  - U-CERT's choice (i.e., hourly), versus the official national settings (i.e., monthly). The option of daily was also included in the comparison.

Parametric combinations of the choices were also assessed.

For the official national settings, the countries of Spain and Italy were analysed.

5. Policy recommendations

U-CERT has aimed at **facilitating convergence of quality and reliability of national procedures**, leveraging the set of EPB Standards. At the beginning of the project, the Renovation Wave strategy was published, stressing the relevance of EPB Assessments and Certification Schemes as valuable tools to promote deep renovation. The end of the project implementation has coincided with the process for the EPBD recast, which is strongly focused in enhancing the quality of the procedures for assessing the buildings' energy performance. U-CERT's value proposition in terms of EPB Assessment methodology ought to serve Member States to a successful EPBD implementation.

In relation to the framework for the calculation of energy performance of buildings, the revised EPBD proposal explicitly opens the door to the use of metered energy, to issue measured EPB Assessments, and to verify correctness of calculated EPB Assessments. U-CERT considers EN 15378-3 as the base standard to build a comprehensive methodology for measured EPB Assessments and Certification Schemes in buildings. Leveraging U-CERT's CSA role, the project identifies CEN-CE's work on EN 15378-3 supporting spreadsheet as a very relevant tool to increase building professionals' capacity with respect to measured EPB Assessments. U-CERT acknowledges the performance gap between calculated and measured EPB Assessments and provides a protocol to reduce it [14].

With regards to the calculation intervals, the EPBD recast opts for hourly or sub-hourly time calculation intervals. U-CERT's recommendation is completely aligned, rejecting the use of monthly time calculation intervals for EPB Assessments, especially since Indoor Environment Quality (incl. thermal comfort) and proper balancing demand and supply (including produced and used electricity) receives increasing attention. As for the calculation methodology, U-CERT's methodology considers every aspect outlined in the revised EPBD Annex I and is expressed according to choices on EPB Standards' Annex A structure [4]. In relation to energy performance requirements for technical building systems, the revised EPBD indicates they should apply to whole systems, rather than standalone components. U-CERT's EPC includes the rated general system efficiency as part of the partial EP indicators considered in U-CERT's EPC.

To conclude, it becomes clear that U-CERT's value propositions are aligned with the diagnostics of what is needed in relation to short-term evolution of EPB Assessments and Certification Schemes. As Member States are mandated to adapt their procedures, they may benefit from U-CERT's results to address their national procedures comprehensively. Furthermore, following U-CERT's guidelines, EU harmonisation and convergence will be increased. Although different from the initial approach, the proposal of revised EPBD provides great flexibility to Member States in relation to updating and improving the quality of national EPB Assessments and Certification Schemes. However, it reinforces the mandate to Member States to describe their national calculation methodology according to Annex A's EPB Standards. U-CERT has proposed an approach to ensure national and regional EPBD implementing bodies receive the support they need not only in drafting their National Annexes, but in fully reaping the benefits from its operationalisation.

6. Future work. EU-wide software kernel

To facilitate the common-EU EPB Assessment calculation methodology, U-CERT supports the promotion and development of a European open-source software kernel meeting the requirements of article 4 and Annex I of the EPBD. Furthermore, widely available dynamic energy simulation software tools that match the EPB standards will strongly promote the harmonised application of the set of EPB standards and the harmonisation of national building performance calculation methodologies. Hourly and dynamic simulation tools represent an important development step in energy calculations and are also suitable for flexibility, grid load and demand response analyses.

The link with product standards, as reliable and affordable input data for calculations for energy performance certificates is crucial for the European industry spending a lot of effort on product testing (e.g., ESPR). One of the major advantages of the European standards is linking the results of European product testing to the building level evaluation.

An open-source kernel could be downloaded for free by everybody with a basic interface just to be able to input and export data. Therefore, for software houses the development of a kernel would not negatively impact their commercial activities, while a positive impact on professionals is expected (e.g., higher quality, more affordable software tools).

A common open-source EU funded kernel would be a **real game changer**, as illustrated in the following instances:

- **Policy implementation support:** Some Member States declared a request for a common open-source kernel based on the CEN/ISO set of EPB standards. They expressed their willingness to adopt EPB standards-based calculation methodologies after the appropriate software tool is available. It is also expected that other countries would be encouraged in adopting the common EU calculation methodology once the related software tool is provided from a trusted source.

  Without an EU-funded kernel there will be a contrasting difference between "big" and "small" Member States. "Small" will have a less performing software, and therefore will have a less performing energy transition. If the Member States have access to an EU funded kernel, this will stimulate legislative improvements.

- **EU harmonisation and transparency**. The calculation method is the "meter" (i.e., common scale) of energy performance of buildings. Today the Member States' ambition in energy transition cannot be assessed equally because the assessment methods are different, leading to different results. Monitoring and comparison of maximum threshold values (that are proposed in the EPBD Recast, version October 21, 2022) cannot be set.
- Creating an **EU database** for the energy performance of buildings, the transfer of information from national database to the Building Stock Observatory, would also be difficult and mixing inconsistent and incomparable data without a kernel. The availability of a common kernel would solve this issue.
- **Professional know-how (Build Up Skills**). Today not all building professionals have equal access to high quality assessment tools. For example, with a monthly timestep it's not possible to consider and to be correctly trained on the new challenges as Zero Emission Buildings, optimal use of on-site renewables, the interaction with the grid, reducing peak loads, etc. All these topics are addressed in the CEN/ISO set of EPB standards' method but not in all Member States' national calculation methods and tools.

- **A level-playing field for the industry - reducing the EU market fragmentation**: Because of the difference in the quality of national software tools and methods, there is no fair competition between the different technical solutions. On-site cogeneration or hybrid heat pumps are not at all, or not correctly, considered in national tools. **There is no technological neutrality**.

- **Digitalisation:** Digitalisation is **THE challenge** for building professional, for example to make EPC's more reliable, to facilitate the work of energy performance assessors. If modern

assessment tools (as scanning the geometry of building, the link to databases, etc.) must develop a specific interface for each national or regional software tool it will cost additional money and it is feasible only for big markets.

- **Continuous development to readily follow new transition requirements:** An EU level centralized maintenance and development centre, where all expertise of an EU-wide community can merge in a transparent way, can follow or, even, anticipate, future EU Commission requirements along the path toward full decarbonization. That means that the performance calculation kernel can be quickly updated and/or extended and distributed among the Member States giving a **real possibility to shorter Directives' actual implementation time**. Note, a kernel update, if no extensions are made, does not require any changes in the user frontend.
- **Macro-economic efficiency**: a single development of a EPB software kernel, free for anyone to use, anywhere around the world, is much cheaper than countless national, parallel developments, mostly duplicating time and again the same work, without reaching the same high quality.
- **Europe's position**: European EPB software is vital for the competition against other regions (USA, China) to avoid that Europe slips down to a marginal intellectual and industry position at global level.

Lastly, it will also **reduce the gap between standards/regulations and the academic world**, because at this moment the latter use tools that are (often freely) available on the market instead of using and evaluating the EPB tools.

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