Guidance document on the revised Annex I EPBD
Common general framework for the calculation of energy performance of buildings

1. INTRODUCTION

Annex I of **Directive 2010/31/EU[1] on the Energy Performance of Buildings** (hereafter "the revised EPBD") provides the common general framework for the calculation of the energy performance of buildings.

To meet the objectives of energy efficiency policy for buildings, the transparency of energy performance certificates should be improved by ensuring that all necessary parameters for calculations, both for minimum energy performance requirements and for certification, are set out and applied consistently. Directive (EU) 2018/844[2] amends Annex I to update the general framework for the calculation of the energy performance of buildings accordingly.

The aim of this guidance document is to clarify the purpose of the revised provisions in Annex I and support their correct transposition and implementation at national level. The note states the views of the Commission services, does not alter the legal effects of the Directive and is without prejudice to the binding interpretation of Annex I as provided by the Court of Justice.

[1] Directive 2010/31/EU of the European Parliament and of the Council of 19 May 2010 on the energy performance of buildings.
[2] Directive (EU) 2018/844 of 30 May 2018 amending Directive 2010/31/EU on the energy performance of buildings and Directive 2012/27/EU on energy efficiency.

2. SCOPE

Annex I of the EPBD is revised in order to **improve the transparency and consistency** of the existing 35 different regional and national energy performance calculation methodologies:

- Point (1) of Annex I is revised to better address how the energy performance of buildings must be determined and to require Member States to describe their calculation methodologies following the energy performance of buildings standards (EPB standards).

- Point (2) of Annex I is revised to (i) better reflect the energy needs associated with the typical use of a building in the light of developments in the construction sector; and (ii) give additional considerations for the definition of Primary Energy Factors (PEFs).

- A new point (2a) gives the possibility of supplementing the general framework for the calculation of energy performance of buildings with additional numeric indicators for the entire building's overall energy use or greenhouse gas emissions.

- Points 3, 4 and 5 of Annex I remain almost unchanged except for the deletion of "where relevant in the calculation" in paragraph 4. This requires calculation to take into account the positive influence of the factors that are subsequently listed.

The adoption of national methodologies for the calculation of the energy performance of buildings is required in Article 3. The provisions of Article 3, as well as those related to the calculation of cost-optimal levels (Articles 4 and 5) remain unchanged.

This guidance document is structured to cover the revised provisions of Annex I in the following way:

- Obligations on determining and expressing energy performance of buildings, covering the first two paragraphs of the revised point (1), the first paragraph of point (2) and the new point (2a);
- Obligation to transparently describe national calculation methodologies following the energy performance of buildings standards, based on the third paragraph of the revised point (1);
- Considerations for the calculation of Primary Energy Factors (PEFs), on the basis of the three last paragraphs of point (2).

3. OBLIGATIONS ON DETERMINING AND EXPRESSING THE ENERGY PERFORMANCE OF BUILDINGS

3.1. Determination of the energy performance of a building (point 1, paragraph 1)

The energy performance of a building must be determined on the basis of the **calculated or the actual energy use** of the building and that it has to reflect all its typical energy uses. This provision is not new. The word "annual" is deleted in line with the definition of energy performance in Article 2 of the EPBD, making the obligation more flexible.

The revision updates the building typical energy uses as extended in the revised definition of technical building systems (Article 2, paragraph 3). In particular, the typical energy uses of a building include, *inter alia*, energy used for **space heating, space cooling, domestic hot water, ventilation, built-in lighting and other technical building systems**.

It has to be noted that the revised definition of technical building systems is broader and covers new areas, such as building automation and control, on-site electricity generation and energy from renewable sources. It is for Member States to decide which technical building systems will be considered in the calculation of energy performance.

3.2. Expressing the energy performance of a building (point 1, paragraph 2 & new point 2a)

Paragraph 2 makes clear that the energy performance of a building must be expressed by a **numeric indicator** of **primary energy use in kWh/(m².y)**.

In case Member States choose a ratio of primary energy consumption divided by a reference consumption to express the energy performance of a building it has to be clarified how this ratio relates to a numeric indicator of primary energy use in kWh/(m^2.y).

The new point 2a allows Member States to consider **additional numeric indicators** to which it specifically refers to:

- total, non-renewable and renewable primary energy use[3], and
- the greenhouse gas emissions produced (which could be expressed in kgCO2eq /(m².y)).

These indicators may only be added to the common numeric indicator expressed in primary energy use in kWh/(m².y) and they cannot replace it under any circumstances.

