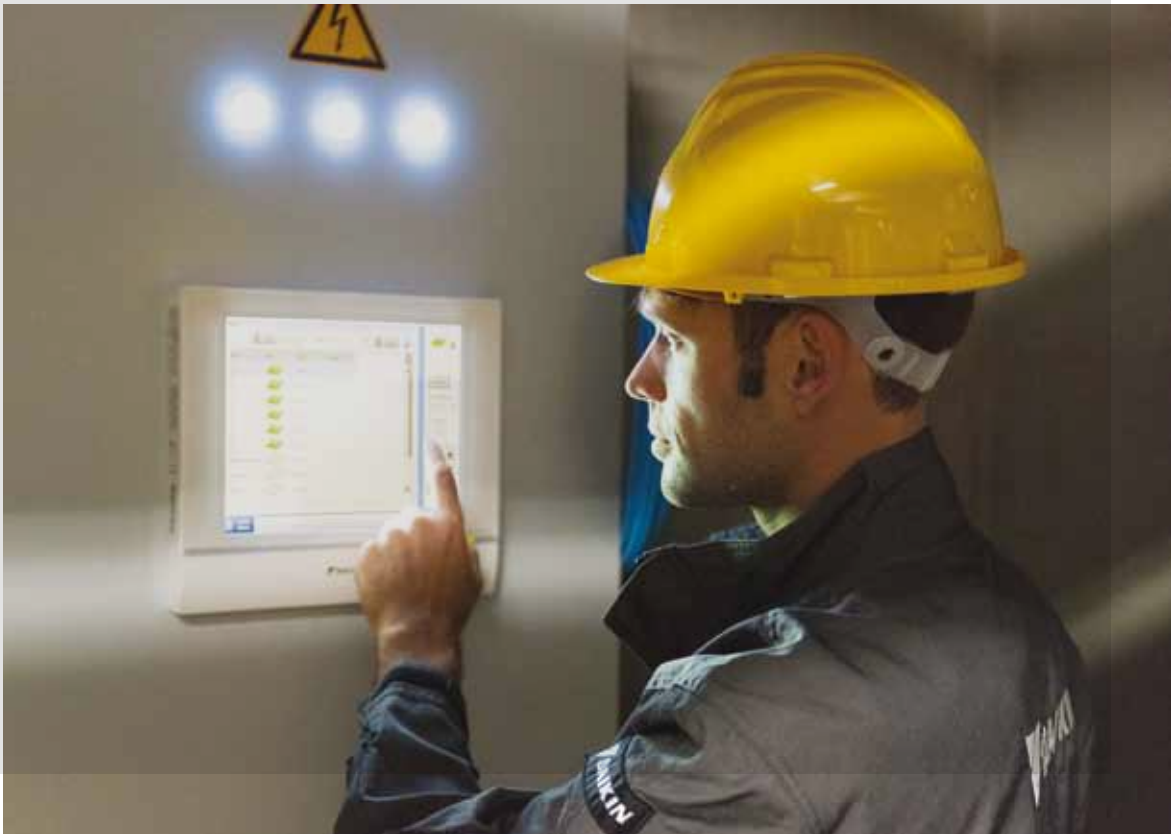
EPEE

The voice of the heating,
cooling and refrigeration industry

European Performance of Buildings Directive (EPBD)

IMPLEMENTATION GUIDELINES

2019



EXECUTIVE SUMMARY

This document includes guidelines for a strong and effective implementation of the EPBD around EPEE's key priorities:

1. **Servicing & maintenance through inspections**
2. **Building Automation & Controls**
3. **Promoting the uptake of European Standards**
4. **Full-load and part load conditions**
5. **High-efficiency alternative systems**

With the amended Energy Performance of Buildings Directive (EPBD), which entered into force on 9 July 2018, the EU has given itself a legal framework to continue pushing efforts at national level to tap into the huge potential for efficiency gains in the building sector.

EPEE represents the heating, cooling and refrigeration industry in Europe and supports an **ambitious and correctly implemented EPBD**. Given that heating and cooling have been identified and projected in the long term as the EU's biggest energy consuming sector, our members' technologies have the potential to significantly reduce energy consumption and the impact on climate, limit energy demand and increase energy security in Europe.

The guidelines developed in this document are intended to clarify five key aspects of the EPBD, providing details on the measures to be implemented as well as recommendations on good practices to be used in order to harmonise the interpretation of this piece of legislation in EU Member States.

PRIORITY 1

SERVICING & MAINTENANCE THROUGH INSPECTIONS

Section 1:

What does the Directive say?

Recital 36 states the importance of inspections of heating, cooling and ventilation systems and Articles 14 and 15 require Member States to set up inspections of equipment for combined space heating/air conditioning and ventilation purposes of over 70 kW. However, Member States may still opt to take alternative measures to inspections consisting of programmes giving building owners 'adequate advice' for making their heating and cooling systems efficient. Nonetheless, Member States will now have to prove that the adequate advice programmes have "equivalent effects" to inspections.

Recital (26) of the 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 unnecessary energy use[1].

