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Energy Performance of Buildings Directive: Achieving both high indoor air quality and low energy consumption in European buildings

EVIA calls upon decision-makers to strengthen provisions ensuring proper Indoor Air Quality (IAQ), while taping into the huge energy savings potential of the existing building stock and raising awareness among consumers on optimized behaviours.

Buildings account for approximately 40% of the EU's overall energy consumption and for 36% of the EU's overall emissions of greenhouse gas. 70% of the buildings, which will be occupied in 2050, are already built. EVIA, representing the European Ventilation Industry, therefore supports the objectives laid down in the Energy Performance of Buildings Directive (EPBD) and welcomes the Commission's first step, recognising the crucial importance of indoor environment quality aspects in buildings. However, it could have gone even further for the benefits of citizens.

The revision of the EPBD is a great opportunity to drive the much needed changes and improvements in the existing building stock and promote systems and solutions that result in high Indoor Air Quality (IAQ), low energy consumption and consumers' empowerment. It is therefore an essential tool to meet the EU's climate and energy targets and improve citizens' health, comfort and productivity.

To achieve these objectives, EVIA considers therefore that improvements in the following two complementary areas are essential:

1. **Ensuring adequate indoor air quality in European buildings**

2. **Regular inspections of ventilation systems to achieve healthy and energy efficient buildings**

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1. Ensuring adequate indoor air quality in European buildings

The EPBD has so far been implemented without giving enough consideration to Indoor Air Quality and thermal comfort (especially in retrofitted buildings). As buildings are getting tighter and better insulated in order to reduce uncontrolled energy losses and increase their envelope performance, the air exchange by infiltration goes down to near zero.

According to the *Promoting actions for healthy indoor air project report* (IAIAQ project)[1], 2 million healthy years are lost in the EU every year due to poor indoor air quality. There is significant scientific evidence on the health benefits of improved IAQ in residential and non-residential buildings through source control, dedicated mechanical ventilation technology and adequate filtration of incoming air. Due to the increasing air tightness of buildings, it is essential to ensure that sufficient fresh air is introduced to keep occupants healthy and to protect the building condition especially adverse effect from moisture.

[1] Jantunen M., Oliveira Fernandes E., Carrer P., Kephalopoulos S., Promoting actions for healthy indoor air (IAIAQ).(2011) European Commission Directorate General for Health and Consumers. Luxembourg.

While Annex I is revised to take into account the importance of the indoor environment, there should be consistency throughout the Directive and minimum Indoor Air Quality requirements in buildings should be set.

Furthermore energy certificates of buildings do not make sense without comparable information about indoor air quality and thermal comfort. Energy aspects can only be compared on the basis of an equivalent indoor air quality and thermal comfort. There are standards in the EPBD mandate to declare such values.

The newly proposed "Smartness Indicator" could support the transition to smart buildings. However, it has to be clarified that a building may only be classified as "smart" if it provides adequate Indoor Air Quality to its occupants and the means to check and control it.

- ⇨ Member States shall take the necessary measures to ensure that minimum indoor air quality requirements for buildings or building units are set.
- ⇨ They shall require minimum ventilation airflow, independent from any user action, which shall take account the intended use of the building.
- ⇨ Member States shall establish a methodology to calculate Indoor Air Quality level:
  - The indoor air quality level shall be reported in a transparent way in the energy performance certificate
  - The energy performance certificate shall also include information about the indoor air quality (ventilation rate) and the indoor thermal environment (summer and winter).
- ⇨ The smartness indicator shall cover features that enhance the ability of occupants and of the building itself to react to indoor air quality and thermal comfort.

2. Regular inspections of ventilation systems to achieve healthy buildings

The EPBD has not sufficiently addressed the challenge of modernising existing buildings. If Member States proceed with the current speed of refurbishment rate (approx. 1% per annum), it will require over 100 years to upgrade the building stock. Triggering renovation is therefore critical and setting mandatory inspection requirement is an effective way to achieve this objective.

If technical systems are left unchecked, they consume more energy and result in sub-optimal behaviours. The EPBD shall therefore not only maintain the existing requirement on inspection of heating and air conditioning systems (articles 14 to 16) but also include such requirements for ventilation systems in order to ensure optimal performance. Indeed, the typical share of air renewal losses in the heating demand can be as high as 50%. Furthermore the possible energy savings in ventilation systems (better fans, use of heat recovery and/or demand control) are comparable to those in AC systems.

