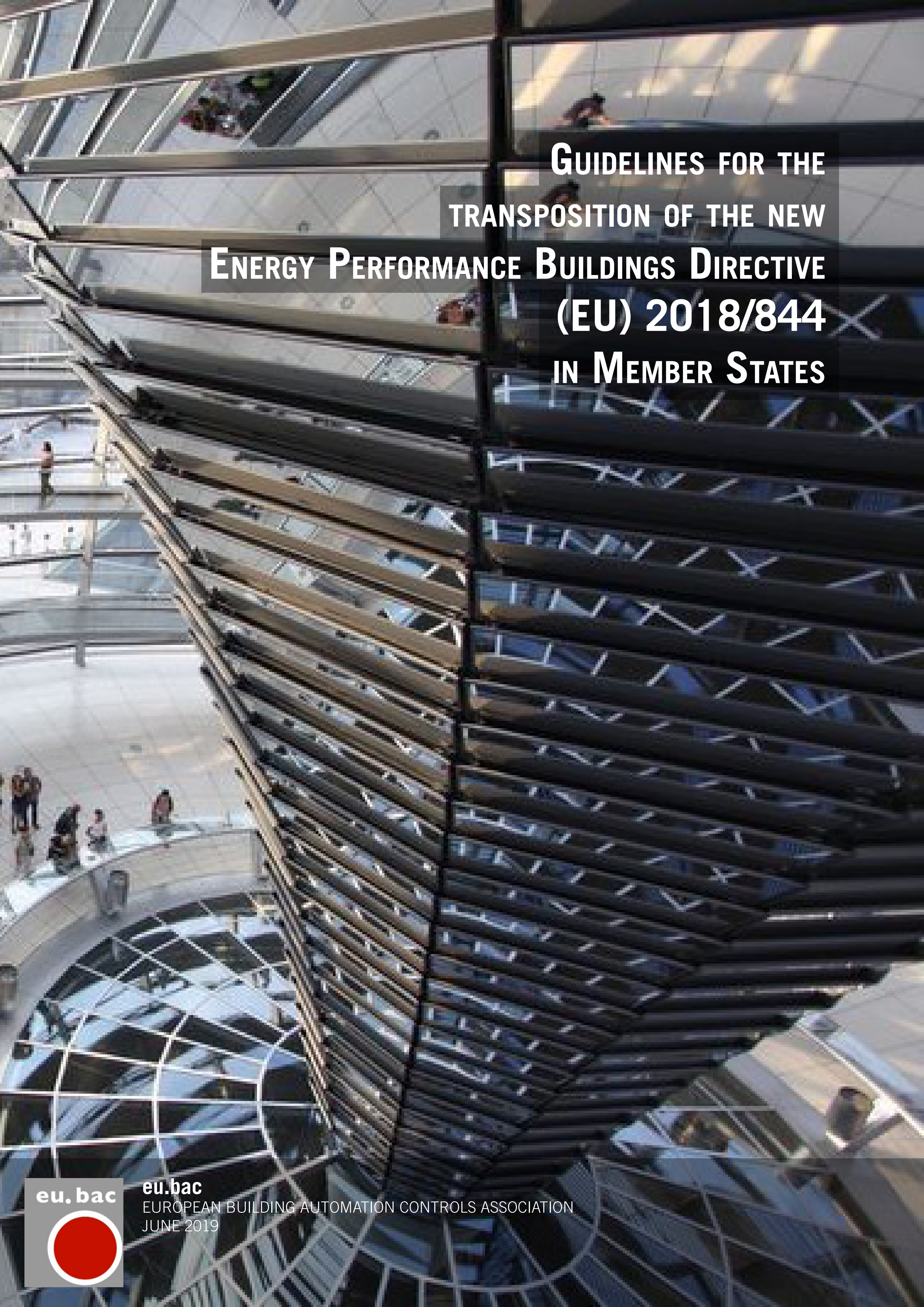

Guidelines for the transposition of the new Energy Performance Buildings Directive (EU) 2018/844 in Member States

eu.bac
EUROPEAN BUILDING AUTOMATION CONTROLS ASSOCIATION
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eu.bac european building automation controls association

SUMMARY OF GUIDELINES FOR THE TRANSPOSITION OF THE NEW ENERGY PERFORMANCE BUILDINGSDIRECTIVE (EU) 2018/844 IN MEMBER STATES

INTRODUCTION

The revised Energy Performance of Buildings Directive (Directive (EU) 2018/844) was approved on 30 May 2018 and entered into force on 9 July 2018.
All the Member States have time until 10 March 2020 to transpose this Directive into national legislation.
In the first days following the entry into force of this piece of legislation, eu.bac - the European Building Automation and Controls Association – decided to start drafting this guide, with the aim to provide technical guidance to all the stakeholders involved in the transposition process. This guide was therefore amended to consider and include all the relevant provisions of the Guidance Documents issued by the European Commission.
The new Directive includes several innovative elements that have the potential to address the market failures currently preventing the benefits of BACS being fully realised, and therefore achieving huge energy and CO2 savings, while empowering users to enhance their comfort and health. In order to achieve this potential, it is key that all policymakers are aware of what is at stake while, at the same time, knowing how to smoothly transpose and implement some articles that may look challenging at a first glance.
A smooth and ambitious implementation is even more essential, especially if we look at how this was done in the past (“The timid recommendations in Article 8 of the EPBD have not been sufficient to overcome barriers preventing the integration of technical progress on key enabling technologies for ‘smart buildings” (EPBD Impact Assessment, 2.3.3. Market failures, page 15))
In this context, we hope that the eu.bac guidelines could be an effective and helpful tool, in order to provide technical support to the Member States for the transposition and implementation of the Directive.
Should you need any further information, please do not hesitate to contact us (find contacts and more info in the section “about eu.bac” in the back cover), we will be happy to help you.

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BACS IN THE NEW EPBD

SUMMARY OF EU.BAC'S SUGGESTIONS FOR TRANSPOSITION

1

Mandatory requirements for installation and retrofit of Building Automation and Control Systems (BACS) in non-residential buildings (existing and new) with effective rated output of over 290 kW by 2025, where technically and economically feasible (Art.14/15).

BACS CAPABILITIES
All buildings in scope must be equipped with BACS by 2025. Only BACS with capabilities defined in Art. 14/15 par.4 are needed to fulfill this requirement. An example of compliance would be: rooms that are designed for continuous occupancy during operating hours have controls equipment that meet at least EN 15232 level B class, while other rooms meet at least level C and dynamic hydronic balancing capabilities according to EN 15316-2.

DOCUMENTATION
Each Member State needs to put in place a system to comply with this requirement and keep track of the implementation.

EXEMPT FROM INSPECTIONS
All buildings equipped with these capabilities must be exempt from mandatory inspections of heating/air-co systems: each MS need to put in place a system to comply with this provision.

IMPACT
Annual energy savings up to 20.3% of all EU service sector building energy consumption (49.7 Mtoe).

COSTS AND SAVINGS
Low-capital investment (30 €/m2), payback 2-3 years, returns 9 times higher than investments.

2

Existing and new multifamily buildings equipped with BACS exempt from mandatory inspections of heating/air-conditioning systems (Art.14/15)

BACS CAPABILITIES
Only BACS with capabilities defined in Art. 14/15 par.5 are eligible for fulfilling this requirement.

DOCUMENTATION
All buildings equipped with these BACS must be exempt from mandatory inspections of heating/air-co systems: each MS need to put in place a system to comply with this provision.

IMPACT
Annual energy savings up to 23.4% EU residential building energy consumption (98.1 Mtoe).

COSTS AND SAVINGS
Low-capital investment (12 €/m2), payback 2-3 y, returns 9 times higher than investments.

BACS IN THE NEW EPBD

SUMMARY OF EU.BAC'S SUGGESTIONS FOR TRANSPOSITION

3

Requirements for the installation of self-regulating devices in new buildings and alongside the replacement of heat generators in existing buildings, where technically and economically feasible (Art.8)

SELF-REGULATING DEVICES

Individual room temperature controls should be installed for new systems (heating or cooling) and when heat generators are replaced (heating only). Typical devices would be TRVs on radiators.

DOCUMENTATION

Member States are required to define the infrequent circumstances where such installations may not be technically and economically feasible. For example, "Economic feasibility generally relates to the upfront price (including installation) and the running costs of self-regulating devices and, to how these costs compare to the expected benefits and other costs borne by the investor".

IMPACT

Annual energy savings up to 160 TWh, 29 Mt CO_2.

COSTS AND SAVINGS

Low-capital investments (1.5 €/m2), payback less than 2 years, returns 7 times higher than investments.

4

Optimization of performance of Technical Building Systems (TBS), under typical or average (real-life) part load operating conditions including dynamic hydraulic balancing

NEW DEFINITION OF TBS

Building Automation and Control Systems are now included and all the existing provisions in the Member States implementing EPBD Art. 8 on optimization of TBS must be expanded also to BACS. In the new EPBD there's also a definition of BACS according to European Standards, which could be included in National Legislation as well.

