May 2017

EPEE POSITION PAPER & SUGGESTED AMENDMENTS
EPBD, EED, and RES: Making Energy Efficiency in buildings a reality

Executive Summary

EPBD: Lay the groundwork
Harmonize calculation methods across EU Member States

EPBD: Make the most of products in buildings
Improve the efficency of Technical Building Systems

EPBD/EED/RES: Promote technological innovation
Support new primary energy factor (PEF)

Amendments and Case Studies in the Annex of this paper

Introduction

EPEE represents the heating, cooling and refrigeration industry in Europe and strongly supports the energy efficiency first principle. 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 the impact on climate, reduce energy consumption, limit energy demand and increase energy security in Europe, provided that the energy framework sets the right priorities.

In this context, EPEE considers the 30% binding energy efficiency target as proposed by the European Commission in the review of the Energy Efficiency Directive (EED) as a step in the right direction. More specifically, we believe that Technical Building Systems have a key role to play to achieve significant energy savings and call for strengthening the relevant provisions in the Energy Performance of Buildings Directive (EPBD) and in the Directive on Renewable Energy Sources (RES).

Finally, we would like to emphasize that European standards are key drivers for technology development and innovation in this sector, and need to be further promoted. The following paper outlines EPEE's main recommendations related to the review of the Directives mentioned above and the important interaction with standardisation.

You will find below EPEE's suggested amendments to the European Commission's proposal for a reviewed Energy Performance of Buildings Directive.

1. Lay the groundwork: Apply harmonized energy performance calculation methods in all EU Member States

Amendment EPBD ANNEX: Mandatory use of EPB standards	
Text proposed by the Commission - Annex I, point 1, paragraph 3:	**Amendment - Annex I, point 1, paragraph 3:**
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)	***Within two years after the approval by Formal Vote in CEN,*** *Member States shall* ***implement and apply the EPB standards in*** *the 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)*
Justification The Commission's proposal in the EPBD Annex to oblige Member States to "describe their national calculation methodology following the national annex framework of related European standards" will not be able to fully exploit the potential of the EPB standards. A unified approach is indispensable to accelerate innovation and energy savings across Europe The EPB standards, which were recently approved by National Standard Bodies, should make it possible to calculate the energy performance of buildings across the EU using the same methodologies. These methodologies rely on the most recent Ecodesign data, helping the market uptake of the most efficient heating technologies. A transitional period of two years will enable planners and architects to put these EPB standards to the test and resolve any remaining inconsistencies. If the standards prove to work during this test period, we hold the view that these EPB standards and their calculation methodologies should become mandatory. This will still allow national building codes to take into account specific climatic and construction circumstances.	

Amendment EPBD ANNEX: Valorisation of Technical Building Systems	
Text proposed by the Commission - Annex I:	**Amendment - Annex I:**
Annex I, point 1: 1. The energy performance of a building shall reflect its typical energy use for heating, cooling, domestic hot water, ventilation and lighting. The energy performance of a building shall be expressed by a numeric indicator of primary energy use in kWh/(m².y), harmonised for the purpose of both energy performance certification and compliance with minimum energy performance requirements. The energy	***Annex I, point 1:*** *1. The energy performance of a building shall reflect its typical energy use for* ***technical building systems*** ~~***heating, cooling, domestic hot water, ventilation and lighting***~~***.*** *The energy performance of a building shall be expressed by a numeric indicator of primary energy use in kWh/(m².y), harmonised for the purpose of both energy performance certification and compliance with minimum energy performance requirements. The energy performance and the methodology applied for*