Paragraph 2 requires that the primary energy use indicator of building energy performance is to be used for the purpose of both energy performance certification and compliance with minimum energy performance requirements. It is highly recommended that Member States

[3] According to EN ISO 52000-1, when expressing the primary energy use, it shall be specified if it is total primary energy, non-renewable or renewable primary energy use.

also use the same methodology for the calculation of energy performance, compliance with minimum energy performance requirements and for Energy Performance Certificates[4]. However, in case different methodologies are used, the final results of the calculations should converge sufficiently to avoid confusion on the energy performance of buildings.

The deletion of "where relevant in the calculation" in paragraph 4 requires the calculation of energy performance to take into account the positive influence of the factors that are subsequently listed, i.e. local solar conditions[5], electricity produced by cogeneration, district heating and cooling systems and natural lighting[6]) in the calculation of energy performance calculations. Even if a factor may not be common in a specific Member State (for example, if climate conditions do not favour solar exposure or if there are no district heating and cooling networks developed), the positive influence of such factors on the calculation methodologies must be considered.

According to paragraph 2 the methodology applied for the determination of the energy performance of a building must be **transparent and open to innovations**. This requirement must apply for all elements that are part of the calculation of energy performance, such as:

- the energy needs of the building, which the calculation of energy performance takes as the starting point,
- the resulting total primary energy demand from the breakdown of energy needed to cover the uses through national PEFs,
- renewable energy produced on-site, and renewable energy supplied through energy carrier, which shall be treated consistently and on a non-discriminatory basis,
- the use of energy performance of buildings standards,
- the best combination of energy efficiency and renewable measures, which are at the core of the EPBD,
- the consideration of the national indoor air quality and comfort levels in the calculation of energy performance for different buildings types[7].

[4] The calculation of energy performance of buildings for setting minimum energy performance requirements shall also follow the common methodology framework in the Commission Delegated Regulation (EU) No 244/2012 of 16 January 2012 supplementing Directive 2010/31/EU of the European Parliament and of the Council on the energy performance of buildings by establishing a comparative methodology framework for calculating cost-optimal levels of minimum energy performance requirements for buildings and building elements (Hereafter "Regulation (EU) No 244/2012".

[5] The "energy balance" approach, which takes into account both energy losses (related to heat loss) as well as energy gains (from passive solar irradiance on buildings and building elements) when calculating the energy performance of a building or a building element of the building envelope, is an approach used in some Member States to consider the solar conditions.

[6] A new European Standard (EN 17037) for "Daylight on Buildings" provides a common methodology for the evaluation of daylighting conditions in buildings, which considers variations related to geographical and climatic differences in Europe.

[7] Regulation (EU) No 244/2012, ANNEX III, Table 4: "*Each calculation should refer to the same comfort level. Pro forma each variant/package/measure should provide the acceptable comfort. If different comfort levels are taken into account, the base of the comparison will be lost*".

3.3. Transposition measures and recommendations

The revised provisions of paragraphs 1 and 2 of point 1 and the new point 2a primarily aim to clarify current obligations. Member States must revise their building codes and current calculation methodologies and, if not already stated in their current measures, make clear in the respective transposition measures, by the transposition date:

- which method they use (calculated or actual energy use) to determine energy performance of buildings;
- if the methodology is used for both setting cost-optimal minimum energy performance requirements and for energy performance certification;
- the energy uses applied for the calculation of energy performance;
- how the positive influence of local solar conditions, electricity produced by cogeneration, district heating and cooling systems and natural lighting is considered (in line with point 4 of the revised Annex I);
- that the energy performance is expressed in primary energy use in kWh/(m².y) for the purpose of both energy performance certification and compliance with minimum energy performance requirements.

Member States may also introduce the additional indicators to express the energy performance of a building referred to in point 2a. In case additional indicators are defined next to the required indicator on primary energy use, Member States should also include all relevant information to support their proper implementation, such as the unit to be expressed, if they are applied to all types of buildings, to new and/or existing buildings, if they will be used for the energy performance certification and/or to supplement minimum energy performance requirements, as well as the methodology to calculate them.

4. OBLIGATION TO TRANSPARANTELY DESCRIBE NATIONAL CALCULATION METHODOLOGIES

4.1. Description of national calculation methodologies following the energy performance standards

In order to improve much needed comparability and increase transparency, the revised EPBD introduces the obligation for Member States to describe their national calculation methodology following the national annexes of the overarching standards[8], 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). A short description of the standards is presented in Annex to this document.

