Contribution to Commission Future[1] Delegated Act on Whole Life-Cycle Global Warming Potential Reporting for Buildings[2]

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The Commission is currently working on a delegated act providing guidance on Articles 7(2), 7(3), 7(5), and Annex III of the recast EPBD. It aims to the clarification and implementation of the EPBD provisions relating to building whole life cycle Global Warming Potential (LC-GWP). Even if the delegated act has the same force of the Directive, it cannot overcome the basic principles stated there. Thus, the Member States will still have flexibility to interpret and specify the EPBD provisions within the legal frame of recast EPBD.

This document is a contribution to the Commission's work in progress, the preparation work of which is carried out through a supporting contract with a consultants' consortium (Viegand Maagøe, COWI and Exergia), referred herewith as study team. Up to now there is no official document available, but only the consultation documents and deliverables relevant to the stakeholders' involvement through two webinars. This document contains a summary analysis of the study team's current interpretation of these Articles and the foreseen potential issues, complemented by our opinion and suggestion.

Keywords: EPBD, GWP, LC-GWP, EPD, CPR, LCA, Delegated Act

Political framework

The EPBD requires in Article 7(2) that "Member States shall ensure that the life cycle GWP is calculated in accordance with Annex Ill and disclosed in the energy performance certificate of the building: (a) from 1 January 2028, for all new buildings with a useful floor area larger than 1 000 m²; (b) from 1 January 2030, for all new buildings.". While in Article 7(3) it requires the Commission "to adopt delegated acts in accordance with Article 32 to amend Annex Ill to set out a Union framework for the national calculation of life cycle GWP with a view to achieving climate neutrality. The first such delegated act shall be adopted by 31 December 2025." Such delegated acts shall be conformed to objectives, content, scope and duration of the delegation of power (Article 32). Furthermore, EPBD requires in Article 7(2) that "by 1 January 2027 Member States shall publish and notify to the Commission a roadmap detailing the introduction of limit values on the total cumulative life-cycle GWP of all new buildings and set targets for new buildings from 2030, considering a progressive downward trend, as well as maximum limit values, detailed for different climatic zones and building typologies. Those maximum limit values shall be in line with the Union's objective of

achieving climate neutrality. The Commission shall issue guidance, share evidence on existing national policies, and offer technical support to Member States, at their request".

The Commission is required to provide two different sets of guidance documents:

- Delegated acts that set out a common Union framework for the national calculation of life cycle GWP.
- A guidance document to support the development of national roadmap to the progressive introduction of compulsory requirements on LC-GWP limits to be verified by new buildings.

Herewith, only the first will be discussed, which shall be provided for December 2025 (see LC-GWP timeline reported in **Figure 1**).

Delegated acts on LC-GWP

The aim of the delegated acts (DA) on LC-GWP, as required by Article 7(3), is to provide an EU harmonized approach, by setting out a framework aiming at a transparent and consistent LC-GWP calculation methodology. The aim is not to provide a step-by-step methodology, but to clearly define a **minimum harmonised** framework, clarifying the **legal terms** related to Article 7(2) and Annex III, and the **technical terms** related to Article 7(2) and Annex III.

A further aim is to support Member States in the national application of LC-GWP provisions, highlighting possible flexibility with methodological choices related to Article 7(2) and Annex Ill.

Annex III of the EPBD recast is requiring for the calculation of the life cycle GWP of new buildings that:

- The total life cycle GWP is for each life-cycle stage expressed as $kgCO_2eq/(m^2)$ (of useful floor area) calculated over a reference study period of 50 years.
- Data selection, scenario definition, and calculations shall be carried out in accordance with EN 15978 (EN 15978:2011) [3], which is currently under revision).
- The scope of building elements and technical equipment is as defined in the Level(s) common EU framework for indicator 1.2.
- Data regarding specific construction products calculated in accordance with Regulation (EU) No 305/2011 (CPR) shall be used when available.
- Where a national calculation tool or method exists, that tool or method may be used to provide the required disclosure.
- Other calculation tools or methods may be used if they fulfil the minimum criteria established by the Level(s) common EU framework.