performance and the methodology applied for its determination shall be transparent and open to innovation. 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).	*its determination shall be transparent and open to innovation.* ***Within two years after the approval by Formal Vote in CEN,*** *Member States shall* ***implement and use the EPB standards in*** *the 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)*
Annex I, point 2 2. The energy needs for space heating, space cooling, domestic hot water and adequate ventilation shall be calculated in order to ensure minimum health and comfort levels defined by Member States The calculation of primary energy shall be based on primary energy factors per energy carrier, which may be based on national or regional annual weighted averages or on more specific information made available for individual district system. Primary energy factors shall discount the share of renewable energy in energy carriers so that calculations equally treat: (a) the energy from renewable source that is generated on-site (behind the individual meter, i.e. not accounted as supplied), and (b) the energy from renewable energy sources supplied through the energy carrier.	***Annex, point 2*** *2. The energy needs for* ***technical building systems*** ~~***space heating, space cooling, domestic hot water and adequate ventilation***~~ *shall be calculated in order to ensure minimum health and comfort levels defined by Member States* *The calculation of primary energy shall be based on primary energy factors per energy carrier, which may be based on national or regional annual weighted averages or on more specific information made available for individual district system.* *Primary energy factors shall discount the share of renewable energy in energy carriers so that calculations equally treat: (a) the energy from renewable source that is generated on-site (behind the individual meter, i.e. not accounted as supplied), and (b) the energy from renewable energy sources supplied through the energy carrier.*
Annex I, point 3 3. The methodology shall be laid down taking into consideration at least the following aspects: (a) the following actual thermal characteristics of the building including its internal partitions: (i) thermal capacity; (ii) insulation; (iii) passive heating; (iv) cooling elements; and (v) thermal bridges; (b) heating installation and hot water supply, including their insulation characteristics; (c) air-conditioning installations; (d) natural and mechanical ventilation which may include air-tightness; (e) built-in lighting installation (mainly in the non-residential sector); (f) the design, positioning and orientation of the	***Annex I, point 3*** *3. The methodology shall be laid down taking into consideration at least the following aspects: (a) the following actual thermal characteristics of the building including its internal partitions: (i) thermal capacity; (ii) insulation; (iii) passive heating; (iv) cooling elements; and (v) thermal bridges;* *(b) heating installation and hot water supply, including their insulation characteristics;* *(c) air-conditioning installations;* *(d) natural and mechanical ventilation which may include air-tightness;* *(e) built-in lighting installation (mainly in the non-residential sector);* *(f) the design, positioning and orientation of the*

building, including outdoor climate; (g) passive solar systems and solar protection; (h) indoor climatic conditions, including the designed indoor climate; (i) internal loads.	*building, including outdoor climate;* *(g) passive solar systems and solar protection;* *(h) indoor climatic conditions, including the designed indoor climate;* *(i) internal loads.* ***(j) building automation and control (residential and non-residential)***
Justification Technical Building Systems (TBS) offer a way to leverage the huge energy savings' potential related to optimised generation, distribution, storage and emission of heating and cooling. Despite the obvious benefits, basic building management and control functionalities of heating and cooling systems as well as regular service and maintenance are often missing or being neglected, although they could trigger energy savings of over 30% at very low payback times. Strengthening the focus on Technical Building Systems is an efficient way to address these shortcomings and is much needed to overcome well-known market barriers such as split incentives between homeowners and tenants, lack of investment and of awareness. This is the reason why TBS should be valorised in Annex I of the EPBD.	

2. Make the most of products in buildings: Improve the efficiency of Technical Building Systems

Amendment EPBD Article 2 and Article 8 : Taking into account full load and part load conditions	
Text proposed by the Commission – Article 2 & Article 8:	**Amendment – Article 2 & Article 8:**
	Article 2, new point 17a and 17b (between points 17 and 18): ***17.a. 'full load' means the maximum design demand of technical building systems for space heating, space cooling, ventilation and domestic hot water*** ***17.b. 'part load' means a fraction of full load.***
	Article 2, new point 19.b (after point 19): ***19.b. 'building automation and control system' means a system comprising all products, software and engineering services for automatic controls (including interlocks), monitoring, optimization, for operation, human intervention, and management to achieve energy–efficient, economical, and safe operation of technical building services.***
Article 8, paragraph 5: 5. Member States shall ensure that, when a technical building system is installed, replaced or upgraded, the overall energy performance of the complete altered system is assessed,	**Article 8, paragraph 5:** 5. Member States shall ensure that, when a technical building system is installed, replaced or upgraded, the overall energy performance of the complete altered system is assessed, **at full**

documented and passed on to the building owner, so that it remains available for the verification of compliance with the minimum requirements set pursuant to paragraph 1 and the issue of energy performance certificates. Member States shall ensure that this information is included in the national energy performance certificate database referred to in Article 18(3).	**and part load conditions,** documented and passed on to the building owner, so that **the resulting information** ~~**it**~~ remains available for the verification of compliance with the minimum requirements set pursuant to paragraph 1 and the issue of energy performance certificates. Member States shall ensure that this information is included **as a separate entry** in the national energy performance certificate database referred to in Article 18(3).
Justification 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 and full load conditions. However, these conditions do not occur very often. In reality, technical building systems usually operate under so-called part-load conditions which do have a big improvement potential. The European Commission does not take into account these important factors in its proposal on Technical Building Systems in Articles 2 & 8 of the EPBD.	

