**Guidance document on revised Article 2, 8(1) and 8(9) EPBD**

**Technical Building Systems**

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# INTRODUCTION

Article 8 paragraph 1 of **Directive 2010/31/EU on the Energy Performance of Buildings as originally adopted on 19 May 2010[[1]](#footnote-1)** (hereafter referred to as the ‘former EPBD’) required Member States to set system requirements in respect of the overall performance, the proper installation, and the appropriate dimensioning, adjustment and control of technical building systems. This obligation applied to technical building systems installed in existing buildings and Member States could also apply it to technical building systems installed in new buildings. In addition, Article 2 paragraph 3 of the former EPBD defined a technical building system as a *“technical equipment for the heating, cooling, ventilation, hot water, lighting or for a combination thereof, of a building or building unit”*.

With regard to **technical building systems**, Article 1 of **Directive (EU) 2018/844 amending Directive 2010/31/EU on the energy performance of buildings and Directive 2012/27 on energy efficiency[[2]](#footnote-2)** (hereafter referred to as the ‘Amending Directive’):

1. keeps the provisions on technical building system requirements in Article 8 paragraph 1 as they were under the former EPBD (with the exception of the list of systems for which system requirements had to apply in sub-paragraph 2, which has been deleted);
2. updates and extends the definition of technical building systems (Article 2 paragraph 3);
3. introduces new provisions on the assessment and documentation of the overall performance of technical building systems (Article 8 paragraph 9).

The aim of this guidance document is to clarify the purpose of the revised and new provisions on technical building systems in Article 2 and 8 of the revised EPBD. 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 Article 2 and Article 8, paragraphs 1 and 9 as provided by the Court of Justice.

# UNDERSTANDING OF THE PROVISIONS APPLYING TO TECHNICAL BUILDING SYSTEMS IN ARTICLE 2 AND 8 OF THE REVISED EPBD

## Aim and objectives

The aim of the provisions on technical building systems of Article 8, paragraphs 1 and 9, is twofold. Firstly to ensure that technical building systems are adequately designed, installed and commissioned in order to optimise their actual performance. Secondly to ensure that any intervention that can have an impact on the performance of a technical building system is tracked and documented, as such information is valuable to the owner but also, so as to facilitate the assessment of the performance of the building as a whole (e.g. in the context of energy performance certification).

## Technical Building Systems

### Extension of the definition

The obligations arising from Article 8 paragraphs 1 and 9 of the revised EPBD apply to technical building systems as defined in Article 2(3) thereof. According to that definition, technical building system means *“technical equipment for space heating, space cooling, ventilation, domestic hot water, built-in lighting, building automation and control, on-site electricity generation of a combination thereof, including those systems using energy from renewable sources, of a building or building unit.”*

The definition of technical building systems was already provided in the former EPBD but the revised EPBD updates this definition by: 1) using a different wording for some systems, in order to clarify their scope; 2) extending it to include additional systems: ‘technical equipment for building automation and control’ and ‘technical equipment for on-site electricity generation’.

The following table summarizes the updates made on the definition under the revised EPBD:

|  |  |  |
| --- | --- | --- |
| **Former EPBD** | **Revised EPBD** | **Type of change** |
| ‘heating’ | ‘**space** heating’ | Clarification of the scope. |
| ‘cooling’ | ‘**space** cooling’ | Clarification of the scope. |
| ‘ventilation’ | ‘ventilation’ | No change. |
| ‘hot water’ | ‘**domestic** hot water’ | Clarification of the scope. |
| ‘lighting’ | ‘**built-in** lighting’ | Clarification of the scope[[3]](#footnote-3). |
| N/A | ‘**building automation and control**’ | New technical building system. |
| N/A | ‘**On-site electricity generation**’ | New technical building system. |

### New technical building systems

The following systems: ‘technical equipment for building automation and control’ and “technical equipment for on-site electricity generation’, have been added to the definition of technical building systems.