IMPLEMENTATION VIA CHECKLIST

Overall system optimization under dynamically varying typical operating conditions is achieved by ensuring that systems are equipped with relevant subsets of a list of capabilities applicable to HVAC systems. These capabilities optimize HVAC system energy and comfort performance under actual building use conditions, by ensuring that each part/room of the building uses only the minimum amount of energy, at the right time, at the right place, to provide the indoor conditions chosen by the occupants.

ARTICLE 2
DEFINITIONS

ARTICLE 2

DEFINITIONS

Paragraph 3 – BACS included among
“Technical Building Systems (TBS)” :

‘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, or a combination thereof, including those systems using energy from renewable sources, of a building or building unit’

PRACTICAL CONSEQUENCES

The inclusion of BACS (here meaning all BACS falling in the scope of the broad definition under paragraph 3a) among the TBS is of outmost importance, in particular with a view to the optimization of TBS under Art. 8.1 (more info from page 14 onwards). It means that every time the EPBD text (and all the national legislations implementing it) refers to TBS, it also refers to BACS. The Member States will have to transpose this element and put in place policies to extend the existing ones (applying already to the other TBS) also to BACS.

Paragraph 3a – **Definition of BACS**:

'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'

PRACTICAL CONSEQUENCES

The definition of BACS is introduced in accordance to what already in scope of the existing relevant standards: EN ISO 16484-2 and EN 15232/16497. It is a general, wide definition that will have to be included also in the national legislations by the Member States. It is important for the Member States to include this definition in their legislation, making a clear distinction between these BACS (that are now a Technical Building System, with all the relevant consequences) and the subgroup of these BACS that fall under the scope of Art. 14/15.
In a nutshell, all BACS in scope of this definition in Art. 2, par. 3a, are Technical Building Systems, but only the ones among them that deliver those capabilities listed in Art. 14 and 15 par. 4 are eligible for the mandatory installation of BACS under the same articles (more info at page 42) and for the exemption from regular inspections (more info at page 54).

ARTICLE 8

“TBS”

TECHNICAL BUILDING SYSTEM

ARTICLE 8

TECHNICAL BUILDING SYSTEM “TBS”

Paragraphs 1 and 9
Optimization of the energy use of TBS:

PARAGRAPH 1

Member States shall, for the purpose of optimising the energy use of technical building systems, set system requirements in respect of the overall energy performance, the proper installation, and the appropriate dimensioning, adjustment and control of the technical building systems which are installed in existing buildings. Member States may also apply these system requirements to new buildings.
System requirements shall be set for new, replacement and upgrading of technical building systems and shall be applied in so far as they are technically, economically and functionally feasible.

PARAGRAPH 9

Member States shall ensure that, when a technical building system is installed, replaced or upgraded, the overall energy performance of the altered part, and where relevant, of the complete altered system is assessed. The results shall be documented and passed on to the building owner, so that they remain available and can be used for the verification of compliance with the minimum requirements laid down pursuant to paragraph 1 and the issue of energy performance certificates. Without prejudice to Article 12, Member States shall decide whether to require the issuing of a new energy performance certificate.

RECITAL (35)

According to the Commission's impact assessment, provisions concerning the inspections of heating systems and air-conditioning systems were found to be inefficient because they did not sufficiently ensure the initial and continued performance of those technical systems. Even cheap energy efficiency technical solutions with very short payback periods, such as hydraulic balancing of the heating system and the installation or replacement of thermostatic control valves, are insufficiently considered today. The provisions on inspections should be amended to ensure a better result from inspections. Those amendments should place the focus of inspections on central heating systems and air-conditioning systems, including where those systems are combined with ventilation systems. Those amendments should exclude small heating systems such as electric heaters and wood stoves when they fall below the thresholds for inspection pursuant to Directive 2010/31/EU as amended by this Directive.

RECITAL (36)

When carrying out inspections and in order to achieve the intended building energy performance improvements in practice, the aim should be to improve the actual energy performance of heating systems, air-conditioning systems and ventilation systems under real-life use conditions. The actual performance of such systems is governed by the energy used under dynamically varying typical or average operating conditions. Such conditions require at most times only a part of the nominal output capacity, and therefore inspections of heating systems, air-conditioning systems and ventilation systems should include an assessment of the relevant capabilities of the equipment to improve system performance under varying conditions, such as part load operating conditions.

RELATED ARTICLES 14(1), SECOND SENTENCE, AND EQUIVALENT FOR ARTICLE 15(1)

The inspection shall include an assessment of the efficiency and sizing of the heat generator compared with the heating requirements of the building and, where relevant, consider the capabilities of the heating system or of the system for combined space heating and ventilation to optimise its performance under typical or average operating conditions.

RECOMMENDED APPROACH / LIST OF CAPABILITIES

Overall system optimization under dynamically varying typical operating conditions is fundamental for a successful energy transition in buildings.
In this regard, too often overlooked, the new Directive and the Guidance Document of the European Commission provide Member States with several details on how to turn words into actions.

For this purpose, according to Art. 8, par.1, Member States shall set system requirements, in respect of some elements of the TBS: overall energy performance, proper installation, appropriate dimensioning, appropriate adjustment and appropriate control.

As we saw in the previous pages, BACS are one of the two new TBS introduced in the revised EPBD (together with on-site electricity generation systems).
In order to facilitate the transposition and implementation of this article, the European Commission, in its Guidance Document, included a table with possible interpretations of how these requirements can be concretely achieved in the BACS field.

TYPE OF REQUIREMENT	POSSIBLE INTERPRETATIONS FOR BACS	USEFUL REFERENCES
'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) and on some characteristics of buildings (e.g. surface area).	**EN 15232, EN 16947-1:2017 and TR 16947-2**
'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, operation and maintenance requirements, 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.	**ISO 16484-1:2010**

TYPE OF REQUIREMENT	POSSIBLE INTERPRETATIONS FOR BACS	USEFUL REFERENCES
‘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.	**EN 16946-1:2017 and TR 16946-2**
‘appropriate dimensioning’	Adjustment’ refers to post-installation test of the system in order to check that the system operates properly, and to fine-tuning when the system operates under real conditions. Such actions would generally require human intervention, but BACS give the opportunity to also consider ongoing commissioning approaches, where this process is partially automated.	**EN 16946-1:2017 and TR 16946-2; ISO 50003**
‘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 (e.g. display of consumption data or any other interaction with building operator and building occupants).	**EN 15232, EN 16947-1:2017 and TR 16947-2**

In the first column of the above table there are the requirements as established by the Directive: it is important to highlight that Member States shall set these system requirements for all “the technical building systems which are installed in existing buildings”, it is mandatory. Therefore, with the BACS (as defined in paragraph 3a) included among TBS, another duty of each Member State when transposing and implementing this Directive is to apply these requirements also to BACS in existing buildings, irrespective of the size or nature of the building.
The mandatory requirement apply to existing buildings, but Member States may decide to apply these requirements also to new buildings – and this option is highly suggested; if there’s such an ambition concerning existing buildings, not having it in new buildings would cause loopholes.
These provisions will be triggered when a technical building system is installed, replaced or upgraded and “in so far as they are technically, economically and functionally feasible”.

The Commission makes it clear, in its Guidance document, that each Member State must ensure that these cases are "clearly identified, framed and justified" and that the interpretation of the feasibility "must not be left to the sole judgement of owners or system installers".
As said, optimization of the energy performance of technical buildings systems is one of those areas that was often disregarded by Member States: for this reason the European Commission not only provided these details concerning the interpretation for new TBS such as BACS, but also specified how these requirements can be interpreted for the existing TBS, adding that "the transposition of the revision can be an opportunity to update these requirements".
It is also interesting to look at that possible interpretation that the Commission is giving of these requirements applied to systems for space heating, space cooling and ventilation.

Type of requirement	Possible interpretations for systems for space HEATING	Useful references
'overall energy performance'	In this context, overall performance refers to the performance of the whole process of energy transformation in heat generators, heat distribution across the building, heat emission in individual rooms or spaces of the building and, where applicable, heat storage. In particular, it is not limited to performance of heat generators and can include requirements that affect other parts of the system (e.g. insulation of distribution piping network).	EN 15316 standard series, e.g. EN 15316-1, EN 15316-2, EN 15316-3, EN 15316-4-1, EN 15316-4-2, EN 15316-4-5, EN 15316-4-8, EN 15316-5
'appropriate dimensioning'	For heating systems, 'appropriate dimensioning' would refer to the determination of heating needs, taking into account relevant parameters (in particular intended usage of the building and its spaces) and to the translation of these requirements into design specifications for heating systems.	EN 12831-1, EN 12831–3, Module M8–2, M8–3EN 12828 EN 14337, EN 1264-3:2009
'proper installation'	Proper installation refers to the need to ensure the system will be able to operate in accordance with design specifications. Ensuring proper installation can rely e.g. on national technical guidelines, products manufacturer documentation, certification of installers.	EN 14336, EN 1264-4, EN 14337
'appropriate adjustment'	Adjustment refers here to the test and fine-tuning of the system under real-life conditions, in particular to check and possibly adjust system functions that can have an important impact on performance (e.g. control capabilities – see below).	EN 15378-1, EN 14336, EN 15378–3
'appropriate control'	Concerns control capabilities that heating systems can include in order to optimize performance, e.g. automatic adaptation of heat output of emitters in individual rooms or spaces, adaptation of system temperature based on outside temperature ('weather compensation') or time schedules, dynamic and static hydronic balancing, system operation monitoring, adjustment of water / air flow depending on needs, etc.	EN 15500-1, EN 15316-2, EN 15232, space heater energy labelling regulations