Article 8.9 requires that when a Technical Building System (TBS) is installed or refurbished, a new assessment of its energy consumption is made and handed over to the building owner.

Articles 14.6 & 15.6 provide that buildings complying with BACs or electronic monitoring systems, depending on their size, may then be exempted from the inspection requirements.

Section 2:

What does it mean for Member States?

Inspections ensure buildings & products deliver on their energy savings

According to a number of studies[2], pragmatic, capital-light, fast payback measures focusing on technical building systems can generate energy savings in buildings, ranging from 20% to more. These can also significantly contribute to improving the health-related benefits of good air quality in buildings.

A holistic approach to technical building systems through a correct implementation of inspection requirements at national level can improve their energy efficiency and also indoor air quality by optimising management of the various systems present in buildings. Inspections can help to counteract the unavoidable ageing effects on products and systems, if they are followed by regular maintenance and servicing. Therefore, the real impact potential is of course **not from the inspection itself, but the actual implementation of the recommendations for repair and improvement.**

In multiple countries, installations and inspections are not reported to the relevant authorities and there is a lack of enforcement of this requirement. For example, in the Netherlands only 10% of buildings within the scope of air conditioning are being inspected. This does not help the building owners to keep their equipment running efficiently, to potentially repair inefficiencies and thereby save energy.

---

[1] **Fedene/Cardonnel**, France, 2014: +10% in 5 years, +18% in 7 years, +35% in 10 years

[2] **DG Energy (2015)**: Highlights the importance of an integrated control system and demonstrates that building controls are key to reduce energy consumption in existing commercial and industry facilities
Waide Strategic Efficiency (2014): Proper application of building automated technology and controls has the theoretical potential to save about 22% of building energy consumption by 2021
Ecofys Study (2017): Optimising the energy use of technical building systems
Cardonnel Ingéniérie (2015): Replacing thermal heating and cooling equipment can result in energy savings of 25 to 40% combined with payback times of 5 to 10 years depending on the type of the building vs. 24 to 28 years for investments into upgrading the envelope of the same buildings

Inspection programmes should be included within national renovation strategies

Inspection programmes should be set in the bigger context of a National Renovation Strategy. As the heating and cooling of buildings has been identified as the biggest energy consumer for the building sector, making these systems more efficient and reducing their energy consumption has to be a key element of any government's energy plan. Due to the complexity of the building sector with many actors involved (from constructors, real estate to owners and occupants) and the variety of buildings, **an energy consumption plan for the sector requires many elements to fit together.** These need to be interlinked in a coherent way that takes into account the country's climate, building types and ownership structure. This can be done in a Renovation Strategy, which should also include inspection programmes. **Regular inspections should help identify inefficiencies and faults in a system. The Strategy should then foresee a regulatory scheme which would both incentivise and compel the building owner to realise the recommendations resulting from such inspections, thereby repairing and refurbishing the systems, as appropriate.** With proper maintenance over a period of 10 years, buildings could be able to reduce up to 25% of their energy consumption. This explains why strong measures to deliver these gains in efficiency should be a clear priority for national governments.

Other inspection requirements already exist in other EU legislation, such as for leak checks for equipment with refrigerants gases, safety inspections for gas boilers. Such inspections can be regulated in different ways, for example inspections of systems containing fluorinated gasses have to be performed by certified professionals. When transposing the EPBD, Member States could align these various inspection regimes – possibly by combining them into one inspection, in order to make the programmes more efficient and less costly or invasive. Having a one-point check implies the need for effective training of inspection and maintenance personnel. More comprehensive training schemes could be developed in order to cover the various aspects of technical building systems. Governments should of course support the development of such training schemes.

To encourage real implementation of such inspection programmes, and achieve more savings, national governments could make use of different tools such as: incentives and tax-breaks for building-owners following installers' recommendations, linking business licenses, authorisations or even property taxes to actual compliance with mandatory inspection requirements and implementing penalties when not respected.

EPEE therefore calls for a thorough implementation of the EPBD's inspection requirements at national level. When Member States have already implemented the current 12KW & 20KW thresholds for inspections, it makes sense for them to continue applying that scope, given the easiness of measurement at equipment output level.

National inspection programmes should be linked to maintenance and servicing activities, to ensure the recommendations of the inspectors are being considered and put into practice. Inspections should at least measure and recommend how to have a comfortable and healthy indoor environment, how to ensure economic and safe operation of technical building systems and how to improve the energy efficiency of buildings.

When a new assessment is done when a TBS is installed or refurbished it should **include energy consumption data per equipment, and system design data to show the correct sizing and system integration.**

[3] Data extrapolated from: https://aircokeuren.nl/

[4] Fedene/Cardonnel, France, 2014: +10% in 5 years, +18% in 7 years, +35% in 10 years

Member States should consider including a mandatory assessment of the efficiency of the heating/cooling system in the EPC (energy performance certificate) of a building when the building in question or apartment is being sold or rented. By ensuring that any sale or renting of a building should be preceded by an "up-to-date" inspection/assessment of the heating & cooling systems, building owners could be pushed to improve their HVAC system more frequently.