* ‘Building automation and control systems’ are defined in Article 2 paragraph 3a of the revised EPBD: *“‘building automation and control system’ means a system comprising all products, software and engineering services that can support energy-efficient, economical and safe operation of technical building systems through automatic controls and by facilitating the manual management of those technical building systems;”*
* ‘On-site electricity generation systems’ shall be understood as a system designed to produce electricity and that is installed in or in the immediate vicinity of the building and that has some level of integration with the building and its electrical installation[[4]](#footnote-4). Such systems include, in particular, photovoltaic panels integrated to the building envelope (e.g. roof-mounted photovoltaics panels), micro combined heat and power (CHP) installations, and small wind turbines.

### Additional relevant definitions

In addition to the definition of technical building systems, Article 2 of the revised EPBD includes definitions for ‘heating system’ and ‘air-conditioning system’[[5]](#footnote-5):

* *“‘Heating system’ means a combination of the components required to provide a form of indoor air treatment, by which the temperature is increased”*[[6]](#footnote-6).
* *“‘Air-conditioning system’ means a combination of the components required to provide a form of indoor air treatment, by which temperature is controlled or can be lowered”*[[7]](#footnote-7).

## When obligations are triggered

The provisions on technical building systems in Article 8, paragraphs 1 and 9, of the revised EPBD are triggered when a technical building system is installed, replaced or upgraded.

It should be clarified that the conditions for these obligations to apply relate only to technical building systems themselves and not to the type of building or building unit under consideration. The technical building system definition makes clear that a technical building system is an equipment of ‘a building or building unit’, meaning that provisions applying to technical building systems are applicable in buildings or building units, regardless of their type and characteristics.

However, the provision on setting system requirements is obligatory only with regard to the technical building systems in existing buildings. It is up to Member States whether they choose to extend the obligation also with respect to technical building systems in new buildings.

## Technical, economic and functional feasibility

Article 8 paragraph 1 of the EPBD states that system requirements must be applied *“in so far as they are technically, economically and functionally feasible”*[[8]](#footnote-8).

It is for Member States to detail in which specific cases the application of system requirements could not be feasible from a technical, economic or functional perspective. Member States must ensure that these cases are clearly identified, framed and justified.

In particular the interpretation of technical, economic and functional feasibility must not be left to owners or to system installers. Conditions under which feasibility is evaluated must be defined at Member State level or, where applicable, in the case of regional conditionalities affecting only part of the Member State territory, at regional level. However, in the latter case, regional conditionalities must be defined in national transposition measures. In any case, these conditions must be documented (e.g. in technical guidelines) and apply uniformly on the national (or, where applicable, regional) territory. Finally, the non-application of system requirements must be assessed under clear procedures established by public authorities.

The following table sets out how each type of feasibility can be interpreted and, for each, gives an example.

|  |  |  |
| --- | --- | --- |
| **Type of feasibility** | **Meaning** | **Examples** |
| Technical feasibility | System requirements are technically feasible when the technical characteristics of the system and the building (or building unit) allow for the requirements to be applied. System requirements are not technically feasible when it is impossible from a technical perspective to apply them, i.e. when the technical characteristics of the system simply prevent the requirements from being applied. | Technical feasibility would be absent when the system as deployed does not allow for the installation of the devices needed to comply with the requirements, e.g.:   * Requirements on heat recovery for ventilation systems: inlet and exhaust are not located in the same areas. * Requirements on the insulation of pipes: portions of pipes are not accessible. |
| Economic feasibility | Economic feasibility relates to the costs of the application of requirements and whether: (i) the procurement entity can bear these costs; (ii) these costs are proportionate with regard to the costs of the planned intervention (e.g. system upgrade) (iii) expected benefits outweigh these costs[[9]](#footnote-9), taking into account the expected lifetime of the system. | Economic feasibility can e.g. be calculated based:   * On a maximum ratio between the costs of the application of the requirements and the costs of the planned intervention. * On a maximum payback period, taking into account monetary benefits from the application of the requirements. |
| Functional feasibility | System requirements are functionally feasible where they lead to changes that are beneficial and relevant with regard to the characteristics of the system and / or building (or building unit) considered, and to the constraints that may apply on the system and / or building. | The application of system requirements may not be functionally feasible when e.g.:   * Applicable regulations (e.g. safety) contradict considered requirements. * The application of the requirements results in a loss of usability of the building or building unit (e.g. substantial loss of building space) |