Amendment EPBD Article 14 & Article 15: Mandatory inspections and building automation and controls	
Text proposed by the Commission – Article 14 & Article 15:	**Amendment – Article 14 & Article 15:**
Article 14: (a) paragraph 1 is replaced by the following: 1. Member States shall lay down the necessary measures to establish a regular inspection of the accessible parts of systems used for heating buildings, such as the heat generator, control system and circulation pump(s) for non-residential buildings with total primary energy use of over 250MWh and for residential buildings with a centralised technical building system of a cumulated effective rated output of over 100 kW. That inspection shall include an assessment of the boiler efficiency and the boiler sizing compared with the heating requirements of the building. The assessment of the boiler sizing does not have to be repeated as long as no changes were made to the heating system or as regards the heating requirements of the building in the meantime.'	***Article 14:*** *(a) paragraph 1 is replaced by the following:* *'1. Member States shall lay down the necessary measures to establish a regular inspection of the accessible parts of systems used for heating buildings, such as the heat generator, control and ventilation systems, and circulation pump(s) for* ~~***non-residential with total primary energy use of over 250MWh and for residential***~~ *buildings with a technical building system of an effective rated output of over* ~~***100***~~ ***70*** *kW at least. That inspection shall include an assessment of the* ~~***boiler heat***~~ ***generator*** *efficiency and* ~~***the boiler***~~ ***equipment*** *sizing compared with the heating requirements of the building,* ***of the effectiveness of control of individual room temperature, and of the balancing of energy distribution in the heating system including at full and part load conditions.*** *The*

	assessment of the ***~~boiler~~ heat generator*** *sizing does not have to be repeated as long as no changes were made to the heating system or as regards the heating requirements of the building in the meantime.';* ***The inspection should be followed by servicing and maintenance of the accessible parts of systems used for heating buildings, if assessed by the inspection as being needed.***
b) paragraphs 2, 3, 4 and 5 are deleted and replaced by the following: '2. As an alternative to paragraph 1 Member States may set requirements to ensure that non-residential buildings with total primary energy use of over 250 MWh per year are equipped with building automation and control systems. These systems shall be capable of: (a) continuously monitoring, analysing and 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. 3. As an alternative to paragraph 1 Member States may set requirements to ensure that residential buildings with centralised technical building systems of a cumulated effective rated output of over 100 kW are equipped: (a) with continuous electronic monitoring that measures systems' efficiency and inform building owners or managers when it has fallen significantly and when system servicing is necessary, and (b) with effective control functionalities to ensure optimum generation, distribution and	*(b) paragraphs 2, 3, 4 and 5 are deleted and replaced by the following:* *'2.* ***~~As an alternative to paragraph 1~~*** *Member States* ***~~may set~~ shall lay down the necessary requirements*** *to ensure that non-residential buildings with total primary energy use of over 250 MWh per year are equipped with building automation and control systems by 1 January 2023. These systems shall be capable of:* *(a) continuously monitoring, analysing and 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.* *3.* ***~~As an alternative to paragraph 1~~*** *Member States* ***~~may set~~ shall lay down the necessary*** *requirements to ensure that residential buildings with centralised technical building systems of a cumulated effective rated output of over 100 kW are equipped by 1 January 2023:* *(a) with continuous electronic monitoring that measures systems' efficiency and inform building owners or managers when it has*