Each standard has an "Annex A" - a template providing choices between specific methods (e.g. simple or more detailed) and choices of (technical, policy or climate related) input data. The Annexes A are considered a useful tool for Member States to describe their national calculation methodologies. The choices according to the Annex A template, made by the Member States and/or National Standardization Bodies are to be laid down in National datasheets or National Annexes to these standards.

Whilst recital 40 of Directive (EU) 2018/844 recognises that the use of the EPB standards "[…] *would have a positive impact on the implementation of the revised EPBD*", the revised Annex I makes clear that this is not meant to be a legal codification of these standards or to make them mandatory.

Member States keep the same flexibility as before to adapt their national or regional calculation methodologies in accordance with their local and climatic conditions[9].

4.2. Transposition measures and recommendations

Member States must describe their national/regional calculation methodologies following the national annexes of the overarching standards, which already provide a template for specifying the choices and the required input data. Member States will have to meet this requirement at the latest by the transposition deadline, namely by 10 March 2020[10].

[8] For an explanation on the national annexes for the EPB standards, see www.epb.center/implementation/national-annexes

[9] Local conditions could for instance refer to different climatic zones, the practical accessibility of energy infrastructure, local energy grids, different building typologies, etc. (i.e. continental and coastal conditions could significantly differ).

[10] According to Article 3 of the amending Directive (EU) 2018/844, Member States must communicate to the Commission how they have transposed or implemented new obligations imposed by the revised EPBD by the transposition deadline (20 months after the date of entry into force, namely by 10 March 2020). As part of this communication Member States will have to show that they fully comply with the obligation to describe their calculation methodologies according to the standards.

Member States have several options for notifying compliance with this obligation. One straightforward option is to notify the filled-in Annexes of the overarching standards as part of the official communication to the Commission of national transposition measures on Directive (EU) 2018/844).

In order to facilitate transparency and improve comparability, it is recommended that Member States make publicly available the description of their calculation methodologies according to Annexes of the overarching standards. This could be done for example by uploading the filled-in templates to a website or by annexing the filled-in templates as part of their building codes, etc. In that case, Member States may notify to the Commission the appropriate publicly available source to prove that the obligation is fulfilled.

Making the calculation methodology publicly available will also help Member States fulfil the requirement in the second paragraph of point 1 of Annex 1, that "*The methodology applied for the determination of the energy performance of a building shall be transparent…*".

DG-ENER has recently launched a contract service to support Member States in the use of the EPB standards. This should include case studies or pilot cases to show the possible use of the EPB standards and the development of tools (e.g. spreadsheets) to facilitate their use as well as guidance documents on the practical use of the standards.

The service should provide direct advice and consultation to the ministries, agencies or designated standardisation bodies on how to describe their national/regional calculation methodologies following the national annexes of the overarching standards.

In particular, the project team under the service contract intends to support Member States in the completion of the national Annexes of the 5 overarching EPB standards, if they use these EPB standards, or to support Member States in the use of the national Annexes of the 5 overarching EPB standards to describe their national method.

This support comprises a step-by-step approach that includes a generic template for the completion of a national Annex of any EPB standard, with editorial guidance and tips, explanation of the different types of input requested in the Annexes A of the 5 overarching EPB standards, highlighting some key issues and the preparation of examples.

The core part of the communication and dissemination is the EPB Center website (www.epb.center) acting as interface to and from the target groups.

5. CONSIDERATIONS FOR THE CALCULATION OF PRIMARY ENERGY FACTORS (PEFS)

The energy performance of a building has to be expressed by a numeric indicator of primary energy use, which is the energy needed to satisfy the energy needs of a building. Primary energy is calculated from the delivered and exported amounts of energy flows, using primary energy conversion factors (PEFs) or weighting factors[11]. Energy flows include electric energy drawn from the grid, gas from networks, oil or pellets (all with their respective primary energy conversion factors) transported to the building for feeding the buildings technical system, as well as heat or electricity produced onsite.

Under the EPBD, the calculation of PEFs for different energy carriers used in buildings is the responsibility of Member States. Different national electricity mixes, the efficiency of the power plants share, the share of renewable energy, different calculation methodologies may affect the calculation of PEFs. Even with a common set of conventions, PEF values for different Member States may well differ. Experience has shown that figures reported by Member States differ significantly and procedures used to define PEFs are not always transparent.

The objective of the revised point 2 of Annex I is to introduce a degree of transparency in the calculation of PEFs, to ensure that role of the building envelope is not underestimated and to address the role of on-site and off-site renewable energy sources[12].

