The needs of building professionals to make the EU's green and digital energy transition transparent, technology-neutral and effective by developing an EU calculation engine (software "kernel")

1. Context

The **European Commission** financed by two mandates to **CEN** (M343, M480) the development of a series of CEN/ISO standards for calculating the energy performance of buildings (Art. 4, EPBD Recast), the so-called set of EPB standards. These standards have been published in 2017, then implemented by national standardisation bodies and now undergoing the systematic review process occurring every 5 years.

Some **Member States** developed their own national calculation methods and related calculation tools, because they had already national methods (e.g. France, Germany, Italy, Spain). Other Member States took over partly or totally the first version of the CEN/ISO EPB standards and developed also the related tools (e.g. Croatia, Romania) or they just took over the standards and refer to them in legislation but they did not develop tools (e.g. Slovakia).

Most of the EU member states have not yet adopted the 2017 series of EPB standards for legal purposes, remaining to use the old calculation methods for which the software tools had been developed. However, these old methods are too inaccurate to reliably assess energy performance of buildings with low energy needs and to allow for reliable optimisation of technical solutions increasing energy efficiency and the use of renewables in the building sector.

Because of the **5 years** review of the standards and the EPBD Recast (still ongoing) with **increasing requirements on the performance of the buildings** (NZEB, ZEB, climate neutrality), it is essential that the calculation **methods** and related software **tools** are upgraded (e.g. from a **monthly** calculation step to an **hourly** calculation step) **in nearly all Member States**.

For "big" Member States (e.g. Germany, France, Italy, Spain) this might be done by the government and/ or commercial software companies because there is a market that can provide adequate financial resources. But "small" countries with a small market do not have the same financial power. For example, this is the reason why Croatia still uses modified versions of the old standards (combined simple hour and monthly methods) taking into account all new technologies in a simplified manner.

The lack of a high-quality software, able to assess correctly high-performance buildings, will be a barrier for an equally efficient energy transition in all of EU's Member States.

2. Building professional needs

Building professionals **are confronted today to more than 30 different national or regional calculation methods of different quality** leading to different results for the same building. The professionals cannot work cross-border because they need to be certified according to national or regional methods of sometimes lower quality.

There is **no technical reason why the national calculation methods should be different**. Until now we do not have 1 example of a building in all Europe that cannot be calculated with the CEN/ISO set of EPB standards. On the contrary, many of the national methods cannot calculate nowadays technologies correctly (e.g., on-site renewables, CHP systems, building automation and control), nor evaluate the impact on the indoor environment quality (e.g. thermal comfort, indoor air quality).

Building professionals need a common, high-quality software tool because professionals use software tools in daily practice.
National differences according to the EU's principle of subsidiarity should be related to the requirement level while not to the technical calculation methods.

3. Benefits of an open-source software kernel

The open-source software kernel is the solution opted for in France (funded by the French Government) for the implementation of the French regulation and in the USA (EnergyPlus https://energyplus.net/), funded by the American Government and used also in EU.

However, it should be underlined that Energy Plus does not follow the principles of the European standards, definitions and terminology. An American software also favours American Standards.

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.

The open-source kernel will be downloaded for free by everybody with a basic interface just to be able to input and export data. In France commercial software companies, using as basis the kernel, developed all the needed user-friendly interfaces for practical use in day-to-day activities and furthermore provide training and support services. Therefore, for software houses the development of a kernel didn't negatively impact their commercial activities, while there was a positive impact on professionals (higher quality, more affordable software tools).

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

- **Policy implementation support:** Some Member States (MS) declared a request for a common open-source kernel based on the CEN/ISO set of EPB standards for the reasons mentioned before (complexity of the calculation methodology, lack of funding and expertise, size of national market). They expressed their willingness (e.g. Croatia) to adopt EPB standards based calculation methodologies after the appropriate software tool is available. It is also expected that the 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" MSs. "Small" MSs will have a less performing software, and therefore will have a less performing energy transition. If the MSs have access to an EU funded kernel, this will stimulate legislative improvements.

- **EU harmonisation and transparency**. The calculation method is the "meter" (common scale) of energy performance of buildings. Today the MSs 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 (see aforementioned reasons). For example, with a monthly timestep it's not possible to take into account and to be correctly trained on the new challenges as ZEB 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 MSs 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, taken into account 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.

  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.

4. Potential developments and roll-out of an open-source kernel

Three phases could be distinguished in the potential development and roll-out:

a) The **development of the open-source kernel** itself (modular implementation of the CEN/ISO set of EPB standards, adaptation to the final version of EPBD Recast), together with its **development procedure** (what rules to accept, test) how to **participate to the developer's community**.
   This work needs to be done **within one project**, associating different competences and stakeholders. The administrative form for funding could be a **service contract or a project under the LIFE CET programme**, whichever is most adequate and timely!
   Time is a very important aspect in order not to miss an exceptional situation when the Member States need to implement the EPBD Recast.

b) The **initial market uptake and rollout**, including the creation of a dedicated website and guidebook, the training and support of third-party software developers to enable and facilitate them to develop user-friendly interfaces and national adaptations, the communication and

dissemination towards high educational establishments, professional organisations, industrials, national authorities.
This type of work is in general **a coordination and support action (CSA)** close to actions proposed in the LIFE CET (Clean Energy Transition) programme.

c) The **maintenance** (maintain quality and delivery over the application lifecycle, helpdesk), and **further development** of the open-source software kernel (integration of EPB computations with SRI and LEVELS computations).
This work could be done in a **self-funded business case**, financed by commercial software companies to assist them in incorporation the kernel into their software packages. A fee could also be linked to the certification of the software.

This type of roll-out has been experienced in the CEN-CE project, in which the EPB Center is acting as the CEN-CE Central Scheme Operator at EU level.

It's most important to underline that the first phase (a) should be engaged **ASAP**, to give **a positive signal to the MSs** before they start national transposition and implementation of the EPBD Recast.

The second phase (b) could be engaged later, still it could start already in parallel with phase (a).