use of energy.’;	*fallen significantly and when system servicing is necessary, and* *(b) with effective control functionalities to ensure optimum generation, distribution and use of energy.’; including individual room temperature control and dynamic hydraulic balancing functionalities.* *(c) paragraph 3.b.* ***(originally Article 14.3 in the current Directive 2010/31/EU)*** *is added:* *3.b. The accessible parts of systems used for heating buildings, such as the heat generator, control and* ***ventilation*** *system**s,** and circulation pump(s) for non-residential buildings with total primary energy use of over 250MWh and for residential buildings with a centralised technical building system of a cumulated effective rated output of over 100 kW shall be inspected at least every two years.*
Article 15: (a) paragraph 1 is replaced by the following: 1. Member States shall lay down the necessary measures to establish a regular inspection of the accessible parts of air-conditioning systems for nonresidential buildings with total primary energy use of over 250MWh and for residential buildings with a centralised technical building system of a cumulated effective rated output of over 100 kW. The inspection shall include an assessment of the air-conditioning efficiency and the sizing compared to the cooling requirements of the building. The assessment of the sizing does not have to be repeated as long as no changes were made to this air-conditioning system or as regards the cooling requirements of the building in the meantime. (b) paragraphs 2, 3, 4 and 5 are deleted and replaced by the following: ‘2. As an alternative to paragraph 1 Member States may set requirements to ensure that	***Article 15:*** *(a) paragraph 1 is replaced by the following:* *1. Member States shall lay down the necessary measures to establish a regular inspection of the accessible parts of air-conditioning systems for* ***~~non-residential buildings with total primary energy use of over 250MWh and for residential~~*** *buildings with a technical building system of an effective rated output of over* ***~~100~~ 70*** *kW at least. The inspection shall include an assessment of the air-conditioning efficiency and the sizing compared to the cooling requirements of the building,* ***of the effectiveness of control of individual room temperature, and of the balancing of energy distribution in the air-conditioning system including at full and part load conditions.*** *The assessment of the sizing does not have to be repeated as long as no changes were made to this air-conditioning system or as regards the cooling requirements of the building in the meantime.* ***The inspection should be followed by servicing and maintenance of the accessible parts of air-conditioning systems, if assessed by the inspection as being needed.*** *(b) paragraphs 2, 3, 4 and 5 are deleted and replaced by the following:* *‘2.* ***~~As an alternative to paragraph 1~~*** *Member*

non-residential buildings with total primary energy use of over 250 MWh per year are equipped with building automation and control systems. These systems shall be capable of: (a) continuously monitoring, analysing and 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; EN 19 EN (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.	*States* ~~***may set***~~ ***shall lay down the necessary*** *requirements to ensure that non-residential buildings with total primary energy use of over 250 MWh per year are equipped with building automation and control systems by 1 January 2023. These systems shall be capable of: (a) continuously monitoring, analysing and 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; EN 19 EN (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.*
3. As an alternative to paragraph 1 Member States may set requirements to ensure that residential buildings with centralised technical building systems of a cumulated effective rated output of over 100 kW (a) with continuous electronic monitoring that measures systems' efficiency and inform building owners or managers when it has fallen significantly and when system servicing is necessary, and (b) with effective control functionalities to ensure optimum generation, distribution and use of energy.';	*3.* ~~***As an alternative to paragraph 1***~~ *Member States* ~~***may set***~~ ***shall lay down the necessary*** *requirements to ensure that residential buildings with centralised technical building systems of a cumulated effective rated output of over 100 kW are equipped by 1 January 2023 (a) with continuous electronic monitoring that measures systems' efficiency and inform building owners or managers when it has fallen significantly and when system servicing is necessary, and (b) with effective control functionalities to ensure optimum generation, distribution and use of energy.';* ***(c) paragraph 3.b. is added:*** ***3.b. The accessible parts of air-conditioning systems for non-residential buildings with total primary energy use of over 250MWh and for residential buildings with a centralised technical building system of a cumulated effective rated output of over 100 kW shall be inspected at least every two years.***
Justification Optimising Technical Building Systems (TBS) offers great potential to trigger energy savings of over 30% with very low pay-back periods and no lock-in effects whilst strongly contributing to the decarbonisation of European buildings (2 – 32 Mtoe / year) (see Cardonnel Ingénierie Study in Annex). Nonetheless for TBS to deliver their energy savings potential they need to be properly	

maintained and controlled. Controls enable building owners to continuously monitor the performance of their buildings and make corrections when problems arise. They enable owners/tenants to modify the performance of systems immediately to respond dynamically to loads in a building and be proactive about saving energy efficiency. Buildings without controls are set to be optimized for a set design condition that is most likely not representative of operation for most of the year. Physical inspections and building automation and controls must work together, and not against each other. Our concern is that inspections alone, even recommissioning of buildings, rarely result in long-term changes. With remote monitoring the owner/tenant gets immediate indicators that something is wrong, not just once a year opportunities to identify and correct issues.