5.1. The energy needs to be considered (point 2, paragraph 1)

In order to calculate the energy performance of a building the energy needs have to be initially defined, namely the amount of energy (regardless of its source) that will be consumed in order to provide the necessary building indoor conditions. Defining the energy needs of a building is an important step for the calculation of its energy performance, in line with the cost-optimal methodology, gradually expanding the system boundary from energy needs, to energy use and then delivered energy and primary energy.

The revised EPBD determines that energy needs for **space heating, space cooling, domestic hot water, ventilation, lighting and potentially other** areas are to be covered, to reflect the extended revised definition of technical building systems (Article 2, paragraph 3). This revised provision highlights that the calculation of energy needs must **optimise health, indoor air quality and comfort levels** as defined by Member States at national or regional

[11] "Weighting factor" is the terminology used in the CEN overarching standard when referring to PEFs, so both "Primary Energy Factors" and "Weighting Factors" are considered to have an equivalent meaning. Both terms are used by Member States.

[12] With regards to the default PEF value (2.1) defined for electricity generation in the revised Energy Efficiency Directive, it has to be noted that in the context of the revised EPBD, Member States are free to apply their own PEFs, including for electricity from the grid, even at sub-national level.

level, in the calculation of energy needs[13]. These elements are crucial, as buildings are defined in the EPBD as constructions for which energy is used to condition the indoor climate. Moreover, better performing buildings provide higher comfort levels and wellbeing for their occupants and improve healthy indoor climate conditions. These requirements are not novel, as the EPBD already sets out that Member States must ensure appropriate general indoor conditions and that that these conditions must be taken into account for the improvement of the energy performance of buildings, when defining the minimum requirements and for calculating the energy performance of buildings.

The cost-optimal calculation exercise has to be designed in such a way that differences in air quality and comfort are transparent. In case of a serious violation of indoor air quality or other aspects, a measure might be excluded from the national calculation exercise and requirement setting[14]. Reference buildings also have to be representative of their functionality, including indoor climate conditions, while the selected energy efficiency measures and measures based on renewable energy sources, and packages/variants, shall be compatible with air quality and indoor comfort levels according to CEN standard 15251 on indoor air quality or equivalent national standards. In cases where measures produce different comfort levels, this shall be made transparent in the calculations[15].

5.2. Definition of PEFs (point 2, paragraph 2)

The revised EPBD clarifies that PEFs or weighting factors per energy carrier may be based on **national regional or local annual, and possibly also seasonal or monthly**, weighted averages or on more specific information made available for individual district systems. This explicitly acknowledges current flexibility for Member States when defining the PEFs.

One example relates to the treatment of electricity (and to some extent district heating) networks, where the use of seasonal or monthly factors for electricity instead of single annual average values could be more suitable in the case of heating. Similarly, the photovoltaics component of generation is better described on a seasonal basis. Local conditions can also be taken into account when defining PEFs for the purpose of calculating the energy performance of buildings.

5.3. Pursuing the optimal energy performance of the building envelope (point 2, paragraph 3)

Paragraph 3 of point 2 requires Member States to ensure that in the application of primary energy and weighted factors, **the optimal energy performance of the building envelope is pursued**. Reducing the overall energy demand is a crucial component when optimising the

[13] For reference comfort conditions, EN15251 "Indoor environmental input parameters for design and assessment of energy performance of buildings addressing indoor air quality, thermal environment, lighting and acoustics" or equivalent should be taken into account. More information can be found in the "Basic listing of cost elements to be taken into account for calculating initial investment costs of buildings and building elements" of the Guidelines accompanying Commission Delegated Regulation (EU) No 244/2012, Section 6.5

[14] Guidelines accompanying Commission Delegated Regulation (EU) No 244/2012, Section 4.3

[15] Regulation (EU) No 244/2012, ANNEX I, SECTION 2, point 6.

energy performance of a building. In this context, the consideration of the envelope should not be underestimated. In addition, technical building systems and building automation and control systems (BACS) are more impactful and most easily optimised in combination with highly-performing envelopes.

5.4. On-site and off-site renewable energy sources (point 2, paragraph 4)

The revised EPBD provides that Member States may take into account the renewable energy sources (RES) supplied through the energy carrier and RES that are generated and used on-site when defining PEFs. The provision does not specify the treatment of on-site / off-site RES, allowing Member States to calculate PEFs according to local or national conditions.