The DA has the goal to clarify and improve what is described in Annex III ("to amend Annex Ill") more than setting up new requirements. For these reasons, the study team has foreseen a list of possible issues to be considered in the DA development by the Commission, which are grouped into legal clarifications, minimum harmonized framework, methodology clarifications, and other clarifications.

In the following, these potential issues are listed, and an answer is given based on a deep analysis of the EPBD text and the results of a stakeholder meeting [1].

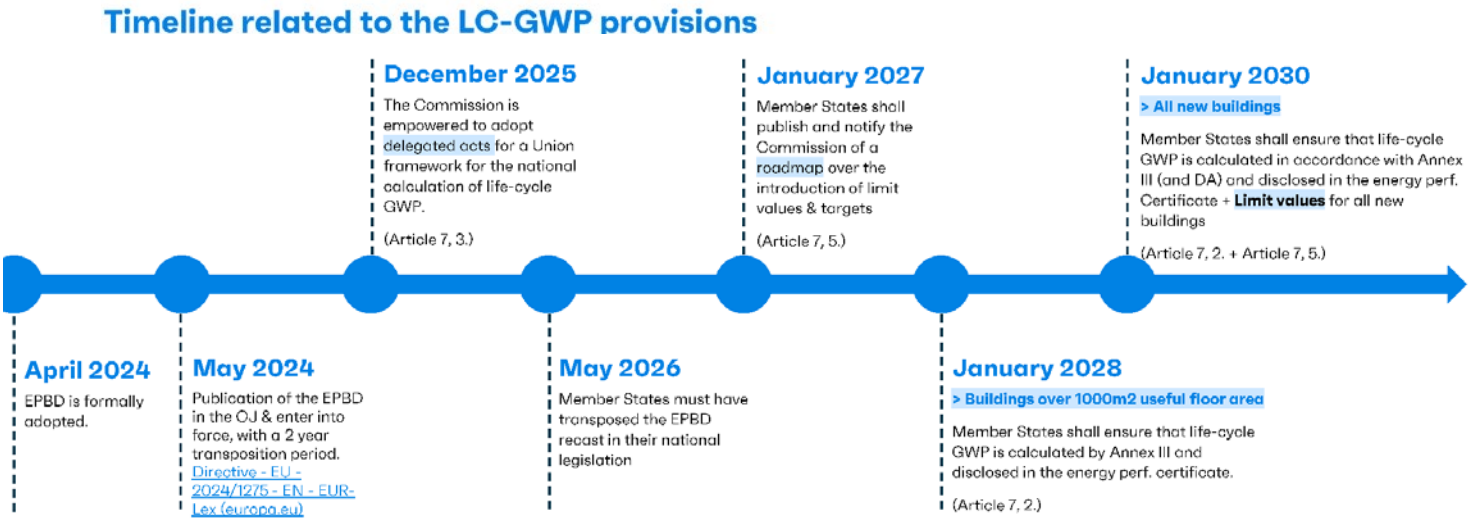

Figure 1. LC-GWP provisions timeline. [1]

Legal clarifications

The potential issues related to the legal interpretation of items reported in EPBD Annex III are:

- What is the scope, according to EN 15978 definitions (i.e., which buildings):
  - **Clear answer from EPBD analysis**: according to Art. 7(2) from 1 January 2028 all new buildings with a useful floor area larger than 1 000 m²; from 1 January 2030 all new buildings, with the exceptions that are allowed by Art. 20(6) (buildings for religious activities, temporary and non-residential agricultural buildings, stand-alone buildings with a total useful floor area of less than 50 m²) and by Art-4(d) of the EPBD 2010/31/EU (buildings used for few months a year), if implemented by Member States in their transpositions before 28 May 2024.

- What to do if the expected lifetime of the building is less than the reference study period of 50 years:
  - **Answer to be addressed by DA**: according to ISO 15686-1 (under revision) scenarios for refurbishment, or demolition and construction of an equivalent new building shall be developed in this case; thus, some clear indication shall be provided by the DA to avoid a completely free approach.