Member States may reduce the frequency of these inspections or lighten them, as appropriate, when an electronic monitoring and control system is in place. However, as long as it is not the case in existing buildings, mandatory inspection requirements are fundamental to reduce the energy needs from buildings and to ensure an appropriate level of Indoor Air Quality.

Finally, consumers do not know much about their ventilation systems, which are usually provided as part of the equipment delivered within the building especially for multi-family residential buildings. In addition, breakdown or deterioration of ventilation systems is much more difficult for a consumer to detect than for other systems such as heating. For these reasons, consumers would greatly benefit from regular inspections, which would provide information on how their existing system performs and lead them to invest in modern and energy-efficient technologies, with a direct impact on their energy bills and the quality of the air they breathe. *See Annex 2 for more details on inspections in Germany.*

- ⇨ The revised EPBD shall ensure mandatory regular inspections of technical building systems, including ventilation.
- ⇨ The revised EPBD shall include requirements to install active building automation and control systems as an alternative to mandatory regular inspections.

See in the Annexes:

1. *Suggested amendments to the EPBD proposal to ensure adequate indoor air quality in European buildings*
2. *The benefits of regular inspections (German study)*

Annex 1: Suggested amendments to the EPBD proposal to ensure adequate indoor air quality in European buildings

Commission's proposal	*EVIA Amendment*
	Article 1 – Subject matter (f) regular inspection of heating, **ventilation** and air-conditioning systems in buildings;
	Article 4 - Setting of minimum energy performance requirements *1. Paragraph 4.* These requirements shall take account of general indoor climate conditions **and indoor air quality**, in order to avoid possible negative effects such as inadequate **thermal comfort and** ventilation, as well as local conditions and the designated function and the age of the building.
	New article: Setting of minimum ventilation performance requirements **1. Member States shall take the necessary measures to ensure that minimum indoor air quality requirements for buildings or building units are set. They shall require minimum ventilation airflow, independently from any user action. These requirements shall take into account the intended use of the building and refer to appropriate EN standards.** **2. Member States shall establish a methodology to calculate ventilation performance consistent with appropriate EN standards. The ventilation performance will be mentioned in the energy performance certificate.**
	Article 6 – New buildings 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 is considered and taken into account in order to deliver on the long-term 2050 goal to decarbonize their national building stock. High efficiency alternative systems are evaluated under the EU Ecodesign and Energy Labelling Regulations.**
Article 8 - Technical building systems 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	**Article 8 - Technical building systems** 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, **an adequate indoor air quality level when relevant,** 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. (…) 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, documented it 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). 6. The Commission is empowered to adopt delegated acts in accordance with Article 23 supplementing this Directive with a definition of 'smartness indicator' and with the conditions under which the 'smartness indicator' would be provided as additional information to prospective new tenants or buyers. The smartness indicator shall cover flexibility features, enhanced functionalities and capabilities resulting from more interconnected and built-in intelligent devices being integrated into the conventional technical building systems. The features shall enhance the ability of occupants and the building itself to react to comfort or operational requirements, take part in demand response and contribute to the optimum, smooth and safe operation of the various energy systems and district infrastructures to which the building is connected.	applied in so far as they are technically, economically and functionally feasible. (…) 5. Member States shall ensure that, when a technical building system is installed, replaced or upgraded, the overall energy **and, when relevant, indoor air quality** performance of the complete altered system is assessed, 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). 6. The Commission is empowered to adopt delegated acts in accordance with Article 23 supplementing this Directive with a definition of 'smartness indicator' and with the conditions under which the 'smartness indicator' would be provided as additional information to prospective new tenants or buyers. The smartness indicator shall cover flexibility features, enhanced functionalities and capabilities resulting from more interconnected and built-in intelligent devices being integrated into the conventional technical building systems. The features shall enhance the ability of occupants and the building itself to react to **indoor air quality and thermal** comfort **and** operational requirements, take part in demand response and contribute to the optimum, smooth, **healthy** and safe operation of the various energy systems and district infrastructures to which the building is connected
Article 14 – Inspection of heating systems 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 – Inspection of heating *and ventilation* systems** 1. Member States shall lay down the necessary measures to establish a regular inspection of the accessible parts of systems used for heating **and ventilating** buildings, such as the heat generator, **ventilation systems,** control system and circulation **systems** ~~pump(s)~~, for non-residential buildings with **a** total ~~primary energy use~~ **surface area** of over ~~250MWh~~ **1000 m²** and for residential buildings with a centralised technical building system of a cumulated effective rated output of over 100 kW **or of a cumulated effective rated air flow of over 1000 m³/hour for ventilation systems**. That inspection shall include an assessment of the ~~boiler heat generator~~ **unit** efficiency and ~~the boiler heat generator~~ sizing compared with ~~the heating~~ the requirements of the building. 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 and **ventilating** requirements of the building in the meantime.