The revised EPBD is explicit on the possibility of addressing renewable energy sources when defining PEFs. Several considerations are worth recalling in this regard:

- The energy produced on-building reduces the energy needs and it is not accounted as delivered/supplied energy to the building.
- The calculation of primary energy factors includes both non-renewable energy and renewable energy supplied to the building (total PEF).
- The separation of primary energy into non-renewable and renewable components allows comparing results between electricity from different renewable energy sources, and also with electricity generation from fossil fuels.
- A distinction between renewable and non-renewable primary energy factors can help understand the energy consumption of a building.

The revised EPBD further clarifies that the consideration of renewable energy sources (supplied through the energy carrier, and generated on-site) is possible, provided that the calculation of primary energy factors applies on a non-discriminatory basis.

Generally, the principle of non-discrimination requires that comparable situations must not be treated differently and that different situations must not be treated in the same way unless such treatment is objectively justified. This allows Member States to choose the regime which corresponds best to its particular situation, taking into account the specific national circumstances[16].

Deducting the renewable energy share from primary energy factors[17] is one possible way to ensure that on-site and off-site renewables are treated comparably, preventing that the boundaries of the calculation of the energy performance of buildings have an effect on national or regional renewable energy policies.

[16] Case C-195/12: Industrie du bois de Vielsalm & Cie SA ('IBV') vs Région wallonne (Walloon Region) [2013], paragraph 50-52, 62.

[17] Note that in implementing the requirements of the EPBD, Member States are responsible for defining primary energy factors for different energy carriers used in buildings. The definition of primary energy factors can use different conventions, and the challenge is to select the most appropriate one for each national energy system.

Member States may similarly balance the principle of non-discrimination of renewable energy sources as compared to non-renewable energy sources. Transparency on figures, conventions and underlying assumptions for calculating renewable and non-renewable PEFs is one way of ensuring non-discriminatory treatment.

With regards to the cost-optimal calculation methodology, and the calculation of primary energy for the determination of the cost-optimal levels (not affected by the revised provisions), it is mentioned in the accompanying guidelines[18] that for the purpose of the cost-optimal evaluation the non-renewable part of primary energy is considered.

5.5. Transposition measures and recommendations

Member States must revise their building codes and, if not already stated in their current national calculation methodologies, make clear the energy needs in their respective transposition measures, by the transposition date. PEFs should be regularly reviewed, to reflect the changes in the national energy mix and in the energy market over time, and underlying calculation methodologies.

Member States within the framework of determining their national calculation methodology, should always try to find the best combination of energy efficiency and renewable measures. The use of RES should be encouraged, but this should always be in conjunction with seeking energy savings from the building envelope and its technical building systems. Under the cost-optimal methodology, the RES-based active technologies enter into direct competition with demand-side solutions, which is in line with the purpose and intention of the cost-optimal calculation to identify the solution that represents the least global costs without discriminating against or favouring a certain technology[21].

Technical guidelines could be provided at national or regional level on how to improve the indoor quality of buildings by avoiding thermal bridges, inadequate insulation and unplanned air pathways that can result in surface temperatures below the dew point of the air and in dampness.

[18] Guidelines accompanying Commission Delegated Regulation (EU) No 244/2012, Section 2.

ANNEX A - THE OVERARCHING ENERGY PERFORMANCE OF BUILDINGS STANDARDS

Concerning the list of overarching standards, these are the key standards:

- EN ISO 52000-1, Energy performance of buildings — Overarching EPB assessment – Part 1: General framework and procedures[19]
- EN ISO 52003-1, Energy performance of buildings – Indicators, requirements, ratings and certificates – Part 1: General aspects and application to the overall energy performance[20]
- EN ISO 52010-1, Energy performance of buildings - External climatic conditions - Part 1: Conversion of climatic data for energy calculations[21]
- EN ISO 52016-1, Energy performance of buildings — Energy needs for heating and cooling, internal temperatures and sensible and latent heat loads — Part 1: Calculation procedures[22]
- EN ISO 52018-1, Energy performance of buildings — Indicators for partial EPB requirements related to thermal energy balance and fabric features — Part 1: Overview of options[23]

These five overarching EPB standards have in common that each of them describes an important step in the assessment of the energy performance of building.

[19] https://epb.center/support/documents/m1-overarching-epb/iso-52000-1
[20] https://epb.center/support/documents/m1-overarching-epb/iso-52003-1
[21] https://epb.center/support/documents/m1-overarching-epb/iso-52010-1
[22] https://epb.center/support/documents/m2-building-such/iso-52016-1
[23] https://epb.center/support/documents/m2-building-such/iso-52018-1