- EN 15978:2011 is reported in the EPBD, which is going to be replaced by a new updated version at the end of 2025:
  - **Answer to be addressed by DA**: the reference to the technical standard shall be updated and, if some delay is foreseen, the DA shall highlight some elements, like the description of modules and the building model, which are going to change from the old to the new version

- While other calculation tools or methods than EN 15978 (and related standards) may be used if they fulfil the minimum criteria established by the Level(s) common EU framework, existing or required-by-law National methodologies, and tools seem to be free of any constraint:
  - **Answer to be addressed by DA:** to avoid considerable differences among Member States, the DA shall put clear minimum requirements on national tools and methods.

- What kind of data can be used:
  - **Answer to be addressed by DA:** while there is a clear indication that, when available, data regarding specific construction products calculated in accordance with Regulation (EU) No 2024/3110 (new Construction Product Regulation, CPR, repealing Regulation (EU) No 305/2011 recalled by EPBD) or with product regulation derived from Directive 2009/125/EC, Regulation (EU) 2024/1781 and/or from Regulation (EU) /2017/1369 shall be used, there is no clear indication on what to do if that kind of data are not available. A reasonable answer could be to use self-declared EPDs (Environmental Product Declarations) according to EN 15804 until specific CPRs are available (see Box on CEN Standards, CPR, EDP, PCR, and c-PCR). If EPDs for a specific country are not available, EPD data from other countries may be used but with adaptation to the importing country conditions (mainly for transportation and end-of-life modules). Finally, if no EPDs are available in any form, conservative default values should be provided on national basis. That makes it evident that Member States must have the freedom to define generic and default data to be used when more specific data or calculations are unavailable.

Minimum harmonised framework

The minimum harmonised framework is the main object of the DA, because the reference assessment framework recalled by EN 15978, which deals only with the Environmental Sustainability of a building, defined by the EN 15643, is very general and applies to all kinds of construction works.

EPBD Art. 2(24) specifies only that the GWP must be assessed along the full life cycle of the building, while Art. 2(24) specifies that it must include "production and transport of construction products, construction-site activities, the use of energy in the building and replacement of construction products, as well as demolition, transport, and management of waste materials and their reuse, recycling and final disposal."

In **Figure 2** the representation of all life cycle stages and modules is reported with the specification of the scope of each of them. This representation, taken from EN 15643, is a bit different than what is included in the EN 15978:2011, but will be the same of what will be included in the new prEN 15978-1 to be published at the end of the year.

According to the definition of EPBD Art. 2(24), **Figure 3** illustrate a synthetic representation of a proposed minimum requirement of modules, to be defined in the Delegate Act. The proposed mandatory minimum harmonized framework is represented by the coloured modules. ▶

CEN Standards, CPR, EDP, PCR, and c-PCR

The CEN standard EN 15643 "Sustainability of construction works - Framework for assessment of buildings and civil engineering works" is a general framework, which regards sustainability as a whole. Under this general umbrella, three specific CEN standards exist that deal with environmental sustainability, EN 15978, social sustainability, EN 16309, and economic sustainability, EN 16627. All these standards are currently under review and will be replaced by prEN 15978-1, prEN 15978-2 and prEN 15978-3. The latest two sustainabilities are not taken into consideration by EPBD as well as only one environmental sustainability indicator is considered, the Global Warming Potential. EN 15978, dealing with environmental sustainability needs specification rules to be applicable to a complex system as building. Some of them are specified through the reference to the Level(s) common EU framework, while data regarding specific construction products must be conform to the new Construction Product Regulation (Regulation (EU) No 2024/3110). This CPR specifies that all product environmental impact indicators, which are mandatorily reported in the Environmental Product Declaration (EPD), must be assessed using harmonised CEN product standards made mandatory by means of EU implementing acts. If these standards are not already available, the Commission may adopt implementing acts laying down essential characteristics, assessment methods and technical details for one or more product families or for one or more product categories within a family. These harmonised product standards or the implementing acts are labelled Product Category Rules (PCR). The CEN standard EN 15804 provides core product category rules (PCR) for Type III environmental declarations (LCA based analysis) for any construction product and construction service. If the PCR is still too general complementary PCR (c-PCR) may be developed for a more specific category of construction products. If mandatory PCR and/or c-PCR are not available, the required environmental impact indicators can be assessed or using PCR/c-PCR developed by third-party bodies or self-applying EN 15804 specifying the custom-made assumptions.