Type of requirement	Possible interpretations for systems for space COOLING	Useful references
'overall energy performance'	In this context, overall performance refers to the performance of the whole process of energy transformation in cooling generators, cooling distribution across the building, cooling emission in individual rooms or spaces of the building and, where applicable, cool storage. In particular, it is not limited to performance of cooling generators can include requirements that affect other parts of the system (e.g. insulation of distribution piping network).	EN 16798 standard series on cooling systems, e.g. EN 16798–9, EN 16798–13, EN 16798–15
'appropriate dimensioning'	Dimensioning refers to the optimal sizing of the cooling system with regard to the cooling needs of the building and its spaces.	EN 1264-3:2009
'proper installation'	Proper installation refers to the need to ensure the system will be able to operate in accordance with design specifications. Ensuring proper installation can rely e.g. on national technical guidelines, products manufacturer documentation, certification of installers.	EN 1264-4
'appropriate adjustment'	Adjustment refers here to the test and fine-tuning of the system under real-life conditions73, in particular to check and possibly adjust system functions that can have an important impact on performance (e.g. control capabilities – see below).	EN 16798–17
'appropriate control'	Concerns control capabilities that systems for space cooling can include in order to optimize performance, e.g. automatic adaptation of cooling output of emitters in individual rooms or spaces.	EN 15500-1, EN 15316-2, EN 15232

Type of requirement	Possible interpretations for systems for space VENTILATION	Useful references
‘overall energy performance’	The energy performance of the ventilation system as a whole, taking into account e.g. fans energy efficiency, the characteristics of the ventilation duct network, heat recovery, etc.	EN 16798–3, EN 16798–5–1, EN 16798–5–2
‘appropriate dimensioning’	Dimensioning refers to the optimal sizing of the ventilation system with regard to the ventilation needs of the building and its spaces.	EN 16798-7, CEN/TR 14788, CR 1752
‘proper installation’	Proper installation refers to the need to ensure the system will be able to operate in accordance with design specifications. Ensuring proper installation can rely e.g. on national technical guidelines, products manufacturer documentation, certification of installers.	N/A
‘appropriate adjustment’	Adjustment refers here to the test and fine-tuning of the system under real-life conditions, in particular to check and possibly adjust system functions that can have an important impact on performance (e.g. control capabilities – see below).	EN 12599, EN 16798-17, EN 14134
‘appropriate control’	Concerns control capabilities that ventilation systems can include in order to optimize performance, e.g. airflow modulation.	EN 15232, EN 15500-1

In light of this, it would therefore be wise for Member States to take this opportunity (introducing requirements for optimizations of BACS) to review and update the requirements of space heating, space cooling and ventilation, fulfilling the requirements listed in the above table.
Some Member States are already following a check-list approach that could be further used to include all the capabilities listed in the tables above.
Eu.bac agrees with the above lists and believes the Member States should strictly follow these suggestions provided by the European Commission.

Without prejudice to this, eu.bac drew up a list of the capabilities (in most of the cases already included in the above lists) that cannot be missing, in order to ensure system optimization under dynamically varying typical operating conditions:

1. Capability of the heat or cool generator system, or ventilation air handling unit, to vary the heating/cooling power or fresh air output upon signals from the control system / demand signals from the emission spaces – so called "modulation" of the output

2. Capability of the HVAC system to vary energy distribution according to actual demand (e.g. capability of the pumps, compressors and fans to adjust water/refrigerant/air flows and temperatures to actual needs)

3. Capability of the control system to automatically modulate and adapt the output of heat or cool emitters – e.g. radiators or a fan coil unit – to match actual and desired room temperature in individual rooms of the building – so called individual room temperature control based on various parameters such as room temperature / occupancy

4. Capability of the control system to adapt space heating and cooling energy output to outdoor temperatures – so called weather compensation

5. Capability of the control system to automatically adjust humidity level – so called humidification or de-humidification

6. Capability of the control system to manage automated solar protection to ensure the correct level of HVAC / avoid unnecessary cooling and glare protection depending on natural solar gains or overheating depending on seasons

7. Capability of the control system to manage artificial lighting level depending on natural light through automated solar protection

8. Capability of the control system to coordinate systems that are integrated in order to facilitate energy efficiency and smooth operation (e.g. scheduler and setpoint manager for rooms covering all installed services (e.g. heating, cooling, ventilation, light and sun protection))

9. Capability of the control system to avoid simultaneous heating and cooling at the same time in the same room / space through any installed system (e.g. ventilation and heating)

10. Capability of the HVAC / hydronic system to ensure smooth distribution of energy across the building in water-based heating, air conditioning and cooling systems – so called dynamic hydronic balancing

11. Capability of the control system to support monitoring operation and changes in the system – in particular setpoints and schedules of room systems and equipment

These capabilities optimize HVAC system's energy and comfort performance under actual building use conditions, by ensuring that each part/room of the building uses only the minimum amount of energy, at the right time, at the right place, to provide the indoor conditions chosen by the occupants. Some of the system capabilities are covered partly by eco-design and energy labelling for energy-related products for Space heaters, Air heating and cooling products, Circulators, and Ventilation units. However, although product performance e.g. of space heaters is tested under parts of nominal energy input, test conditions assume optimized system characteristics, such as an optimal return temperature. System capabilities above ensure that actual operating conditions are close to assumed test conditions, so that expected energy performance improvements are achieved in practice.

The following structure for implementing Article 8(1), with the aim at optimizing performance under typical operating conditions, was taken in some Member States:

- appropriate subsets of capabilities are defined depending e.g. on the characteristics of installed heat and cool generators and emitters (e.g. radiators, surface heating/cooling, fan-coil) and ventilation systems, taking into account expected cost-effectiveness;

- appropriate trigger points for retrofit of capabilities in existing buildings are defined. They have to ensure appropriate control and adjustment is provided at least for those building renovation situations that result in fundamental changes to the operating conditions for technical building systems. Replacement of heat or cool generator is the fundamental trigger, as the already low additional cost is optimized, and expected/declared performance improvements from investments into a new heat/cool generator is helped to be achieved in practice. Additional triggers are replacement of heat or cool emission systems;

- another set of trigger points are extensions, renovations that both include construction shell and windows. Since these activities change the loads and thermal dynamics and e.g. air tightness of the building they shall be considered trigger points as well.

ASSESSMENT EX ART. 8.9

WHEN IS IT LIMITED TO THE ALTERED PART AND WHEN SHOULD IT BE EXTENDED TO THE COMPLETE ALTERED SYSTEM? WHAT DOES "COMPLETE ALTERED SYSTEM" MEAN?

Paragraph 9

Member States shall ensure that, when a technical building system is installed, replaced or upgraded, the overall energy performance of the altered part, and where relevant, of the complete altered system is assessed. The results shall be documented and passed on to the building owner, so that they remain available and can be used for the verification of compliance with the minimum requirements laid down pursuant to paragraph 1 and the issue of energy performance certificates. Without prejudice to Article 12, Member States shall decide whether to require the issuing of a new energy performance certificate.

First of all, as written in the EPBD text and clearly stated by the European Commission in its guidelines, “in all cases, the performance of the altered part has to be assessed and documented”.
“In all cases” means all cases when a technical building system is installed, replaced or upgraded: as BACS is now included among the TBS this means that when a BACS is installed, replaced or upgraded, the performance of the altered part must be assessed and documented (more details in the following chapter on this).
In addition to this - “where relevant” – the scope of the assessment must be not only that of the altered part but that of the complete altered system.
The European Commission clearly indicates the cases where it is relevant:

1.	2.	3.
a new system is installed	a whole system is replaced	A part, or parts, of a system undergo a major upgrade that can significantly affect the overall performance of the system

It can therefore be concluded that, whenever a BACS is installed or replaced, the assessment should regard the “complete altered system”. In any case, it is up to the Member States 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.

eu.bac believes that there are certain cases in which the new TBS has such an important impact on the system that it is worth assessing its impact on the overall energy system, such as:

1. additions of technical systems service full or for a part of a building (e.g. cooling system)
2. changes of windows, building shell if changes are, for example,> 5% of the surface of that type
3. addition of a building service (e.g. cooling, ventilation) in, for example, at least 5% of the volume of the conditioned building
4. changes in the TBS service (e.g. hydronic system) that affect, for example, more than 5% of the volume of the conditioned building.
5. changes in the control subsystem of a service that affects scheduling, set point management or hard-wired interconnection with BACS (e.g. using dry contact(s))

The example of interventions that can trigger an assessment of the whole system performance, as provided by the European Commission in its Guidance Document, are:

1. 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;
2. 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;
3. Any upgrade or alteration that affects the balance of the system.

HOW SHOULD THIS ASSESSMENT BE DOCUMENTED IN ORDER TO MAKE IT WORK?

Art. 8 has the potential to trigger significant energy and cost savings via optimization of energy performance of technical building systems. To ensure effectiveness of the provision, it should be clarified that the documentation has to be provided independently from the EPC, as the scope of application and content are different. This could be realized through the inclusion of this information "as a separate entry" in the national energy performance database.