Such programmes should be an integral part of the national Renovation Strategy to drive energy efficiency of the heating and cooling of buildings, with built-in incentives and penalty structures, to increase implementation and enforcement.

"Adequate advice" programmes do not replace inspections

EPEE cautions that programmes for stand-alone "adequate advice" may not replace inspections as such, as their impact is difficult to measure and their coverage usually more sporadic. So far, such programmes have generally not lead to any improvement of the maintenance of the heating, ventilation and cooling systems.
We would recommend that the European Commission could give some guidance as to how such an advice programme could look like and how to measure its results.

➔ **EPEE recommends that when Member States set up an 'adequate advice' programme that achieves similar energy savings as an inspection scheme for heating and cooling equipment, it considers the following elements:**

• 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), 15(4) and 15(5).
• The measure to show that an 'adequate advice' programme can achieve energy savings is important – the European Commission should give some advice so that the measure would be harmonised, comparable and sufficiently robust.
• Any advice programme should encourage building owners and managers to make sure their heating and cooling systems are installed, maintained and serviced properly to ensure energy losses are detected and repaired effectively.
• Member States who have already put in place inspection programmes should not be encouraged to dismantle them, but to use these programmes as best practices for other Member States.

Section 3: Best practices & examples

• **Inspections are of course not useful if they do not lead to any improvements in efficiency, any maintenance of the performance levels of the systems inspected and to any repairs of any failing parts.** It would be useful to encourage building owners to act on the recommendations of inspectors, and to record such repairs and maintenance for long-term follow-up purposes, in a Building Passport or other logbook for Energy Performance Certificates.

• As an example of pushing building owners to such energy consumption planning, **the French draft Building sector law** which is set to be adopted in 2018. The law sets an obligation for private owners of tertiary (i.e. non-residential) buildings to improve their energy efficiency with 40% by 2030, 50% by 2040 and 60% by 2050. The details are to be given in a decree. In a previous draft decree the obligation was for the owner to draw up a plan to improve the building over a long time-period, which needed to be approved.

• EPEE believes that such a plan is a very good incentive for building owners to look at their building's long-term needs, in particular for energy consumption. This is very useful, as understanding energy consumption in the operational phase is the key to savings in heating and cooling systems. Such long-term energy efficiency obligations should ideally also be accompanied by technical advice and financial schemes.

• As an example of ensuring monitoring systems are put in place for health related reasons, the "**European technical guidelines for the prevention, control and investigation of infections caused by Legionella species**[5]" specifies that hot and cold water networks (in particular those for sanitary water) should be designed and run to avoid/minimize the risk of Legionellosis and recommends the use of a monitoring system for the water circuits to limit the spreading of this disease. Given the importance of avoiding the spreading of many diseases linked to bad indoor air quality (i.e. badly maintained or installed technologies), we suggest that BACs and monitoring systems can serve as an alternative to inspections in buildings, as they would provide additional guarantee that the indoor environment stays healthy.

• As an example of an ambitious inspection programme, in the Netherlands[6], EPBD inspection implementation is based on different classes. The first class (12-45kW) could be fulfilled by inspectors having a so called A certification. This A certification used to be harmonised with the F-gas certification. Inspectors and engineers receiving an F-gas certification would receive an EPBD category A certification automatically during the period of 2010-2013. This has been discontinued, and since 2014 there has been a separate examination. For larger buildings an additional certificate B is required. The clarity of the structure of this system has been very valuable, harmonizing EPBD inspection and F-gas regulation requirements. The system has ensured that the market of 12 to 45kW (which represents the majority of the buildings) is well covered and around 1.000 companies, in theory, could fulfil the EPBD A inspection requirements. NVKL, a Dutch association for air treatment and refrigeration technology, also supported the government's initiatives by investing in an app to facilitate inspection and reporting. Although the overall goal of the Dutch Government and NVKL was to incentivise inspections to improve overall efficiency of buildings, the lack of market surveillance in practice did not incentivise buildings owners to actually perform the EPBD inspections and the use of the app remained limited due to poor market acceptance of the obligation for building owners to conduct air conditioning inspections. **Member States should ensure proper enforcement is in place when considering developing these inspection certification categories and liaise with national business associations to ensure efficient coordination in implementation.** It is important to note that national associations representing different actors in the refrigeration industry can play a significant role in promoting compliance with the EPBD, by providing information and encouraging best practices.

• The **EPB Center** aims at promoting the implementation and use of EPB standards, which therefore can be a useful resource for Member States to use when looking for guidance on the specific implementation of the EPBD framework at national level.

---

[5] item 1.60 on page 37, "Large buildings may have complex water systems with more than one loop. It is important that the whole system is balanced and the return of each loop to the calorifier is at a minimum of 50 °C ..."(note: the calorifier is the boiler heating the water).

[6] **https://epbd-inspectie.info/**

PRIORITY 2

BUILDING AUTOMATION & CONTROLS

Section 1:
What does the Directive say?