BUILDING ASSESSMENT INFORMATION																					
BUILDING LIFE CYCLE INFORMATION																				**INFORMATION BEYOND THE BUILDING LIFE CYCLE**	
A - Construction Stage						**B - Use Stage**								**C - End-of-life Stage**				**D - Net Benefits beyond the system boundary**	
Pre-constructior, Stage	**Product(ion) Stage**			**Construction Process Stage**		**Related to the building fabric**					**Related to the buildings operation**										
A0	**A1**	**A2**	**A3**	**A4**	**A5**	**B1**	**B2**	**B3**	**B4**	**B5**	**B6**	**B7**	**B8**	**C1**	**C2**	**C3**	**C4**	**D**	
Non-physical processes before construction, tests, acquisition of land/site and design	**Raw material supply**	**Transport**	**Manifacturing**	**Transport**	**Construction, Site development, Deconstruction of Pre-existing Buildings, Installation Process**	**Use, installed products**	**Maintainance**	Repair	Replacement	Refurbishment	Operational energy use	Operational water use	Users'Activities	**Deconstruction**	**Transport**	**Waste processing for Reuse, Recycling and Energy Recovery**	**Disposal**	**D1 Net Flows from Reuse-Recycling - Energy Recovery - Other Recovery**	**D2 - Exported Utilities**

Figure 2. Overview of the life cycle stages in EN 15643.

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Figure 3. Overview of the proposed minimum requirement of modules.

- The main goal of the DA should be to avoid burden for manufacturers to create additional data, adopting the same life cycle stages for the building GWP as that required at the product level by the new CPR.

  Each module (A1, A2, …) can be subdivided into sub-modules to better specify the scope. For instance, the current status of prEN 15978 introduces the sub-division reported in **Figure 4**.

  As for the modules, a proposed minimum requirement of sub-modules can be given, excluding, for instance, sub-modules A5.1 and / or B1.1 from the mandatory set being, on average, very marginal on the whole assessing procedure.

  Module B6 requires further attention because it is true that energy use is assessed by the Energy Performance Certificate (EPC), thus it is already available, but for its transposition in operational carbon spitting among the different energy carriers and eventually services are needed as required by prEN 15978. The EPBD provided template for the EPC does not include such spitting of the minimum requirement among the different energy carriers and/or services. Thus, if the prEN 15978 approach is followed DA should require or to include such information in the EPC (very difficult) or to impose that who is performing the energy assessment is the same subject that is performing the environmental assessment (in such case it has access to all detailed information on the energy calculation) or to simplify the prEN approach allowing to avoid this splitting among energy carriers and using directly the total operational carbon mandatory displayed in the new EPC. Also, another question arises about the energy service systems installed in the buildings when they export energy carriers: both operational and embedded emissions must be fully or only partially allocated to the building? If partially, what must be the share? Different approaches can be used, even if the more rational would be the physical based one, which allocates to the building the share of generated energy carriers used for self-consumption and then uses the same share for the embedded carbon. This point should be addressed by the DA to avoid that each Member State is going to choose completely different approaches.

  Finally, it would be important that the DA specifies when, in each module or submodule, specific site data (i.e., primary data) must be used and/or when default data (i.e., secondary data) may be applied, even if data source and quality should be in the hands of Member State. This is to avoid that different data quality and adaptation procedures can be used, especially when imported products are used in a building.