For the documentation under Article 8(9), and for inspections under Articles 14(1) and 15(1), a checklist-type approach can be taken, matching the structure of requirements set under Article8(1), to assess the status of installed system capabilities, and document compliance of system upgrades with applicable system requirements. Measurements are not needed.

Such an approach is taken e.g. in Germany, France and Denmark.

ARTICLE 8

TECHNICAL BUILDING SYSTEM "TBS"

Paragraph 1 (3rd subpar.)
Individual Room Temperature Control functionalities

Member States shall require new buildings, where technically and economically feasible, to be equipped with self-regulating devices for the separate regulation of the temperature in each room or, where justified, in a designated heated zone of the building unit. In existing buildings, the installation of such self-regulating devices shall be required when heat generators are replaced, where technically and economically feasible.

WHICH KIND OF DEVICES CAN FALL IN THE SCOPE OF THE DEFINITION "SELF-REGULATING DEVICES FOR THE SEPARATE REGULATION OF THE TEMPERATURE"?

All temperature control devices are 'self-regulating' in that they will sense the temperature and, in response, automatically adjust the heating output to maintain the desired temperature.
The key aspect of this requirement is that it needs to be done on a room by room basis and therefore the control must both monitor temperature and adjust heating output in each room.
This means in particular that, as explained by the European Commission in its guidelines:

> Any solution based on the manual regulation of heating output would not fulfil the requirements, even if the adjustment can be performed at room (or zone) level.

> Any solution that allows for the automatic regulation of temperature but not at room (or zone) level, e.g. automatic regulation at dwelling-level, would not fulfil the requirements.

Typical devices for individual room temperature control will depend upon the type of emitter in the room but the following would be the most common:

THERMOSTATIC RADIATOR VALVES (TRVS) for rooms heated by radiators as part of a hydronic system. These are fitted to a radiator where it connects to the pipework, replacing the unregulated manual valves unable to react to room temperature changes, that would otherwise be used to set up the system. They have a sensor to monitor the temperature of the room they are in and then automatically adjust the heat output of the radiator in response to this by opening or closing the valve.

ROOM THERMOSTAT for rooms heated by surface heating as part of a hydronic system. These will connect to the mixing valve for each room to adjust the flow temperature to the surface heating for that room, therefore automatically adjusting heat output into the room to maintain the setpoint temperature.

FAN COIL UNIT REGULATING DEVICES hat control water and airflows automatically, to maintain/achieve the desired room temperature.

INDIVIDUAL DEVICE CONTROLS for stand-alone heaters. Where rooms are heated by individual heaters that are not connected to a heat generator serving multiple rooms it is likely that these heaters would have in-built controls to maintain a set-point temperature in the room. Ecodesign requirements for local space heaters should ensure that all replacement electric panel heaters, for example, will incorporate such controls. However, in some circumstances it may be necessary to install a room thermostat wired into a local space heater to provide the self-regulating room temperature control.

WHERE IS IT TECHNICALLY AND ECONOMICALLY FEASIBLE?

The European Commission, in its guidelines, firstly clarifies how to interpret these terms:

> Technical feasibility generally refers to possible technical barriers that can prevent or make technically irrelevant the obligations,

> Economic feasibility generally relates to the upfront price (including installation) and the running costs of self-regulating devices and, to how these costs compare to the expected benefits and other costs borne by the investor. In the context of these provisions, only upfront price is relevant as running costs of self-regulating devices will be negligible.

Furthermore, the EC also adds that "In the vast majority of cases, the question of technical and economic feasibility will not apply for new buildings, as the need for temperature self-regulation at room (or zone) level can be addressed in the design phase (preventing any technical barrier in the subsequent steps and ensuring related costs are optimal)."

With regard to existing buildings, the technical feasibility is strictly related to the economic feasibility. It is always technically feasible but in limited cases the amount of substantial alteration to make it feasible can lead to prohibitive costs, according to the European Commission.

In this respect, the European Commission makes it very clear that each Member State "must clarify how the costs are calculated and how they are compared": these parameters must be clearly identified in the regulation transposing the EPBD into national legislation.

The preferable approach to do this, in the view of the European Commission, is "Comparing the upfront costs of self-regulating devices to the expected energy cost savings resulting from the installation of these devices, and setting a threshold on a maximum payback period (e.g. 5 years)".

This is the most effective option in the pursuit of the aims of this amendment, as it would ensure the installation of technologies (whose payback is 2-3 years) that are able to maximize the health and comfort of the occupants, while at the same time securing energy and costs savings.

The alternative option proposed in the text is "comparing the upfront costs of self-regulating devices to the costs of the replacement of the heat generators and setting a threshold on the maximum ratio between the two". The Recital 21 of the new EPBD, for example, says that the installation of self-regulating device could be deemed economically feasible where the cost of it is less than 10 % of the total costs of the replaced heat generators.

We believe that this parameter is not the right one: return on investments and payback are criteria that are often most suitable that CAPEX, because the absolute amount of additional investment is low.

For example, for radiator-based systems, irrespective of climate conditions, the economic feasibility of heat generators exchange, coupled to installation of self-regulating devices, is always superior to the economics of heat generators exchange alone.

The economic feasibility is further enhanced by a systematic heating system optimization for typical dynamically varying operating conditions such as dynamic hydronic balancing, weather compensations, setback functionalities.

Where the BACS functionalities under Art. 14 and 15 par. 4 are installed, according to the criteria laid down at page 49 of this document, requirements under this Article for self-regulating devices are deemed as fulfilled.

The following, taken from the European Commission Guidance Document, clearly summarize the EC's view on this topic:

TYPE OF FEASIBILITY	HOW IT CAN TRANSLATE	CAN APPLY TO New Buildings	 Existing Buildings
Technical feasibility	The room (zone) has no heating / cooling.	✓ (but rare)	✓ (but rare)
	The heating system makes it impossible to install self- regulating devices.	✗	✓ (but not frequent)
Economic feasibility	The upfront costs are too high compared to other costs.	✗	✓ (but not frequent)
	The investment cannot be sufficiently recovered.	✗	✓ (but rare)

WHERE IS IT JUSTIFIED TO USE A DESIGNATED HEATED ZONE OF THE BUILDING UNIT INSTEAD OF INDIVIDUAL ROOMS?

The concept of "heated zone" is the opposite of "individual": all the benefits, especially the huge potential savings, are linked to control individual rooms.
Without individual control it is not possible to optimize the consumption and comfort. Just as indication, each degree of room temperature corresponds to energy use difference of about 6%-7%.
Therefore, in residential buildings, installation of equipment controlling designated heated zone instead of single rooms is not justified.
The application of "designated heated zone" should be therefore limited only to non-residential buildings, for room of equivalent type and usage, when no additional energy savings can be achieved in a "room by room – zoning".

IN SUMMARY, WHAT ARE THE EFFECTS OF THIS AMENDMENT?

Member States have until 10 March 2020 to transpose this provision into national legislation. In any case, no later than 10 March 2020 (and excepted the rare cases of technical/economical unfeasibility):

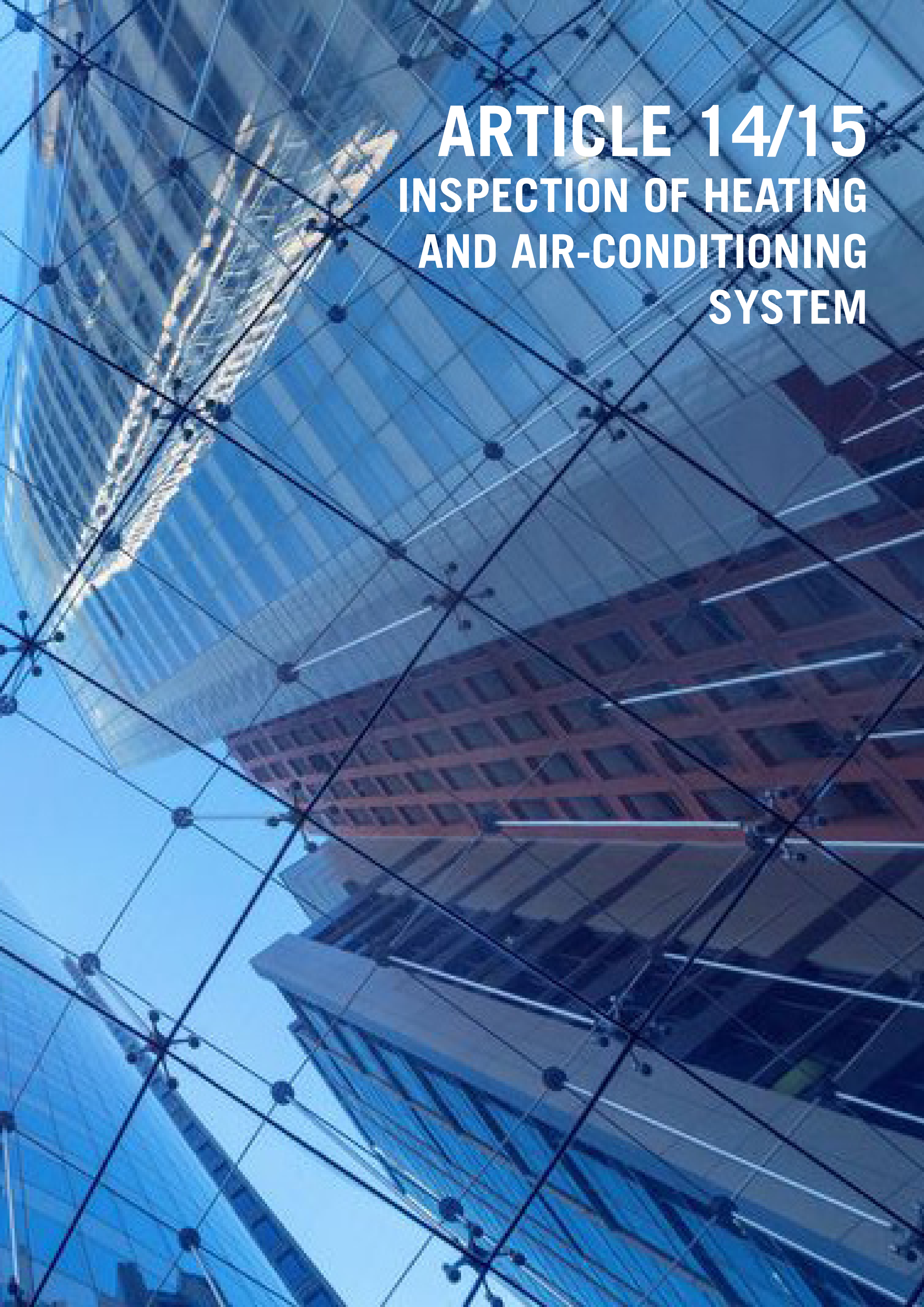
Every new building will have to be equipped with self-regulating devices by the transposition deadline. This must be ensured in the case of buildings for which permit applications are submitted after the transposition deadline.