The amended EPBD introduces Building Automation & Controls (BACS) requirements:

• **Article 2.3a** introduces a definition of building automation and control systems as "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".

• **Article 8.1** requires self-regulating devices to be installed in new buildings and when heating & cooling systems are refurbished. As an exception to the rule, Member States can detail in which specific cases the installation of self-regulating devices is not feasible from a technical or economic perspective. Member States must ensure that these cases are clearly identified, framed and justified. The decision not to install self-regulating devices on the grounds of technical or economic (non) feasibility must be assessed under clear procedures established by public authorities.

• **Articles 14.4 and 15.4** provide that "Member states shall set the requirements to ensure that non-residential buildings with an effective rated heating or combined heating, air conditioning and ventilation system output of over 290kW, where technically and economically feasible, be equipped with building automation and control systems by 2025."

• **Articles 14.5 and 15.5** provide that Member States may set requirements for residential buildings to be equipped with the functionality of continuous electronic monitoring that measures systems' efficiency and informs building owners or managers or occupants when it has fallen significantly (when it deviates from the operating value for a significant time) and when system servicing and/or preventive servicing is necessary, as well as effective control functionalities to ensure optimum generation, distribution, storage and use of energy.

Section 2:
What does it mean for Member States?

It is essential that national legislation takes a holistic and integrated view when approaching the energy and comfort performance of buildings. This should be done by optimizing the energy performance of technical building systems in both residential and non-residential buildings. The key to optimize technical building systems is to ensure effective building automation and control. This does not require invasive renovation measures, it pays back quickly and has no lock-in effects. According to a study[7], energy savings can range from 23% to 49% depending on the type of building and packages of sensors and energy-saving controls deployed.

Increased information sharing on the benefits of BACS

However, despite these obvious benefits, the great potential of optimizing energy performance of technical building systems through building automation and control can still be further exploited. Awareness raising and additional information are needed for building owners, managers and occupants. This needs to come both from authorities and the industry. One-stop-shops that are running or those that are planned in some Member States will have a key role to play.

A government website with additional information could usefully be set up already at this stage. The industry is also engaged in raising awareness on these topics.

Obligation for non-residential buildings to be equipped with BACS by 2025

An important point of caution: many buildings today have some sort of controls in their heating and cooling systems, with some form of central management, but do these fulfil the requirements of the 2025 BACS instalment obligation? The European Commission in its guidance to Member States is very clear: the system must comply with the new BACS definition (see above) and must fulfil the criteria set in paragraph 4 of articles 14 and 15:

• 'continuously monitor, log, analyse and allow for adjusting energy use;

• benchmark the building's energy efficiency, detect losses in efficiency of technical building systems, and inform the person responsible for the facilities or technical building management about opportunities for energy efficiency improvement; and

• allow communication with connected technical building systems and other appliances inside the building, and be interoperable with technical building systems across different types of proprietary technologies, devices and manufacturers.'

This means that a Member State would have to set up a system to assess existing BACS, and to set out an obligation to refurbish the systems if they do not fulfil the BACS criteria set. This assessment should be implemented and enforced properly to ensure the full benefit and energy savings potential of BACS.

➔ **Current building systems often have built-in monitoring and control systems** which should be fully assessed to see if they also fulfil the criteria set for the 2025 BACS obligation in larger buildings. If they do not, they should be refurbished up to that level. It is important to maintain any BACS regularly, as otherwise their efficiency in managing energy consumption and allowing both energy savings and increased comfort are jeopardised.

[7] **Impacts of Commercial Building Controls on Energy Savings and Peak Load Reduction** (see Fig. S.2 on page 10 of the pdf, "viii" at the page bottom)

How to implement BACS?

In non-residential - commercial buildings

The capabilities/functions set out in Art. 14(4) and 15(4) can be effectively implemented following the **standard EN 15232**, defining functions and mapping those into classes A to D[8]. To meet the EPBD requirements, controls of HVAC generation, distribution and emission systems serving building zones or rooms which are occupied during operation hours should fulfil at least the criteria of class "B". Rooms or zones which are not occupied during operation hours should meet at least level C.

Additional necessary principles are:

- The installed BACS should be able to prevent simultaneous heating and cooling in the same room/zone.
- For the purpose of benchmarking energy efficiency, the BACS should have access to monitored consumption data representing 60% or more of the building's energy consumption.
- Water-based heating and cooling systems should be dynamically balanced at heat/cool emitter level, pursuant to standard EN 15316-2, to ensure optimized performance under typical operating conditions.
- *"benchmarking the building's energy efficiency"* and *"detecting losses in efficiency of technical building systems"* are addressed by standard EN 15232 functions 7.3 and 7.4. The following mechanisms are examples of concrete implementation. We recommend following this process:

Heat emission and (domestic) hot water distribution	Measure the supply and return water temperature of a heat emitter, e.g. a fan-coil unit, and compare the actual with the design temperature difference. Alternatively, actual vs. design pressure characteristics can be used with specific algorithms. Significant deviation by e.g. 30% indicates loss of efficiency.
Heating/cooling generator	Compare the actual efficiency, expressed as "coefficient of performance", with the design efficiency. Allow for an acceptable deviation and detect whether the difference exceeds that acceptable deviation.
Air handler (VAV)	Pressure reset to ensure that the main fan maintains accurate pressure. During unoccupied periods a test is carried out to determine the pressure with all dampers fully open, and a second test with all dampers closed. The two test results are used to set new control points for the valve, being the ramping ends of the pressure controls sequence.
Room Indoor Air Quality (IAQ)	IAQ value (design) shall be tracked during occupancy time. If the values fall below outside air values 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 under predefined conditions and observing the temperature change. With such a test the general function of a system including controls could be detected.