Against this background, EPEE recommends to include mandatory requirements to install active building automation and control systems for large non-residential buildings with total primary energy use of over 250 MWh per year and include mandatory requirements to install continuous electronic monitoring and effective control functionalities for residential buildings with centralised technical building systems of a cumulated effective rated output of over 100 kW.

EPEE also supports having mandatory regular inspections for all buildings with a technical building system of an effective rated output of over 70kW and to ensure that inspections for buildings with smaller equipment are done at regular intervals (every two years) and that inspections also cover ventilation. Lastly, EPEE recommends that inspections be followed by servicing and maintenance of technical buildings systems, if assessed by the inspection as being needed.

3. Promote technological innovation: Support the new Primary Energy Factor (PEF)

EPEE supports the European Commission's proposal of a PEF of 2.0 as it strikes the right balance between promoting renewable energies, and the "energy efficiency first" principle and provides a solid and coherent bond between the Energy Efficiency Directive (EED), the Directive on Renewable Energy Sources (RES), the Ecodesign Framework Directive and the future Energy Labelling Regulation.

Conclusion

EPBD, EED and RES are closely interlinked and it is important to make best use of their synergies. We welcome the fact that this seems to be the case today and encourage decision makers to continue in this vein, taking into account our proposed recommendations.

However, the importance of standards is often under-estimated although they are key to ensure full implementation and enforcement – in particular with regards to the complexity of the EPBD. A national approach on standardization, as is currently applied does not reflect the economic context in Europe and could, in the worst case, completely undermine the objectives of the Directives.
We therefore call on decision makers to fully recognise, promote and apply the now finalised set of CEN EPBD standards across the EU Member States to make the revision of the EPBD a true success.

As EPEE, we firmly believe in the great potential of Europe's energy framework. By focussing on the right aspects, it will lay the necessary groundwork to lift buildings up one level to become more than just buildings but rather the "energy hubs" of the future, which will play an essential role in view of Europe's long term decarbonisation targets including, for example, the broad scale introduction of electrified cars and much more.

ANNEX – Case studies showing the importance of optimizing the energy performance of Technical Building Systems

It is essential that legislation takes a holistic view when approaching buildings systems by optimizing the energy performance of Technical Building Systems. Key to optimized Technical Building systems is to ensure effective building automation and control. This does not require invasive renovation measures, pays back quickly and has no lock-in effects. However, despite these obvious benefits, the great potential of optimizing energy performance of Technical Building Systems has not been exploited yet.

Case study 1: A study carried out by Cardonnel Ingéniérie highlights the significant negative impact of a lack of proper maintenance and control of thermal equipment on energy consumption, cost and CO2 emissions. In the example given, the energy consumption of a conventional space heater increases by 10% after 5 years and by 35% after 10 years due to a lack of maintenance and control. This has a direct impact on CO2 emissions which increase accordingly and on the payback time, which nearly doubles due to the increased energy consumption. In addition, the study demonstrates that 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. Upgrading the envelope of the same buildings, however, requires payback times of 24 to 28 years, achieving energy savings from 40% to 50%.

Case study 2: A study carried out by Kirsten Gram-Hanssen study on efficient technologies shows that energy certification and passive efficiency technologies like insulation are not sufficient to ensure expected energy efficiency due to the rebound effect in the human user behaviour. Heating consumption in similar buildings can vary with a factor 3 dependent on behaviour. This is a major parameter to observe and the first step to enable energy friendly behaviour is to ensure metering of system performance and then mitigate deviations by active TBS controls.

Case study 3: A study conducted by DG Energy on energy saving potentials in the industry sector 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. According to this study, an Integrated Control System is classified as "projected sector energy saving opportunities with highest technical potential" (with <2 year simple payback), along with other measures.

Case study 4: A study conducted by Waide Strategic Efficiency shows that incremental investments are nine times less than the value of the resulting savings in energy bills. Proper application of building automated technology and controls has the theoretical potential to save about 22% of building energy consumption by 2021.

⇨ **These findings highlight the importance of ensuring that measures to improve the energy performance of buildings should not focus on the building envelope only, but should include all elements and technical systems in a building.**