All existing buildings whose heat generators are replaced as from the date of the national transposition of these obligations will have to be equipped with self-regulating devices.

Member States should advertise these requirements sufficiently in advance for professionals to take them into account early enough in the design of new buildings, and in the preparation of the replacement of heat generators in existing buildings.

ARTICLE 14/15

INSPECTION OF HEATING AND AIR-CONDITIONING SYSTEM



ARTICLE 14/15

INSPECTION OF HEATING AND AIR-CONDITIONING SYSTEM

Paragraph 1 (subpar. 1 and 2)
Inspection of heating system

Member States shall lay down the necessary measures to establish regular inspections of the accessible parts of heating systems or of systems for combined space heating and ventilation, with an effective rated output of over 70 kW, such as the heat generator, control system and circulation pump(s) used for heating buildings. The inspection shall include an assessment of the efficiency and sizing of the heat generator compared with the heating requirements of the building and, where relevant, consider the capabilities of the heating system or of the system for combined space heating and ventilation to optimise its performance at typical or average operating conditions.

Where no changes have been made to the heating system or to the system for combined space heating and ventilation or to the heating requirements of the building following an inspection carried out pursuant to this paragraph, Member States may choose not to require the assessment of the heat generator sizing to be repeated.

WHAT DOES IT MEAN "REGULAR"? HOW OFTEN SHOULD THE INSPECTION BE PERFORMED? WHY THE "BACS ALTERNATIVE" IS PREFERABLE?

eu.bac's suggestion for the EPBD revision was to include more details on how regular the inspection should be. "Traditional" heating/air-conditioning/ventilation systems can be subject to several internal or external "events" affecting their efficiency without alerting the owner, with potential subsequent negative impacts on all the other technical building system. It is therefore suggested that the inspections are performed each year. Among the new elements concerning inspections, the revised Directive introduces alternative measures to them, provided that these alternatives achieve equivalent results. One of these alternatives regards those BACS that are able to deliver those capabilities listed in Art. 14 and 15 par. 4/5:

A continuously monitoring, logging, analysing and allowing for adjusting energy usage;

B benchmarking the building's energy efficiency, detecting losses in efficiency of technical building systems, and informing the person responsible for the facilities or technical building management about opportunities for energy efficiency improvement; and

C allowing communication with connected technical building systems and other appliances inside the building, and being interoperable with technical building systems across different types of proprietary technologies, devices and manufacturers.

Looking at Art. 14's BACS as an alternative to inspections, we see that the benefits of this option, compared to regular inspections, are multiple: ongoing supervision ofsystem performance, holistic system approach, continuous fine-tuning to the building needs, analysis and reporting of system operation in actual real-time use conditions, digitalization of technical building management, ability to interact with the digital grid, access to online information, better adaptation to actual use.
For this reason, the option of choosing BACS over inspections should be incentivized by Member States, both in non-residential and residential buildings, and the need for Member States to make the inspections as stringent as possible should be highlighted, including the element covered by the inspections.

WHAT ARE THE CAPABILITIES OF THE HEATING/AIRCO/VENTILATION SYSTEMS TO OPTIMIZE ITS PERFORMANCE AT TYPICAL OR AVERAGE OPERATING CONDITIONS? WHERE IS IT RELEVANT TO CONSIDER THEM?

According to Recital 36 of the revised EPBD:

"When carrying out inspections and in order to achieve the intended building energy performance improvements in practice, the aim should be to improve the actual energy performance of heating systems, air-conditioning systems and ventilation systems under real-life use conditions. The actual performance of such systems is governed by the energy used under dynamically varying typical or average operating conditions. Such conditions require at most times only a part of the nominal output capacity, and therefore inspections of heating systems, air-conditioning systems and ventilation systems should include an assessment of the relevant capabilities of the equipment to improve system performance under varying conditions, such as part load operating conditions."

Member States must update their legislation to ensure that this performance assessment (of the capabilities of the heating system to optimize its performance under typical or average operating conditions) is included in the scope of inspections.

We believe that measuring of system performance (e.g. in terms of overall kW) under a certain load condition is not appropriate, mainly because i) it is expensive, ii) a "typical" condition is arbitrary and cannot be defined, iii) typical conditions vary dynamically all the time, iv) optimized performance depends on capabilities that adapt performance to any condition typically occurring for a given building.

This approach is taken in several Member States, in EPB standards and in ecodesign/energy labelling, and within EPBD Articles 14 and 15. Some examples of appropriate capabilities can be found in the tables on page 22, regarding optimization of TBS.
Appropriate capabilities adapting building/TBS energy use to typical operating conditions and actual needs of occupants can be clustered in capabilities "acting" on :

1. energy "generation", e.g. central boiler, heat pump/chiller or district heating/cooling substation for space heating/cooling; air handling unit for ventilation,

2. energy distribution across the building, e.g. piping network for hot/cold water in hydronic heating or cooling systems),

3. energy emission per building room or zone, e.g. floor or radiator heating, fan coil units for heating/cooling, radiant panels for cooling.

ARTICLE 14/15

INSPECTION OF HEATING AND AIR-CONDITIONING SYSTEM

Paragraph 3
Advice to users

As an alternative to paragraph 1 and provided that the overall impact is equivalent to that resulting from paragraph 1, Member States may opt to take measures to ensure the provision of advice to users concerning the replacement of heat generators, other modifications to the heating system or to the system for combined space heating and ventilation and alternative solutions to assess the efficiency and appropriate size of those systems.
Before applying the alternative measures referred to in the first subparagraph of this paragraph, each Member State shall, by means of submitting a report to the Commission, document the equivalence of the impact of those measures to the impact of the measures referred to in paragraph 1.
Such a report shall be submitted in accordance with the applicable planning and reporting obligations.

WHAT NEEDS TO BE INCLUDED IN THIS ADVICE?

Recital (26) of the previous EBPD (2010) sets out that regular maintenance and inspection is needed to ensure maintained optimal performance of heating and air-conditioning systems. Missing inspection and maintenance leads to significant system deterioration and large unnecessary energy use .

Alternative measures should address the aspect of maintaining energy performance, with the objective to prevent deterioration of system performance of heat generators, including when newly installed, or heating systems. Obvious alternative solutions to assess the efficiency of heating and air-conditioning systems are the functionalities in articles 14(4) and 14(5), as well as 15(4) and 15(5).

The equivalence of the alternatives must be documented in a report that the Member States shall submit to the Commission as part of their integrated national energy and climate plans referred to in the Governance Regulation. Furthermore, the advice, by definition, should be specific to users and circumstances: it has to be on their system, it has to be distinct from information, which is generic. In this context, the advice needs to contain all the same details that the user would expect from an inspection.

Preventive maintenance of such equipment: The existence of a BACS with the mentioned features does not replace vendor suggested maintenance of equipment. Well-maintained equipment is a precondition to allow the control logic functioning. In time preventive maintenance will evolve to condition-based maintenance based on big data collected by BACS.