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.	2. As an alternative to paragraph 1 Member States may set requirements to ensure that non-residential buildings with **a** total ~~primary energy use~~ **surface area** of over ~~250 MWh per year~~ **1000 m^2** are equipped with building automation and control systems. These systems shall be capable of: (a) continuously monitoring, analysing and adjusting energy usage, **taking into account the requirements of the building, including the one related to indoor air quality level**; (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 use of energy.	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 **or of a cumulated effective rated air flow of over 1000 m^3/hour for ventilation systems** 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 use of energy **and adequate indoor air quality level**.
	Article 11 – Energy performance certificates 1. Member States shall lay down the necessary measures to establish a system of certification of the energy performance of buildings. The energy performance certificate shall include the energy performance of a building and reference values such as minimum energy performance requirements in order to make it possible for owners or tenants of the building or building unit to compare and assess its energy performance. The energy performance certificate may include additional information such as the annual energy consumption for non- residential buildings and the percentage of energy from renewable **and waste energy sources** in the total energy consumption. **The energy performance certificate shall include information about ventilation performance and the indoor thermal environment (summer and winter).**
Annex I 1. The energy performance of a building shall reflect its typical energy use for heating, cooling, domestic hot water, ventilation and lighting.	**Annex I** 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 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). 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.	The energy performance of a building shall be expressed by a numeric indicator of primary **or final** 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 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). 2. The energy needs for space heating, space cooling, domestic hot water and adequate ventilation shall be calculated in order to ensure minimum health, **indoor air quality** and comfort levels defined by Member States. The calculation of primary **or final** 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 **or final** 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. 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; **(new) ventilation systems;** (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 **and indoor air quality**, including the designed indoor climate; (i) internal loads.

Annex 2: The benefits of regular inspections (German study)

The German study "Chancen der Energetischen Inspektion" includes an analysis of the inspections made in Germany until the end of 2012. The following most energy relevant aspects have been found:

- The average age of Air-Conditioning systems is over 25 years
- Only 32% of the AC systems include a heat recovery device
- The average fan efficiency is lower than 35%. Typically > 60% is good practice
- Air volume flow is far too high in 37% of the systems
- Demand control options are missing in 53% of the systems
- 45% of the AC systems are over-designed
- 18% of the chillers are controlled with bad performing hot gas bypass
- 21% can be equipped with free cooling options
- The hydraulic system is, in 24% of the cases, weak

Based on the average findings in the inspections the energy savings potential in Germany can be estimated:

Optimised Operation (low investment):	19 to 32 TWh Primary Energy
	4.5 to 7.6 Mio tons CO_2
Additional change of key components:	33 to 55 TWh Primary Energy
	7.7 to 12.9 Mio tons CO_2

About EVIA:

The European Ventilation Industry Association (EVIA) was established in Brussels in July 2010. EVIA's mission is to represent the views and interests of the ventilation industry and serve as a platform between all the relevant European stakeholders involved in the ventilation sector, such as decision-makers at the EU level as well as our partners in EU Member States.

Our membership is composed of more than 35 member companies and 6 national associations across Europe, realising an annual turnover of over 7 billion euros and employing more than 45,000 people in Europe.

EVIA aims to promote highly energy efficient ventilation applications across Europe, with high consideration for health and comfort aspects. Fresh and good indoor air quality is a critical element of comfort and contributes to keeping people healthy in buildings.

Check our website: www.evia.eu