  Other than stages and modules scope, it is important to define in the DA the minimum scope of building elements, i.e. the minimum granularity of the building model. The Directive directly refers to the Level(s) common EU framework for the scope of building elements and technical equipment, but with reference to the indicator 1.2 (GWP). This may induce confusion in adopting the Level(s) minimum scope of building parts and elements as reported in the User manual 2 - Setting up a project to use the Level(s) common framework - as the minimum scope of building elements for the GWP assessment. A clear reference should be made in DA to the user manual 2 table, or an updated table has to be provided taking into account the balance between the assessment effort and cost and the results quality with an increased building granularity.

Methodology Clarification

The GWP assessment result can significantly vary in relation to the assumed floor area: larger it is lower is the building's GWP. Thus, a common definition of the reference floor area is mandatory if a harmonized methodology shall be used. Also, if building element

CONSTRUCTION PROCES STAGE – M. A5	USAGE STAGE - BUILDING FABRIC M. B1	USAGE STAGE - BUILDING OPERATION M. B6
A5.1 : Pre-construction demolition **A5.2:** Construction activities **A5.3:** Waste and waste management **A5.4:** Transport of construction workers	**B1.1.** Emissions from materials and carbonation **B1.2·** Fugitive emissions of refrigerants	**B6.1 :** Regulated building integrated systems (services) **B6.2:** Non-regulated building integrated systems (services) **B6.3:** Other energy use related to building user activities
USAGE STAGE - BUILDING OPERATION B7	**USAGE STAGE - BUILDING OPERATION M. B8**	**NET BENEFIT BEYOND SYS.BOUNDARY – M. D1**
B7.1 : Essential building-integrated systems **B7.2:** Other building-integrated systems **B7.3:** Non-building-integrated systems	**B8.1:** Transport of persons to and from the building **B8.2:** Charging of electric vehicles within the building site **B8.3:** Others, such as use of "consumables" like paper for offices, or furniture and equipment not fixed to the building	**D1.1.** Reuse **D1.2.** Recycling **D1.3·** Energy recovery

NOTE: 'Regulated' means energy demand from building integrated systems (services) covered by the EU Energy Performance of Buildings Directive

Figure 4. Sub-modules presented in the current status of the prEN 15978.

areas are not correctly defined, the billing of materials will be not correct and consequently their impacts. To use a standardized approach, Level(s) refers to the International Property Management Standard (IPMS) [2] for the surface area definition of building components and sub-components.

The main issue is that not all CEN standards use the same floor area definition. For instance, the EPBD overarching standard, EN ISO 52000-1, defines a reference floor area as floor area used as a reference size. That has caused that any Member States has adopted its own definition.

DA should finally oblige Member States to adopt a uniform description of the floor area, for instance, using the IPMS components area, with the double benefit of a same reference area for the GWP normalization and more clear and consistent billing of materials.

Another important methodological issue is related to the open question about dynamic versus static approach. According to [1], they can be defined as:

- **Static Approach:**
  Time-independent LCA method that aggregates environmental impacts over the building's life cycle without considering when they occur.

- **Dynamic Approach:**
  Time-sensitive approach accounting the impacts related over time (only for GWP fossil, and not on GWP biogenic, to ensure there is no imbalance in the carbon uptake and release).

Of course, while the dynamic approach can be more accurate (it depends on data availability), it is more complex and time consuming than the simplified static approach. Furthermore, there is an open discussion on what indicator is correctly describing the impact on atmosphere temperature of different emissions temporal profiles. It seems than, even if calculated with time-dependent characterization factor, the GWP indicator is not as correct as the Global Temperature Potential. Thus, it would be better to delay the dynamic models use for legal obligation till the research will converge on a unique indicator.

The use of steady models for the embedded carbon assessment is anyhow not in contradiction with the use of dynamic models for energy use and operation al carbon assessment. Such tools, based on hourly calculations, are able to assess operational carbon closer to the real situation, taking in account the possible various energy carriers and energy storage and grid interaction. But, even if building energy performance simulation tools exist since 1970s, the CEN standard allows to use quasi-steady state approach, seasonal or monthly based and almost all Member States are using today such models. There is still a strong resistance to switch to hourly base (true dynamic), even if designers are getting used to work with such tools. Thus, it will be even more difficult to convince all involved actors to use dynamic embedded carbon models. For these reasons today, it would be much better to spend time and money on making the data the static model needs better and more available than on adopting a dynamic method more difficult to use and with a lack of specific data.