## Additional clarifications

The new provisions on the documentation of system performance (Article 8 paragraph 9 of the revised EPBD) make use of some of the concepts from the provisions on setting system requirements: ‘overall energy performance’, ‘installation’, ‘replacement’ and ‘upgrading’. The meaning of these terms in the new provisions on the documentation of system performance is the same as in the provisions on setting system requirements. They must therefore be transposed at national level in the same way.

The provisions on the documentation of system performance also makes uses of the term ‘altered part’, which refers to the specific part (i.e. component) of a system that is affected when the system is upgraded. This is only relevant in the context of a system upgrade, not when a system is installed or replaced.

# IMPLEMENTATION OF THE PROVISIONS APPLYING TO TECHNICAL BUILDING SYSTEMS IN ARTICLE 2 AND 8 OF THE REVISED EPBD

## Transposition of the definitions

Member States have to ensure that the updated definition of technical building systems (Article 2(3)) and the new definitions of building automation and control systems (Article 2(3a)) and heating systems (Article 2(15a)) are correctly transposed.

Where relevant, Member States can also consider giving additional clarifications to supplement the definitions of technical building systems, for instance to describe in more detail the capabilities that building automation and control systems are expected to achieve.

## Transposition of Article 8 Paragraph 1 – system requirements

### New technical building systems

For systems that were not considered in the scope of the former EPBD (building automation and control systems and on-site electricity generation), Member States will have to define and lay down system requirements at national level and ensure that these requirements cover all the aspects referred to in Article 8 paragraph 1: ‘overall energy performance’, ‘proper installation’, ‘appropriate dimensioning’, ‘adjustment’ and ‘control’. The following table outlines the meaning of each of these requirement areas, giving examples (only for illustration purposes) for the two types of systems that have been added to the list of technical building systems in the revised EPBD.

|  |  |  |  |
| --- | --- | --- | --- |
| **Type of requirement** | **Refers to** | **Examples** | |
| **BACS** | **On-site electricity generation** |
| ‘overall energy performance’ | The performance of the system as a whole (not to be confused with the performance at product or component level and the performance of the whole building). | Control capabilities that have an impact on building energy performance (e.g. following EN 15232 standard[[10]](#footnote-10)) | System performance factor of a photovoltaic system (e.g. following EN 15316-4-6 standard[[11]](#footnote-11)) |
| ‘appropriate dimensioning’ | The adequateness of the system size or capacity with regard to the needs and characteristics of the building under expected use conditions. | Determine the optimal control capabilities based on the type of building, expected usage, potential energy savings. | Determine the optimal size of the PV system based on electricity cost reduction, available mounting area and other constraints that could apply. |
| ‘proper installation’ | The way the system should be installed in the building in order to operate properly. | Installation by a trained and / or certified installer. | Installation by a trained and / or certified installer. |
| ‘appropriate adjustment’ | Testing and fine-tuning actions on the system, once installed, and before it starts operating under real usage conditions. | Sequence of tests to be performed after installation to check that the system operates adequately. | Sequence of tests to be performed after installation to check that the system operates adequately. |
| ‘appropriate control’ | Desired or required control capabilities of systems. | Scope of control functions. | (Where applicable) control of electricity feeding (e.g. to grid, self-consumption, or storage) |

Further technical clarifications on possible requirements for the new categories of technical buildings systems introduced can be found in section 4.1.1.

### Systems already covered under the former EPBD

For systems already covered by the former EPBD, Member States could consider using the opportunity of the transposition of the amending Directive to review and possibly update applicable system requirements. This review could in particular be an opportunity to check that the applicable requirements cover sufficiently the different areas listed in the EPBD and assess whether the requirements could be further developed. Feedback from the Concerted Action EPBD[[12]](#footnote-12) suggests that the focus of applicable requirements is generally on component-level performance requirements and that the way other areas (i.e. proper installation, appropriate dimensioning, adjustment and control) are addressed can vary across the European Union. Member States are therefore encouraged to engage in this review and, where relevant, to draw from available good practices.