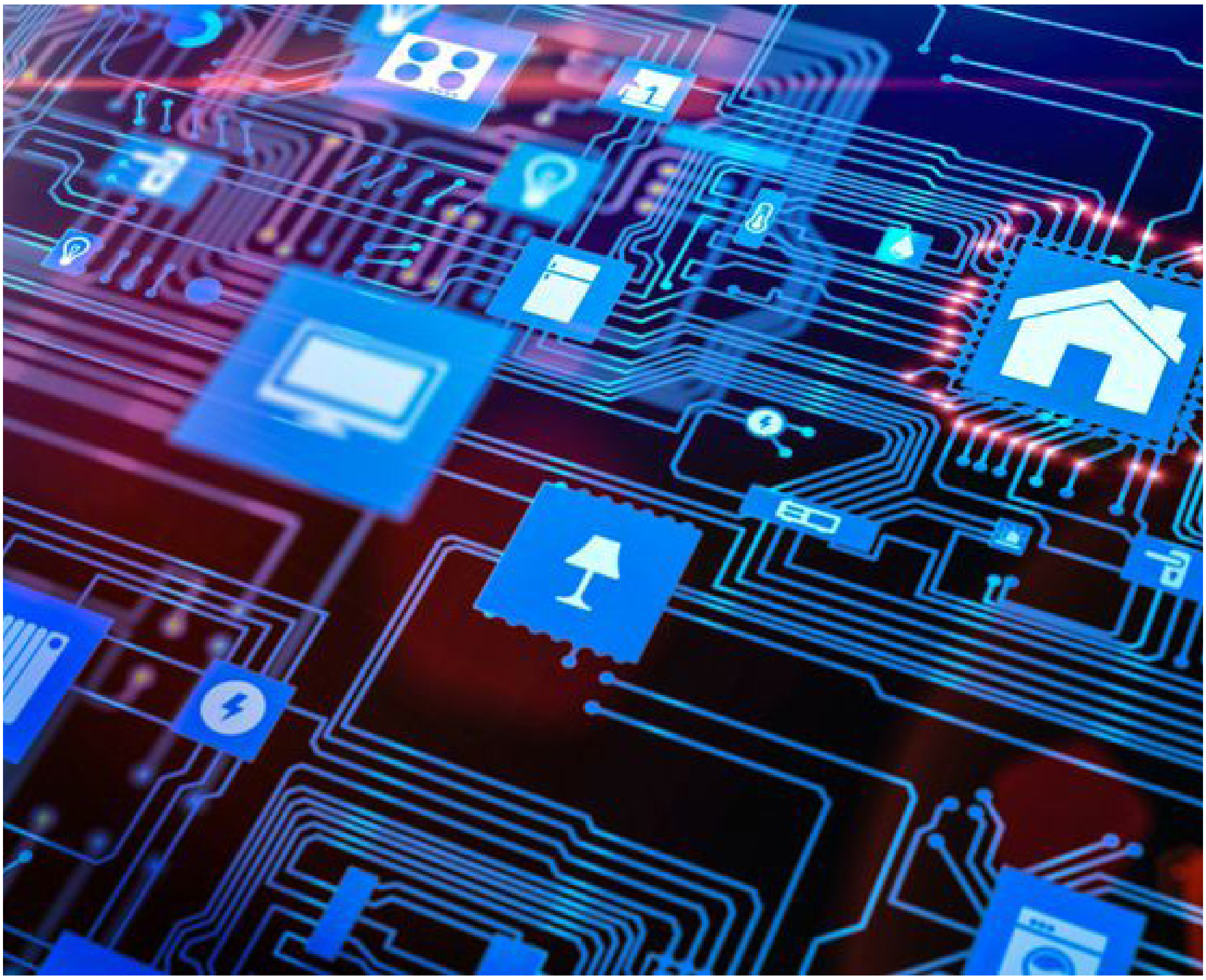
If the advice option is chosen, it must make specific recommendation on how to achieve efficiency against benchmarks. To ensure effectiveness, MS should hold a central record of those recommendations and have a process to check that recommendations have been implemented.
For equivalence with inspections, all buildings with appropriate size systems, should receive advice in the same period of years as regular inspections.

ARTICLE 14/15

INSPECTION OF HEATING AND AIR-CONDITIONING SYSTEM

Paragraph 4
Mandatory Requirements for BACS in non-residential buildings

Member States shall lay down requirements to ensure that, where technically and economically feasible, non-residential buildings with an effective rated output for heating systems or systems for combined space heating and ventilation of over 290kW are equipped with building automation and control systems by 2025.



HOW TO ESTABLISH THE EFFECTIVE RATED OUTPUT AND DECIDE WHICH BUILDINGS ARE IN THE SCOPE?

Firstly, the European Commission, in its guidelines, clarifies that the 290 kW threshold applies to each system individually, i.e. the obligations will apply in all of the following cases:

When the effective rated output of the heating system is above 290 kW;

When the effective rated output of the combined heating and ventilation system is above 290 kW;

When the effective rated output of the air-conditioning system is above 290 kW;

When the effective rated output of the combined air-conditioning and ventilation system is above 290 kW.

Where combined systems are in place, the effective rated output must reflect the capacity of the combination of systems.
The effective rated output corresponds to the maximum output (in kW) during operation, as stated by the manufacturer of the system:

Rated heat output for a heating system;

Rated cooling output for an air-conditioning system.

It should be a duty of the owner of the building to understand if his building falls in the scope of this measure or not (and in any case, it is suggested that Member States clearly give an indication on this in transposing this paragraph), while it is the duty of the Member State to enforce this measure and ensure compliance (on this, see paragraph below, on page 47). The main information for the building owner to understand if the building falls in the scope is clearly the “effective rated output for heating systems or systems for combined space heating and ventilation”. Nevertheless, in case of “mixed-use properties” it can also not be completely clear whether the building falls into the category “non-residential” or “residential”.

Our suggestion is to consider the "effective rated output" of the whole building and:

IF MORE THAN 290 KW and most (>50%) of the useful building floor area is used for non-residential purposes, apply the mandatory requirements for BACS only to the non-residential part of the building; for the residential part of the buildings, the relative provisions will apply (no mandatory requirements, unless decided differently by the Member State, but the buildings equipped BACS functionalities avoid physical inspections of heating/air-conditioning systems);

IF LESS THAN 290 KW, no mandatory requirements will apply, unless decided differently by the Member States

In its Guidance Document, the European Commission clarifies that when systems are integrated, the following three options are open to Member States:

1. Apply the requirements to the whole building,

2. Apply the requirements only to non-residential units,

3. Apply the requirements only to non-residential units if the associated 'non-residential' rated output is above the threshold.

The Commission also adds that, when systems are distinct (i.e. the non-residential units and the residential ones have different systems) and the effective rated output of the non-residential units' systems is above the threshold, requirements should apply at least to the non-residential units.

WHERE IS IT TECHNICALLY AND ECONOMICALLY FEASIBLE?

The European Commission, in its guidelines, firstly clarifies how to interpret these terms:

Technical feasibility generally refers to possible technical barriers that can prevent or make technically irrelevant the obligations,

Economic feasibility generally relates to the upfront price (including installation) and the running costs of BACS and, to how these costs compare to the expected benefits and other costs borne by the investor.

The cases where the installation of these BACS is not technically and/or economically not feasible are rare and these cases, according to the European Commission's guidance document, must be "clearly identified, framed and justified". In particular the interpretation of technical and economic feasibility must not be left to owners or to system installers.
This means that each Member State will have to include details on this in the legislation transposing this Directive into National legislation. With regard to new buildings the Commission itself, in its own Guidance document, says that "in the vast majority of cases, the issue of technical and economic feasibility will not apply for new buildings, as:

1. the design of buildings and systems can ensure that there is no technical barrier to the installation of BACS;

2. the design of buildings and systems can ensure that the costs for the installation of BACS will be minimized;

3. BACS are already part of common practices for new large non-residential buildings."

With regard to existing buildings and from a technical perspective, if there is any case in which there are difficulties to install BACS (e.g. if a subsystem – such as e.g. split unit - does not have local controls or, for example, if local controls does not provide input/output signal capabilities – such as minimum "dry contact" - to influence operation), it is likely to mean that the systems that are in place are very antiquated and likely to be very energy inefficient, and therefore the priority should be a new, state-of-the-art system.
Also with regard to existing buildings, economic feasibility can be linked, according to the European Commission, to the upfront and running costs and / or to the payback period of the investment required to install BACS.
BACS payback is average 3 years. This means that exceptional circumstances of a particular building would need to demonstrably increase the costs (or reduce benefits) before the economic feasibility would be an issue.
If we take a look at existing legislation, a possible relevant example could be 2017's Décret tertiaire" draft in France, which aimed at reducing the energy consumption of tertiary buildings of more than 2000m^2 of 25% by 2020, 40% by 2030, 50% by 2040, and 60% by 2050.

The Décret laid down obligations for buildings' owners and tenants to reduce the energy consumption of large non-residential buildings, by establishing an action plan following an energy study of the building. Two criteria for determining the economic feasibility of the investments within the action plan were established: threshold of maximum 200 €/ m^2 and maximum payback time of 10 years for public buildings, and 5 years for others (hotels, offices, etc.). Such an approach could be of inspiration for other Member States and BACSwould fit those criteria, as they are low capital investments, typically 30 €/m^2 in non-residential buildings, with a fast payback period, between 2 to 5 years.
The Décret was ultimately suspended by the Conseil d'Etat, as the deadline to achieve the target of 25% of energy consumption reduction by 2020 was considered as too short to be achieved by the parties concerned. However, the new law proposal for housing contains a specific article (55) on energy efficiency for tertiary buildings, setting the same targets energy consumption reduction than in the Décret tertiaire (40% by 2030, 50% by 2040, 60% by 2050). The same criteria could be used as a reference in this framework.