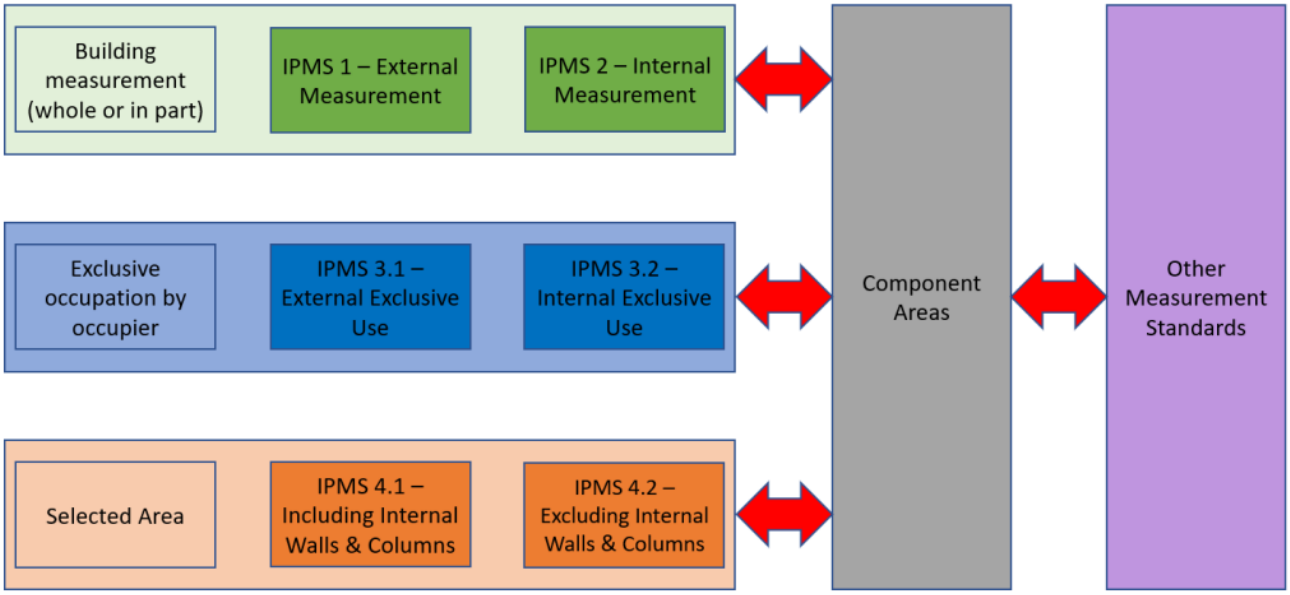

Figure 5. IPMS logic structure and interaction with other measurement standards [2].

Other Clarification

One question mark has been raised about the GWP assessment result submission: when it should be delivered and how many times.

Looking at the EPBD goal, maximum performances with the minimum environmental impact, which is technically feasible and economically sustainable, the same route has to be taken that has been chosen for the energy performance assessment.

In assessing the energy performance, EPBD requires first compliance of the building primary energy use with a maximum threshold at the design stage to get the building permit: first stage of assessment. After the building has been constructed, at the handover phase, a second assessment must be carried out for the building as built to release the Energy Performance Certificate. Because the introduction of a life cycle GWP limit value is planned to be in force from 2030, according to the roadmap any Member State has to prepared by 1 January 2027, the Zero Emission Building energy assessment can be synchronized with its Environmental assessment. That means that the building design can be optimized in a holistic way, evaluating at the same time both the energy and the environmental performances. Then, at the handover, the building will be certified on both aspects using actual building data referred to the installed materials and components (see **Figure 6**).