### Technical, economic and functional feasibility

As explained in section 2.4, system requirements will not be applied in so far as they are technically, economically and functionally not feasible.

## Transposition of Article 8 Paragraph 9 – assessment and documentation of system (or altered part) performance

### Scope of performance assessment: system or altered part

The provisions of Article 8 paragraph 9 require that when a technical building system is installed, replaced or upgraded, the overall performance *“of the altered part and, where relevant, of the complete altered system”*, is assessed and documented.

This means that:

* In all cases, the performance of the altered part has to be assessed and documented (e.g. if the heat generator of a heating system is replaced – which corresponds to a system upgrade –, then the performance of the new heat generator has to be assessed and documented);
* In some cases (‘where relevant’), the performance of the whole system shall be assessed and documented. This would be required in the following three situations:
  1. a new system is installed;
  2. a whole system is replaced;
  3. a part, or parts, of a system undergo a *major* upgrade that can significantly affect the overall performance of the system.

Cases 1 and 2 are straightforward: when a whole new system is installed or replaced (whether in a new building or in an existing building), then there is a clear need to assess and document the performance of the whole (new) system.

In the third case, a part or parts of the system are replaced or improved, thereby upgrading their energy performance which results in the upgrading of the performance of the whole system because the part is so important. In this scenario, the whole system performance must be assessed. For instance:

* Replacement of a major component (e.g. replacement of heat generator in a system) or replacement of a large number of minor components (e.g. replacement of all heat emitters in a building), with potential significant impact on overall performance, is in principle a major upgrade.
* Alteration of aspects of the whole system (e.g. improved insulation of pipes, replacement of pipes, replacement of all light sources, replacement of all radiators …) is in principle a major upgrade.
* Any upgrade or alteration that impact the balance if the system (that can be measured anywhere but on the component itself).

The following are indicative examples where the obligation would not be triggered:

* Maintenance and repairs that only aim to ensure the safe and optimal operation of the system;
* Replacement of a minor component of the system (e.g. replacement of a heat emitter).

In any case, it is up to Member States (and not to building and dwelling owners) to define in their national legislation the cases where it is relevant to assess the performance of the whole system, as opposed to those where only the assessment of the performance of the altered part is required.

In this context, Member States may differentiate between the different buildings and building units that can be affected by these provisions. This can concern e.g. the type of buildings (residential vs non-residential, individual dwelling vs multi-family building). This can also relate to system size, as it can be more relevant to ask for a more detailed assessment when a system is larger and more complex.

### Assessment of overall performance

In the scope of these provisions, assessing the overall performance (of the altered part or of the whole system) means taking the necessary steps to evaluate and express the energy performance (of the altered part or of the whole system).

The term ‘overall’ emphasizes the need – where it applies – to assess the performance of the system as a whole opposed to product or component level performance. It is less relevant in the case where it is the performance of the altered part that is being assessed.

The assessment of performance can be performed in different ways, therefore Member States will have to clarify which approaches should be followed to that end. These can vary depending on different factors (e.g. type of system considered; type of interventions: installation, replacement, upgrade; etc.). In particular, upgrades that are limited in scale and impact could lead to lighter assessment approaches (e.g. recording the intervention and ensuring that all relevant technical documents on the component(s) impacted are collected), while more substantial interventions (typically installation or replacement) should rely on a more thorough assessment of the impact on the system as a whole (e.g. relying on the simulation of system performance when the system is designed and on the verification of the key system capabilities after it is installed).

In defining these approaches for performance assessment, Member States will have to ensure consistency with the implementation of the provisions on the inspections of heating, air-conditioning and ventilation systems in Article 14-15 of the revised EPBD, in particular in relation to the requirement to assess (where relevant) the capabilities of the system under typical average operating conditions. For instance, where guidelines or templates for the inspection of technical building systems under Article 14-15 EPBD are available, references to these guidelines or templates may be made in the performance assessment under Article 8.