[8] - EN 15232 lists BACS functions in different degrees of "sophistication", and then allocates a class A, or B, or C, or D according to the functions installed in a particular building. It also estimates energy savings. (e.g. if you upgrade the BACS from C to B, the expected approximate energy saving in an office building (in principle it is done room/zone per room/zone, and refined into thermal and other applications) is 20%, according to EN 15232

In residential buildings

The importance of maintaining performance of heating and air-conditioning systems is explained in recital (26) of the 2010 EPBD. Recital (37) of the amended EPBD sets out that **electronic monitoring of larger residential buildings holds great energy saving potential for consumers with payback of less than three years.** We would therefore recommend to promote BAC functions in residential buildings through policy measures, even if this is optional in the EPBD. The following mechanisms 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 design performance, or, if unavailable, the performance during the last 2-3 years.
Heating/cooling 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% from design performance, building owners should receive a 'push' notification from the BAC system.

Effective control functionalities are those optimizing building performance under actual part load operating conditions, listed in section [Priority 4: part load].

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 standard EN 15316-2
- Weather compensation
- Time schedule
- Domestic hot water control for optimized temperature, circulation and thermal disinfection/legionella protection

PRIORITY 3

PROMOTING THE UPTAKE OF EUROPEAN STANDARDS

Section 1:
What does the Directive say?

European standards are key drivers for technology development and innovation in this sector. They therefore need to be further promoted.

The amended EPBD encourages the use of the recently adopted CEN EPBD Standards, in a number of provisions:

• **Recital 40:** "Without prejudice to the Member States' choice to apply the set of CEN EPBD standards, their recognition and promotion across the Member States would have a positive impact on the revision of this Directive".

• **Article 3 :** "Member States shall apply a methodology for calculating the energy performance of buildings in accordance with the common general framework set out in Annex I. This methodology shall be adopted at national or regional level."

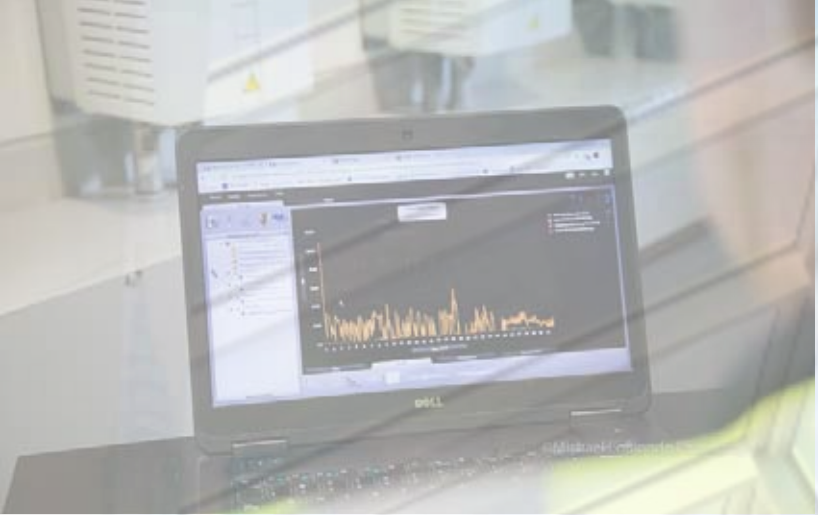
• **Annex I, point 1:** "Member States shall describe their national calculation methodology following the national annex framework of related European standards developed under mandate M/480 given by the European Commission to the European Committee for Standardisation (CEN)".

Section 2:
What does it mean for Member States?

Harmonized energy performance calculation methods

The importance of standards is often under-estimated although they are key to ensure full implementation and enforcement of the EPBD. A national approach on standardization, as it currently applied does not reflect the economic context in Europe and could, in the worst case, completely undermine the objectives of the Directive, and other EU legislation on energy consumption, including the Energy Efficiency Directive (EED) and Ecodesign. In addition such an approach disrupts the proper functioning of the internal market, hindering innovation.