The following table, taken from the European Commission Guidance Document, clearly summarize the EC's view on this topic:

TYPE OF FEASIBILITY	HOW IT CAN TRANSLATE	CAN APPLY TO: New Buildings	CAN APPLY TO: Existing Buildings
Technical feasibility	The technical building systems cannot be controlled without substantial alterations	✗	✓ (but rarely)
Economic feasibility	The upfront costs are excessive compared to the building's characteristics.	✗	✓ (but rarely)
	The investment cannot be sufficiently recovered.	✗	✓ (but rarely)

HOW TO ENSURE THE COMPLIANCE WITH THIS MANDATORY REQUIREMENT FOR BACS?

While for new buildings it is easier to ensure compliance with these requirements (thanks to the provisions related to the Building Code) it would be more difficult to do this in the existing buildings.

According to the new Art.8, every time a new TBS (including, therefore, BACS) is installed, replaced or upgraded, the new energy performance should be assessed and documented. This documentation needed for Art. 8 (see our suggestions above) could be used also for checking the compliance with these mandatory requirements under Art. 14 and 15.

For existing buildings that already comply with the requirements under Art. 14/15 (and therefore do not have any documentations under Art. 8, as they did not have any installation, replacement or upgrade) a possibility for verifying the compliance with this requirement is to use a structure similar to the one that is currently used by Art. 16, Art. 18 and Annex II, on "reports on the inspection of heating and air-conditioning systems" and "independent control systems for energy performance certificates and inspection reports".
As in Annex II of the existing EPBD, the competent authorities (or bodies to which the competent authorities have delegated the responsibility for implementing the independent control system) shall make a random selection of at least a statistically significant percentage of BACS installed and subject this installation to verification.

Also, it would be advisable for Member States to provide immediate notification of the deadline (by 2025 all buildings in scope should be equipped with minimum BACS functionalities) and consider financial incentives for early adopters (see Art.10 EPBD/Art. 7 EED), with the enforcement of penalties for non-compliers.

ARTICLE 14/15

INSPECTION OF HEATING AND AIR-CONDITIONING SYSTEM

Paragraph 4
Functionalities of the mandatory BACS

The building automation and control systems shall be capable of:

A.

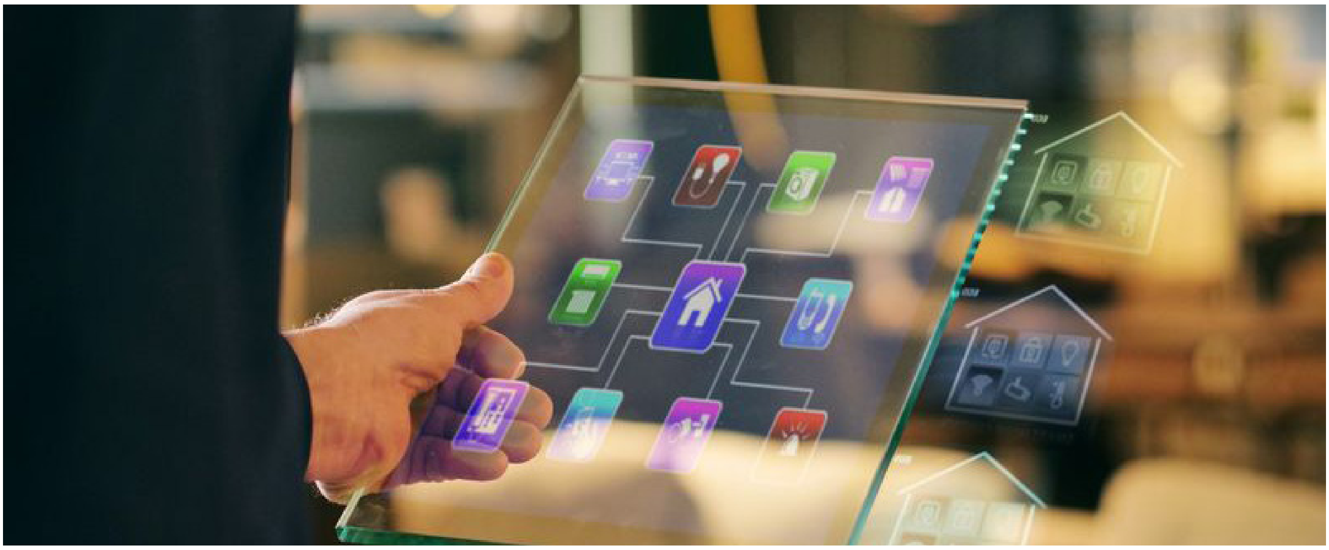
continuously monitoring, logging, analysing and allowing for adjusting energy usage;

B.

benchmarking the building's energy efficiency, detecting losses in efficiency of technical building systems, and informing the person responsible for the facilities or technical building management about opportunities for energy efficiency improvement;

C.

allowing communication with connected technical building systems and other appliances inside the building, and being interoperable with technical building systems across different types of proprietary technologies, devices and manufacturers.



HOW TO DEFINE IF A BACS HAS ALL THESE FUNCTIONS OR NOT?

The requirements of Art. 14 and 15 regard only certain BACS, in line with the definition in Art. 2, par. 3a, but also able to deliver certain functions. If a building is equipped with a BACS that is not able to deliver certain functionalities, it must be upgraded for this purpose. It is therefore key to find a parameter to distinguish the BACS that can deliver the above listed functions and those who are not. Conducting eu.bac System audit will provide an accurate assessment of the available BACS functionality in an existing building.

The European Standard EN15232 / 16947 (“Energy performance of buildings – Impact of Building Automation, Controls and Building Management”) has a list of functions with energy efficiency classes from A to D for each of the functions. Generally, a BACS with class B or above functions will meet the requirement for the mandatory BACS.

Rooms that are designed for continuous occupancy during operating hours shall have controls equipment that meet at least class B, according to EN15232 / 16947, while other rooms shall meet at least level C.

Level B classes and higher can talk to the primary or “generation and distribution” systems and ensure efficient energy flows. Supplying systems like boilers/chillers, air handlers supporting rooms with class B requirement (or mixed classes) shall meet the same class of controls. A building is considered to be occupied if at least one room/zone falls in the category “occupied”.

Another thing that needs to be taken into account is that only level B classes and higher also implies that local adjustments in rooms of e.g. temperature can be reset by the system, usually once or twice a day.

All the installed BACS shall avoid situations where heating and cooling are fighting against each other in same room.

For benchmarking the energy efficiency of the building, BACS will need to have access to monitored consumption data, in order to adjust the energy usage and to optimize the energy performance, which, for most consumers (e.g. terminal units), represents at least 60% of all the used energy.

Hydronic heating and cooling systems shall be dynamically balanced at heat/cool emitter level. This is a condition for optimizing performance of hydronic systems under typical or average operating conditions.

Remarks on functionalities under A :

“continuously monitoring, logging, analysing and allowing for adjusting energy usage”

The functionality is defined in EN 15232 group 7 .
It is assumed that the requirements meet at least the functionality class that the rest of the building is required to meet (class B for occupied and class C for non-occupied buildings).
An installed BACS can determine those parameters at any place within the architecture (even in the cloud).
The priority is to secure a way to have data available over time.

Remarks on functionalities under B :

1 **benchmarking the building's energy efficiency**

The EN 15232/16947 functions 7.3 and 7.4 are addressing the detection of efficiency. It is vital that an installed BACS supports both functions. EN 15232/16947 7.3 supports quality data over time.

2 **detecting losses in efficiency of technical building systems**

This functionality is strictly related to (1), as comparing values and developments over time of the acquired/calculated data allows the detection of drifts in performances.

The following mechanism are examples how building's energy efficiency can be benchmarked and losses of efficiency can be detected:

Heat emission and (domestic) hot water distribution	Measure supply and return water temperature of a heat emitters, e.g. a fan-coil unit, and compare the actual with the design temperature difference. Alternatively, actual vs. design pressure characteristics can be used. Significant deviation indicates loss of efficiency.
Heat/cool generator	Compare actual efficiency, expressed e.g. as "coefficient of performance", with designed efficiency. Allow for a tolerance and detect whether the difference exceeds the acceptable deviation.
Air handler (VAV)	Pressure reset. Having the main fan maintaining the accurate pressure controls. During unoccupied periods a test procedure runs determine the pressure while all dampers are fully open and then while all are closed. The 2 measures of the are the new control points for the valve are to become the ramp ends of the pressure controls sequence.
Room IAQ	IAQ value (design) shall be racked during occupancy time and if the values get below the outside air values then the room is likely to be over-ventilated
Efficiency in function	Similar to the air pressure in the ducts (static) heating and cooling capability could be determined during non-occupied times by heating or cooling rooms and watching out the temperature change. With such a test the general function of a system including controls could be detected.

The above functions mentioned under clause a) and b) allow – while data can be determined at a plant level or a group of similar plants (e.g. air handlers) – detecting efficiency drifts that indicate to operators upcoming or existing issues in the plant operation. A proper reaction to this is plant maintenance. Consumptions that allow "normalization" with e.g. HDD (heating degree days) shall as well be determined and reported on.