### Documentation of system performance

The provisions of Article 8 paragraph 9 require that the results of the assessment of the system (or of altered part) performance are documented and passed on to the building owner. Member States are free to define the form and content of this documentation, which can vary depending on the type of intervention considered. However, in this context, Member States must ensure that the documentation is relevant for the verification of compliance with the minimum requirements on energy performance laid down pursuant to Article 8 paragraph 1 and for energy performance certification (see next sub-section). Member States are also free to define the ways by which the documentation is passed on to the building owner.

### Relation with building energy performance requirements and Energy Performance Certificates

The obligations on the documentation of system (or altered part) performance in Article 8 paragraph 9 aim to ensure that up-to-date information on technical building system performance is made available to building owners. Such information can be used, for instance for energy performance certification purposes or for the verification of compliance with minimum energy performance requirements (e.g. when a building undergoes a major renovation). It is up to Member States to decide whether a new Energy Performance Certificate (EPC) will have to be issued as a result of the assessment of the technical building system (or the altered part) energy performance. However, Member States are encouraged to require a new EPC in the case where the performance of a whole system can be affected (i.e. in case of installation, replacement or major upgrade), as in such cases it is likely that the performance of the whole building will also be affected.

# GOOD PRACTICES

PRELIMINARY DRAFT – to be completed in subsequent steps.

This section aims to highlight good practices in the implementation of the provisions on technical building systems in Article 8 EPBD.

The underlying challenge is that buildings in operation do not perform as intended. Causes may be – as stated in the EPBD tthat they are not “adequately designed, installed and commissioned” or operated. The EC has acknowledged this problem with its call H2020 EeB-07-2015 FOR ENERGY-EFFICIENT BUILDINGS demanding the development of ICT based solutions to close the performance gap.

The QUANTUM project has developed an approach for an appropriate and cost effective quality management process to assess and document building and system performance.

The concept has been already been implented in Germany through AMEV guideline 135 on Technical Monitoring in 2017. The objective of this service is:

* to derive performance indicators for buildings and systems,
* to define a set of operation data to be delivered
* to specify a validation methodology and
* to report on the fulfilment of requirements.

All data has to be provided by components or BACS in a standardized format allowing the assessment and documentation to be carried out by an independent third party.

It is disputable whether this service can be effectively carried out relyinig on BACS since they are part of the assessed system and any party carrying out a test would have to technically and organizationally rely on the BACS and the contractors support. This is especially critical, since

* the management parts of BACS are often completed long after other systems have been accepted and handed over
* the BACS contractor may have an conflict of interest by supporting the assessment.

Therefore the provision of a minimum data set in a standardized format as defined in the AMEV Guideline 135 and in QUANTUM should be mandatory for all systems installed, replaced or upgraded. The same process regarding data provision and third party testing shall be applied to energy inspections.

## Requirements on technical building systems

### New technical building systems

Two new technical building systems are introduced in the revised EPBD: building automation and control systems (BACS) and on-site electricity generation systems. The following tables summarize how such requirements could be interpreted when implementing the revised EPBD. These tables aim neither to be exhaustive nor to be prescriptive – they are provided only for information purposes. As regards on-site electricity generation, our assumption is that the main target is photovoltaic panels; however, wind turbines (which size allows for on-site usage) and micro combined heat and power (micro CHP) are also within the scope.