In particular in the present economic climate, where resources are limited and need to be optimised, such a unified approach is indispensable to accelerate innovation and energy savings across Europe. It will trigger the use of the most energy efficient products and solutions (e.g. heat recovery in ventilation or inverter technologies) promote holistic building concepts (e.g. Building Management Systems and maintenance contracts) and reward the use of renewable energy in a consistent manner. **The current approach, with differing calculation bases in different countries, is counter-productive as it leads to a fragmentation of the market, delays innovation and makes enforcement efforts less transparent and comparable.**



The industry has made strong efforts to increase the energy efficiency of their products, for example via Ecodesign requirements for heating and cooling equipment. **To unleash the full potential of these efforts and, at the same time, to ensure better enforcement of the EPBD, harmonized energy performance calculation methods are a key priority.** The groundwork has been laid with the recent finalisation of the EPBD CEN standards which **now need to be applied across all EU Member States.**

Importance of contributing to and applying CEN standards

EPEE therefore strongly encourages Member States to use CEN standards when describing their national calculation methodology and to align with other incentive programs in Member States to stimulate replacement of fossil based systems by systems using renewable energy with smart abilities. EPEE recommends Member States to give feedback on the implementation of the CEN standards to the respective technical committees to allow them to further improve the quality of the set of standards.

EPEE strongly encourages Member States to go beyond monthly calculation of energy efficiencies and reward high efficient systems by moving towards hourly[9] calculations. Often the benefits of high efficient systems are not clear in "average" monthly calculations. EPEE strongly encourages Member States to also **utilize the EU set of standards to create transparency in heating and cooling loads** and fulfil requirements in a satisfactory manner to avoid any comfort complaints.

EPEE recommends Member States review Primary Energy Factors in a transparent manner and at regular intervals, allowing "High-efficiency alternative systems" to be proper calculated within the Energy Performance of Buildings.

EPEE recommends Member States to make use of the expertise of the EPB Center (www.epb.center) when transposing the CEN standards in their national calculation methodology.

Section 3: Best practices & examples

• The Netherlands is moving swiftly towards a new technical assignment to improve its energy performance calculations. Although still on a monthly basis, the calculation related to high efficient building systems such as (reversible) air-conditioning and heat pumps, is based on hourly data which is issued using a BIN methodology for both heating and cooling, based on part load test data as specified in Ecodesign.

[9] www.rehva.eu/publications-and-resources/rehva-journal/2018/012018/epb-standards-why-choose-hourly-calculation-procedures.html

PRIORITY 4

FULL-LOAD AND PART LOAD CONDITIONS

Section 1:
What does the Directive say?

In the new Articles 14.1 & 15.1, the amended EPBD introduces the need for inspections to take into account "typical or average operating conditions", where relevant. This provision is accompanied by a recital 36, which explains what is meant by part load conditions:

• **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, cooling 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, cooling 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."

Section 2:
What does it mean for Member States?

Optimising the performance through part load conditions

Setting minimum energy efficiency requirements on products is the most obvious solution to increase the energy efficiency of heating and cooling. However, **even the most energy efficient products in buildings will not lead to energy savings if they are not properly sized, installed, controlled and maintained.** Indeed, most technical building systems are dimensioned for peak situations where they have to operate at full load conditions. Then the expected performance on the one side, and the actual performance on the other side, can differ significantly ("performance gap"), also because of other effects such as improper maintenance. Full load conditions do not occur very often because in practice technical building systems almost always have to deliver only a small fraction of their full capacity.

In reality, **there is a huge energy savings potential in optimising the performance of technical building systems under so-called part-load conditions.** The amended EPBD introduces part load conditions under the term "typical operating conditions" (see recital 36 for explanations) as part of the inspection requirements for efficient heat and cold generators. **Taking into account the typical operating conditions when inspecting the heating and cooling systems,** would benefit not only building owners and investors, but also occupants, because it would **show the "performance gap" between the expected and the actual performance of the heating/cooling system.**

How to optimise technical building systems under part load?

To optimize the energy performance of technical building systems under part loads in practice, the physical inspections should simply check if certain capabilities or functionalities of a heating or cooling system are indicated and report if some of these are missing. For the same reason, Article 8(1) states that system requirements for optimizing the overall energy performance, the proper installation, and the appropriate dimensioning, adjustment and control of the technical building systems should aim at optimizing the performance under typical part load operating conditions.

Part load performance depends on certain capabilities/functionalities of a heating, cooling, ventilation and hot water system. **These functionalities are already used in national legislation to some extent, and they are systematically listed and described in several standards** (e.g. in EN 15232). The capabilities can be covered by requirements that can easily be tailored e.g. to climate, building type, installed heating, cooling, ventilation, hot water systems. The capabilities are well established and can be easily applied by installers and manufacturers of technical building system equipment. Some of the main capabilities that can be applied as appropriate are:

- Capability of the heat or cold generator system to vary energy output upon signals from the control system – so called "modulation" of the output
- Capability to vary energy use in dependence of outside temperature – so called weather compensation
- Capability of pumps/compressors/fans to adjust flow and temperature of water, refrigerant, air to actual needs.
- Capability of the control system to automatically adapt energy use of the heat or cool emitters, e.g. radiators or a fan coil unit, in individual rooms of the building – so called individual room temperature control
- Capability to avoid concurrent heating and cooling at the same time in the same room through any installed system
- Capability to ensure smooth distribution of energy across the building in water-based heating or cooling systems in all operating conditions – so called dynamic hydronic balancing
- Monitoring operation and changes in the system – in particular set points

The amended EPBD Article 8(9) is related to assessing the overall energy performance when a technical building system is installed, replaced or upgraded, and requires documentation that system performance meets the requirements under Article 8(1). A coherent application of system optimization and inspection requirements needs alignment and focus on performance under typical part load operating conditions.