If an assessment tool is developed that allows to perform both calculations with a unique building description in input, the effort to produce the assessments is minimized.

Some clarification is also needed on the results format. The Directive requires the calculation of the total cumulative life cycle GWP for each life-cycle stage, which must be disclosed in the energy performance certificate, no more. Level(s), the reference EU framework for buildings sustainability assessment, referred several times, defines instead a reporting format for the GWP indicator that, as shown in **Figure 7**, is spitted in its components: fossil, biogenic, and land use and land use change other than total.

During the seminar [1], a simplified or more complex reporting format has been proposed respectively only with two macro-stages (A1 to C4 and D) or including all modules and sub-modules. While from the point of view of stages and components, the Level(s) format seems to be still the best compromise, what is lacking is what is common for primary energy reporting. Several Member States have set specific thresholds and report

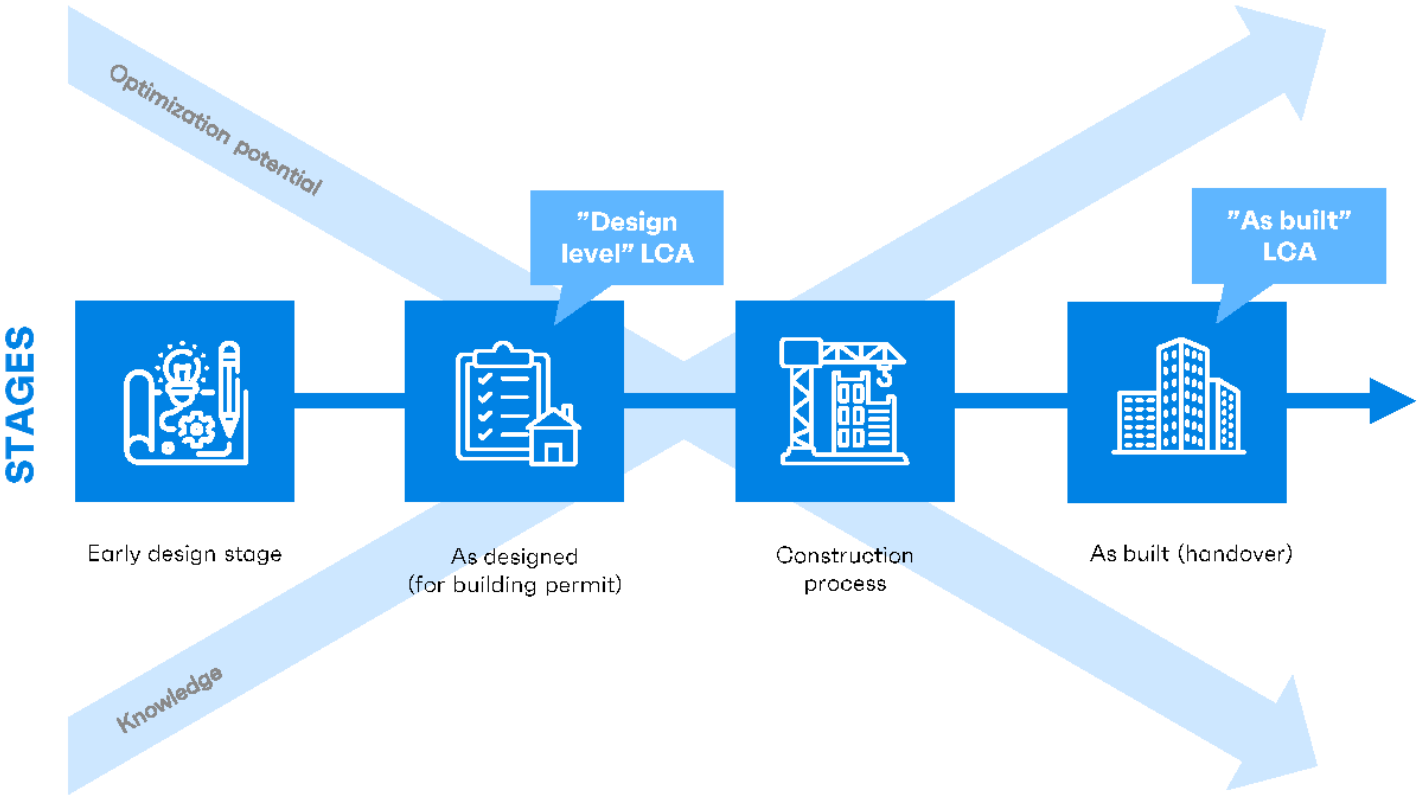

Figure 6. Building construction timeline and GWP report delivery [1].

on the primary energy use for each building service (heating, cooling, ventilation, domestic hot water, lighting at most), as required by EN ISO 52000-1. Thus, it would be better to adopt for the GWP the same spitting among services as for the energy assessment, other than stages and components. Such splitting is optional in prEN 15978 and it is possible only if this information is included in the EPC (they are not mandatory) or if the assessor for the environmental impacts is the same for energy use, as explained before.

Accuracy and completeness are the last issues identified that require some clarification in the DA, even if it is a very complex matter. The only way to guarantee accuracy is to force the use of certified EPDs values and databases, which provide average national values for all activities and components that do not have certified EPDs. It is evident that that should be a Member State task, even if some excellent work has been already done by the Commission through the JRC-Ispra, building a database with customized values for each Member State but only for basic physical substances. The completeness issue can only be solved using the building digital twin (i.e., a BIM), which can automatically link the building drawing to the bill of materials and then to the relative EPDs. In this way, all material flow will be taken into consideration without losing some components because this would result a "hole" in the drawing, in the economic accounting, and in the supplies logbook, and thus very evident to the designer.