Remarks on functionalities under C :

"allowing communication with connected technical building systems and other appliances inside the building, and being interoperable with technical building systems across different types of proprietary technologies, devices and manufacturers."

"Interoperability" shall make sure that the required functions according to the mandatory BACS definitions (usually class B for occupied rooms / primary equipment) are installed and working – especially among TBS systems and appliances that are needed to be integrated in the BACS (under the term c) e.g. room thermostats that are to be integrated in the BACS which is required for class B level). Example: A stand-alone fan coil in an occupied room shall be functionally integrated in the BACS supporting class B functionality.

ARTICLE 14/15

INSPECTION OF HEATING AND AIR-CONDITIONING SYSTEM

Paragraph 5
Requirements for BACS in residential buildings

Member States may lay down requirements to ensure that residential buildings are equipped with:

A.

the functionality of continuous electronic monitoring that measures systems' efficiency and inform building owners or managers when it has fallen significantly and when system servicing is necessary,

B.

effective control functionalities to ensure optimum generation, distribution, storage and use of energy.

HOW TO DEFINE IF A BUILDING HAS ALL THESE FUNCTIONS OR NOT?

The importance of maintaining performance of heating and air-conditioning systems is explained in recital (26) of the 2010 EPBD. Recital (37) sets out that electronic monitoring of larger residential buildings holds great energy saving potential for consumers with payback of less than three years.

The following mechanism are examples of how the systems' efficiency can be monitored and deterioration can be detected:

Building	Compare the actual HVAC and domestic hot water heating performance with the designed performance, or, if unavailable, the performance during the last 2-3 years.
Heat/cool distribution	Measure supply and return water temperature, or pressure characteristics, at suitably chosen parts of the system, such as heat source or riser. Compare the actual with design temperature difference. Significant deviation indicates loss of efficiency. Measure domestic hot water temperatures to indicate too high/low values.

Upon significant deviation, e.g. a deviation by more than 30% of designed performance, building owners should receive a 'push' notification.

Effective control functionalities are those optimizing building performance under actual part load operating conditions, listed in the capabilities at page 22.
For a typical multifamily building with central heating and domestic hot water system, the relevant functionalities are:

- **Individual room temperature control**
- **Dynamic balancing as referred to in EN 15316-2**
- **Weather compensation**
- **Scheduling**
- **Domestic hot water control (temperature, circulation)**

ARTICLE 14/15

INSPECTION OF HEATING AND AIR-CONDITIONING SYSTEM

Paragraph 6
Exemptions from inspections

Buildings that comply with paragraph 4 or 5 shall be exempt from the requirements laid down in paragraph 1.

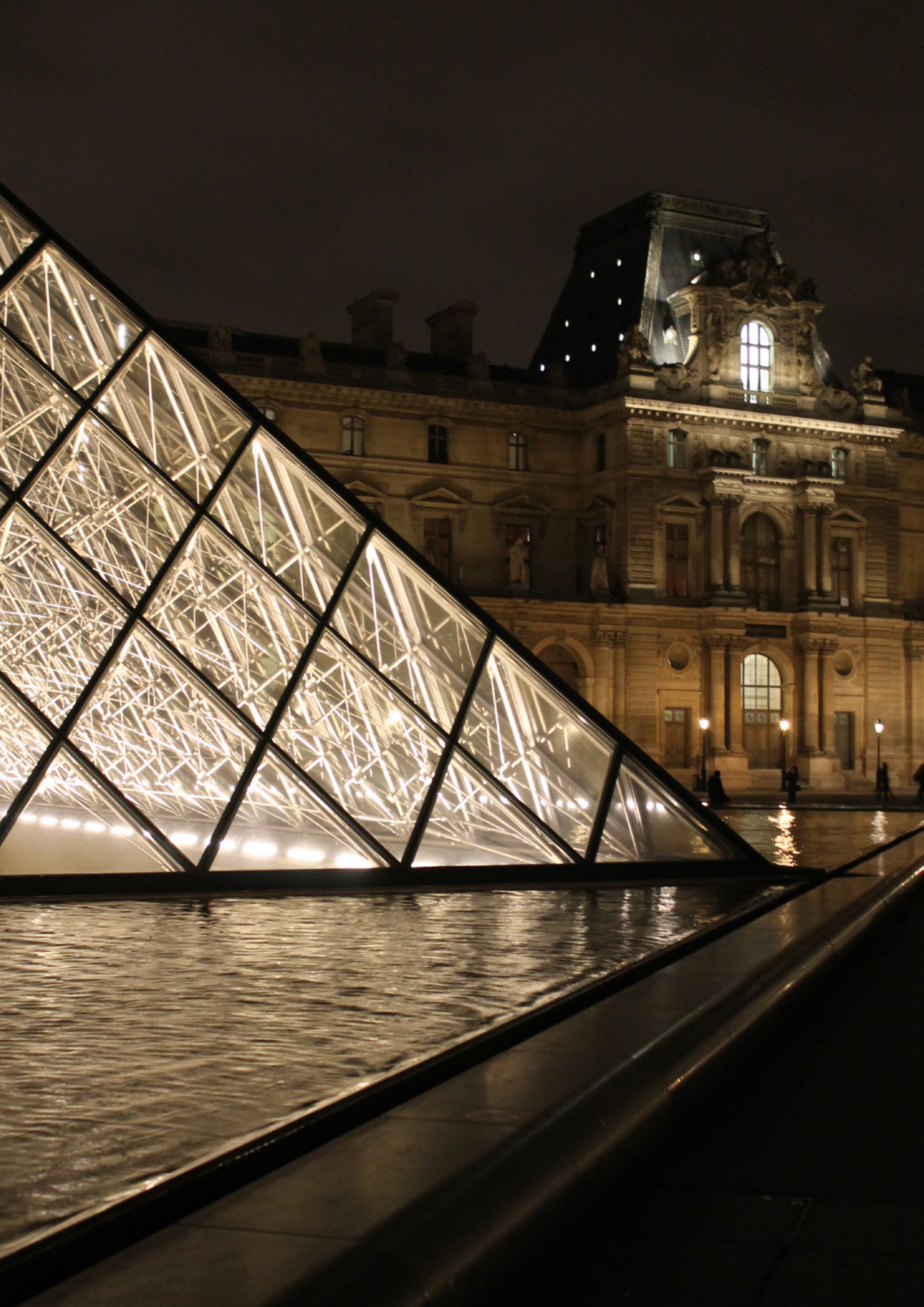
ARE ALL SYSTEMS EQUIPPED WITH BACS FUNCTIONALITIES EXEMPT? HOW TO ENSURE THAT BUILDINGS EQUIPPED WITH BACS WILL NOT BE SUBJECT TO PHYSICAL INSPECTIONS?

While the EPBD text is vague in this field, the European Commission in its guidelines suggests that the exemption refers only to those system above an effective rated output of over 290 kW, adding that it is up to Member States to extend this exemption to all the systems, including those below this threshold.

In our view, all buildings equipped with BACS functionalities according to Art. 14/15 par.4, both in non-residential and residential sectors, despite their dimensions (below or above effective rated output of over 290 kW), should be exempt from physical inspections of heating and air-conditioning systems, as these systems are able to provide the buildings with the same functionalities ensured by the inspections.

Member States need to transpose this principle correctly in their legislations and ensure information to all the owners about this possibility. It is in the best interest of the Member State to speed up the deployment of BACS, which, as we saw at page 49, are able to continuously monitor the performance and detect malfunctions, providing a 24/7 control on the efficiency of the systems.

In our view, it is important to highlight in the national legislation that this exemption is valid for all the buildings, not only those where BACS are mandatory (non-residential buildings with effective rated output over 290kW).



SOURCES AND REFERENCES:

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• **European Commission Guidance Documents on EPBD (in all EU languages)**
Commission Recommendation (EU) 2019/1019 of 7 June 2019 on building modernisation
https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32019H1019

• **EPBD Impact Assessment**
https://ec.europa.eu/energy/sites/ener/files/documents/1_en_impact_assessment_part1_v3.pdf

• **Revised Energy Efficiency Directive**
https://eur-lex.europa.eu/legal-content/EN/TXT/?qid=1549294343812&uri=CELEX:32018L2002

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June 2019

- CALEFFI Hydronic Solutions
- Schneider Electric
- oventrop
- SAUTER Creating Sustainable Environments.
- ThermoZYKLUS
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- meibes
- sbc SAIA BURGESS CONTROLS
- COMAP
- IMI Hydronic Engineering
- LOYTEC A Delta Group Company
- SONDER
- PRIVA
- DISTECH CONTROLS

ABOUT EU.BAC

eu.bac is the European Building Automation and Controls Association. It represents the major European manufacturers of products and systems for home and building automation. Its vision is a world where energy efficient, sustainable, healthy and comfortable buildings are achieved through the optimal application of home and building controls, automation systems and services. eu.bac has founded the European Association of Energy Services Companies (eu.esco) for promoting Energy Performance Contracting as the economically sustainable solution for improving the energy performance of existing buildings using the guaranteed energy savings to pay for the installation.

For more information, please visit www.eubac.org.

For more information, please contact:

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