➜ **EPEE therefore recommends that actual performance and typical part load operating conditions be consistently considered in national laws for renovations and for new-built and not only for the bigger buildings as required by the EPBD.**

➜ **The EU's set of EPB standard should reflect generation efficiency by including typical part load operating conditions. EPEE wishes to raise awareness among Member States to integrate part load performance in EPB calculations as well as in setting financial programs (i.e. ESIF, EFSI).**

➜ **By 2025, Building Management & Control Systems will become mandatory for buildings over 290 kW. EPEE asks that proper Energy Efficiency calculation based on part load conditions should be made mandatory by 2025 to allow proper sizing of systems and execute proper energy efficiency calculations.**

Section 3:

Best practices & examples

- **In France,** the "Arrêté du 22 mars 2017 modifiant l'arrêté du 3 mai 2007 relatif aux caractéristiques thermiques et à la performance énergétique des bâtiments existants" introduces hydronic balancing and certain control capabilities to be installed when upgrading heat emission systems. This is a structured approach to system optimization, considering elements of relevant capabilities. However, in existing buildings, the trigger "emission system upgrade" is not effective, as emission systems are rarely and less frequently changed than heat generators. Further, it should be ensured that hydronic balancing is dynamic.
- **In Spain,** the IDAE Guidelines "Medidas de Ahorro Energético en los circuitos hidráulicos" provides an in-depth assessment of part load optimization of heating and air-conditioning systems with pumps, control and balancing valves with relevant capabilities. It is concluded that part load optimization through these capabilities can deliver energy savings up to 70%. However, this is indicative guidance, and the conclusions should be carried into legislation.

PRIORITY 5

HIGH-EFFICIENCY ALTERNATIVE SYSTEMS

Section 1: What does the Directive say?

The amended EPBD provides that Member States should encourage the use of high-efficiency alternative systems:

- **Recital 19:** "For new buildings and buildings undergoing major renovations, Member States should encourage high-efficiency alternative systems, if technically, functionally, and economically feasible, while also addressing health indoor climate conditions as well as fire and seismic safety, in accordance with domestic safety regulations."

- **Article 6.1:** "Member States shall take the necessary measures to ensure that new buildings meet the minimum energy performance requirements set in accordance with Article 4. For new buildings, Member States shall ensure that, before construction starts, the technical, environmental, and economic feasibility of high-efficiency alternative systems if available is taken into account".

- **Article 7.5:** "Member States shall encourage, in relation to buildings undergoing major renovations, high-efficiency alternative systems, in so far as this is technically, functionally and economically feasible, and address healthy indoor climate conditions, fire safety and risks related to intense seismic activity".

Section 2: What does it mean for Member States?

While the amended EPBD recommends Member States to use high-efficiency alternative systems when feasible in new buildings and in buildings undergoing major renovations, the list of such alternative systems has been deleted from the new Directive.

To give useful direction to planners and investors, it is important that Member States provide clarity on what is meant by "high-efficiency alternative systems". Since the national definitions will unavoidably touch upon energy-related products that are allowed to circulate freely in the EU internal market and that are already subject to specific EU policies (such as Ecodesign regulations), it is also of utmost importance that the national definitions of "high-efficiency alternative systems" are both harmonised across the EU and consistent with the existing EU laws.

Develop clear definition of "high-efficiency alternative systems"

EPEE therefore recommends that a harmonised EU definition of "high-efficiency alternative systems" is used at Member State level. They should be considered as products placed on the market which respect EU Ecodesign and Energy labelling policies used for high efficient systems. Otherwise declarations of conformity should be available, showing energy performance beyond comparable Ecodesign alternatives.