Comments and recommendations

A delegated act (DA) on LC-GWP, as required by Article 7(3), is under development to provide an EU harmonized approach by setting out a framework aiming at a transparent and consistent LC-GWP calculation methodology. Some potential issues related to the large degree of freedom in the application of the mandatory standard to be used for the GWP calculation, EN 15978, also under revision (prEN 15978), must be solved by this DA if a clear and common calculation method shall be used. In the previous text, on the basis of a stakeholder meeting [1] (EU Commission contract for support to the clarification and implementation of the EPBD provisions relating to building whole life GWP), some of these issues have been examined and, in some cases, some potential solutions have been proposed.

When this text has been written, no public draft of DA was available, and thus, no clear view of the actual approach followed by the Commission is possible in facing such potential issues. We hope that such short compendium will be useful to address their work on the right track. The only main recommendation is on the need of better linking the two mandatory assessment requirements, energy performance and environmental impact, being today the GWP operational component the major part, but with the future application of the provision on the Zero Emission Building, the embedded component will be dominant. That means that the building designer, the energy assessor, and the environmental impacts assessor or must be the same subject or must share all information at the design stage to be able to correctly fulfil all requirements at the lowest possible cost. In this second case, an information exchange protocol has to be foreseen to avoid redundant information loops with loss of time and money.

References

[1] Slides for webinar about WLC - 22.10.24.pdf available on https://www.wlc-epbd-guidance.eu/.

[2] International Property Measurement Standards: All Buildings, International Property Measurement Standards Coalition, 2022.

[3] EN 15978:2011 Sustainability of Construction works – Assessment of Environmental Performance of Buildings – Calculation method. ■

Indicator	Unit	Product (A1-3)	Construction process (A4-5)	Use stage (B1-7)	End of life (C1-4)	Benefits and loads beyond the system boundary (D)
(1) GWP - fossil	kg CO_2 eq					
(2) GWP - biogenic	kg CO_2 eq					
GWP – GHGs (1+2)	kg CO_2 eq					
(3) GWP – land use and land use change	kg CO_2 eq					
GWP – overall (1+2+3)	kg CO_2 eq					
Notes: Impacts referred to the use of 1 m^2 of useful internal floor per year for a default reference study period of 50 years[1].						

Figure 7. Level(s) reporting format for GWP.