|  |  |
| --- | --- |
| **Type of requirement** | **Possible interpretations for BACS** |
| ‘overall energy performance’ | Minimum requirements on control capabilities that have an impact on building energy performance. These requirements can concern the scope of control (i.e. which systems are controlled), the depth (or granularity) of control, or both. In defining these requirements, references can be made to available standards, for instance to BACS energy classes as defined in EN 15232 standard. Requirements can vary depending on the type of buildings (e.g. residential vs non-residential), andon some characteristics of buildings (e.g. surface area) and installed technical building systems (e.g. air conditioning, PV system directly connected to electricity using equipment). |
| ‘appropriate dimensioning’ | Dimensioning would refer here not to the system size (as it would for some other systems), but more to the way the design of a BACS can be tailored to a specific building. The aim of dimensioning is to reach the best compromise between costs and capabilities in consideration of the specific needs of the considered building. Requirements on dimensioning will list the relevant aspects that should be taken into account when designing a BACS for a specific building (e.g. expected or measured energy consumption, building usage, technical building systems installed in the building, expected PV self-consumption etc.) in order to reach this optimal compromise. In the scope of these requirements, it can be useful to refer to relevant standards or guidelines (e.g. ISO 16484-1:2010[[13]](#footnote-13)). |
| ‘proper installation’ | Requirements on the ‘proper installation’ is a generic reference to the need to ensure that the system (here, the BACS) is installed in a way that will ensure safe and optimal operation. Usually this is linked to requirements on the qualification of the installer (e.g. certified installer) and to specific technical guidelines. |
| ‘appropriate adjustment’ | ‘Adjustment’ refers to post-installation test of the system in order to check that the system operates properly, and to ultimate fine-tuning before the system operates under real conditions. |
| ‘appropriate control’ | This category mostly applies to technical building systems that are controlled (e.g. heating systems) than to BACS, whose main purpose is to control other systems. However, ‘appropriate control’ can refer here to the functions that a BACS can offer in order to support or facilitate human control, i.e. providing data for functions that would require third party testing to assess whether controls are working all the time as intended. |

1. Directive 2010/31/EU of the European Parliament and of the Council of 19 May 2010 on the energy performance of buildings. [↑](#footnote-ref-1)
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. [↑](#footnote-ref-2)
3. The focus was already on built-in lighting in the former EPBD (see Annex I, which required to take into consideration ‘built-in lighting installation’ in the methodology for calculating the energy performance of buildings). This is also consistent with the consideration of ‘built-in lighting’ as part of the energy uses which have an impact on energy performance of buildings in Annex I of the revised EPBD. [↑](#footnote-ref-3)
4. Member States will need to decide how to transpose the notion of ‘on-site’ in the case where the system is not in or on the building. The fact that the electricity generation system shares (or not) the same connection to the electricity grid should generally help in the distinction between on- and off-site systems. [↑](#footnote-ref-4)
5. The definition of ‘air-conditioning system’ was already provided in the former EPBD and has not been modified in the revised EPBD. The definition of ‘heating system’ is new in the revised EPBD. [↑](#footnote-ref-5)
6. The revised EPBD refers both to ‘heating system’ and to ‘system for space heating’ but these two terms are equivalent within the meaning of the Directive. [↑](#footnote-ref-6)
7. The revised EPBD refers both to ‘air-conditioning system’ and ‘system for space cooling’. These two terms are equivalent within the meaning of the Directive. [↑](#footnote-ref-7)
8. This mention was already included in the former EPBD. [↑](#footnote-ref-8)
9. This means that a cost-benefit assessment would be performed. This latter approach is probably the most relevant, as the application of requirements will generally pay back (in particular because they generate energy cost savings). [↑](#footnote-ref-9)
10. EN 15232 ‘Energy performance of buildings - Impact of Building Automation, Controls and Building Management’. [↑](#footnote-ref-10)
11. EN 15316-4-6 ‘Heating systems in buildings - Method for calculation of system energy requirements and system efficiencies - Part 4-6: Heat generation systems, photovoltaic systems’. [↑](#footnote-ref-11)
12. *Book: 2016 – Implementing the Energy Performance of Buildings Directive (EPBD) – Featuring Country Reports*, Concerted Action EPBD, 2016, <https://www.epbd-ca.eu/ca-outcomes/2011-2015> [↑](#footnote-ref-12)
13. ISO 16484-1:2010 Preview

    Building automation and control systems (BACS) -- Part 1: Project specification and implementation. [↑](#footnote-ref-13)