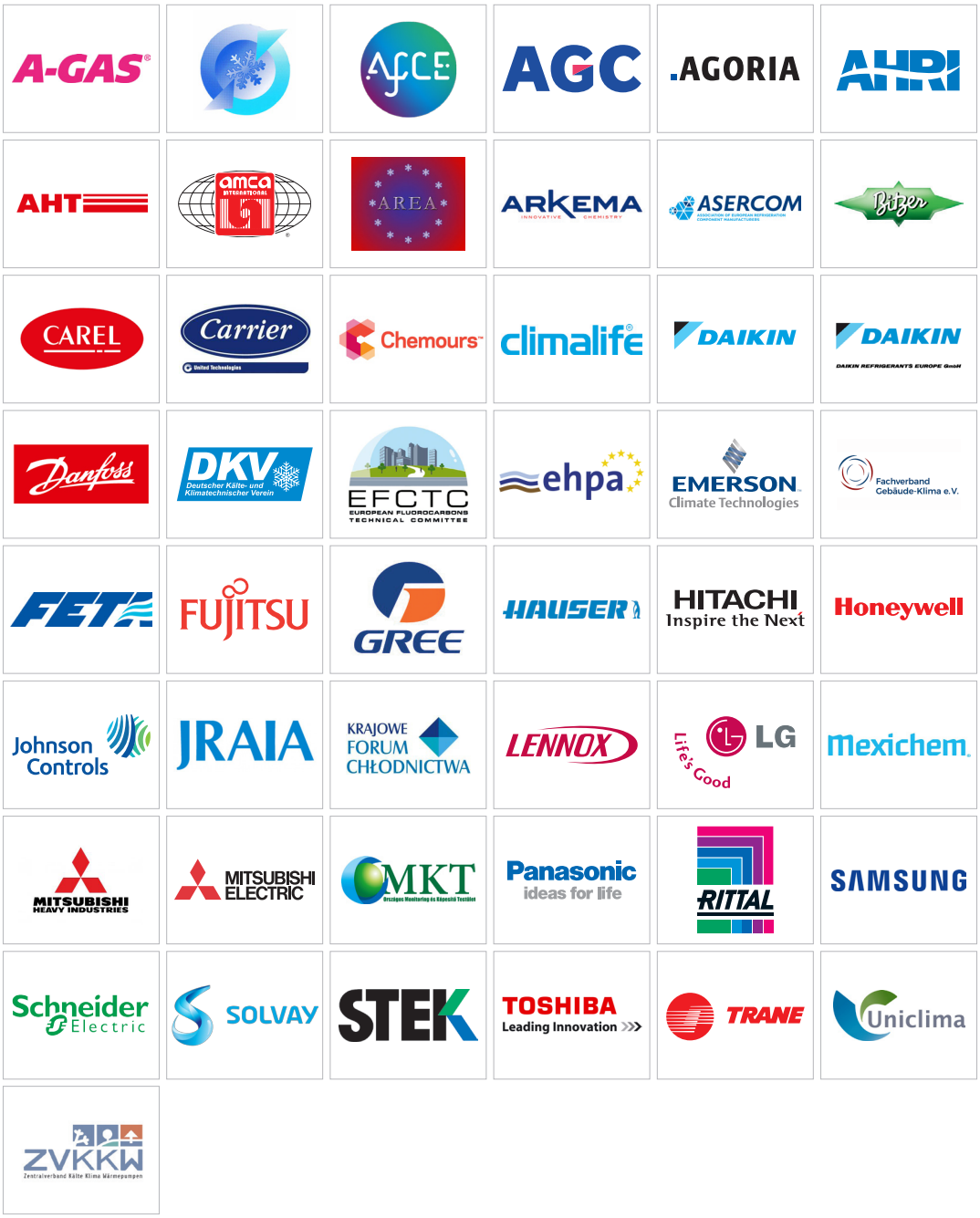
The manufacturer's documentation and installation guidelines should be used as a basis for documentation when installing high performance systems for space heating, air conditioning and/or water heating. To ensure a proper installation, it should become mandatory to execute well documented commissioning of the system, or as an alternative set up a monitoring and control system (regardless of kW installed).

As "high-efficiency alternative systems" based on an EU harmonised definition will coincide often with part load conditions, awareness has to be raised among Member States on how to set up financial programs (ESIF, EFSI) linked to "high-efficiency alternative systems".

Section 3: Best practices & examples

• The Netherlands can be seen as a good example of a Member State pushing forward "High-efficiency alternative systems" through the Sustainable energy investment subsidy scheme (ISDE) and subsidy programs, which allow residential building owners and landlords to replace fossil based systems with "High-efficiency alternative systems" such as (hybrid) heat pumps.

Our members



Our supporters

GCP EUROPE
The voice of €fficient building engineering services

EPEE

The voice of the heating,
cooling and refrigeration industry

ABOUT EPEE

The European Partnership for Energy and the Environment (EPEE) represents the refrigeration, air-conditioning and heat pump industry in Europe. Founded in the year 2000, EPEE's membership is composed of 48 member companies, national and international associations from Europe, Asia and North America.

EPEE member companies realize a turnover of over 30 billion Euros, employ more than 200,000 people in Europe and also create indirect employment through a vast network of small and medium-sized enterprises such as contractors who install, service and maintain equipment.

EPEE member companies have manufacturing sites and research and development facilities across the EU, which innovate for the global market.

As an expert association, EPEE is supporting safe, environmentally and economically viable technologies with the objective of promoting a better understanding of the sector in the EU and contributing to the development of effective European policies. Please see our website (www.epeeglobal.org) for further information.

ANY OTHER QUESTIONS?

CONTACT US AT

EPEE – European Partnership for Energy and the Environment

Avenue des Arts, 46 · 1000 Brussels · Belgium

Tel : +32 (0) 2 732 70 40 · Fax : +32 (0) 2 732 71 76

secretariat@epeeglobal.org · www.epeeglobal.org

Follow us on Twitter @EPEESecretariat