Building Life Quality with the EPBD Recast
Technical recommendations for Indoor Environmental Quality (IEQ) requirements

IEQ and EU's Policy Context

According to the WHO, people spend around 90% of their time indoors, both in residential and non-residential buildings, with 26 million children living in unhealthy homes. In that vein, renovation is at the heart of the European legislative agenda for better energy efficiency and to promote a healthy, comfortable and productive indoor environment for all European citizens. The yearly renovation rates of the building stock across EU Member States vary from 0.4 to 1.2%. If Europe is to fulfil its 2050 climate and energy goals, this rate must at least double to 3% yearly. With 97% of EU's buildings needing renovation, this represents a golden opportunity to boost energy efficiency whilst ensuring adequate indoor environmental quality. Renovating buildings while addressing indoor environmental quality is crucial for the life quality of the people inhabiting the buildings.

The Energy Performance of Buildings Directive (EPBD) is a key legislative measure by the European Union aimed at improving the energy efficiency of buildings across Member States. Originally introduced as part of the EU's broader climate and energy goals, the EPBD sets out a framework for reducing the energy consumption and greenhouse gas emissions associated with the built environment. By establishing stringent energy performance standards, the Directive aims to foster the development of buildings that not only consume less energy but also contribute to the EU's overall objective of achieving a carbon-neutral economy by 2050. However, the significance of the EPBD extends beyond mere energy efficiency. In its recent revisions, the Directive has increasingly recognized the pivotal role of Indoor Environmental Quality (IEQ) in shaping the health, comfort, and productivity of building occupants.

In this context, IEQ is not merely an optional enhancement but a fundamental component of the EPBD's broader goals. It plays a critical role in aligning the Directive's energy efficiency objectives with the social and economic imperatives of creating healthy, comfortable, and productive indoor environments. This integration of IEQ into the EPBD framework, represents a significant step forward in the EU's efforts to improve building performance in a way that benefits both the environment and the people who live and work in these spaces.

As Member States prepare for the transposition of the EPBD Recast into national law by 29 May 2026, this joint technical paper outlines key policy recommendations from the IEQ sector for EU and local policymakers to take into consideration while preparing for its effective implementation and subsequent monitoring at national level.

Indoor Environmental Quality Gathering Signatories

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IEQ and Energy Performance of Buildings

IEQ encompasses four key elements:

- **Indoor Air Quality (IAQ)** is dependent on factors like ventilation, pollutants, and contaminants. Adequate ventilation is crucial for removing pollutants, supplying fresh air and keeping the humidity level in an appropriate range, while measures to control sources of indoor contaminants, such as volatile organic compounds (VOCs), are also essential
- **Thermal Comfort** involves balancing heating and cooling systems to ensure that the environment is neither too hot nor too cold, while also considering factors like humidity and air movement
- **Lighting** requires careful consideration of natural light sources, such as windows, and artificial lighting systems to optimize lighting conditions
- **Acoustics** design involves strategies to reduce noise transmission and absorption, such as insulation, sound barriers, and noise-absorbing materials

The main function of buildings is to provide shelter from the external environment and ensure adequate IEQ. How well this is accomplished, meaning the level of indoor environmental quality (especially in terms of indoor air quality, thermal comfort and lighting comfort), directly affects the energy performance of a building. If the building envelope is not sufficiently airtight:

- The better the air quality is inside a building the more energy is needed for indoor air replacement with outdoor air
- Healthy and comfortable temperature ranges also need more heating and cooling energy than wider and uncomfortable temperature ranges
- Daylighting & artificial lighting to increase the visual comfort may induce higher energy needs both for heating and cooling

The level of IEQ has a direct impact on the energy performance of a building and this impact can be as high as a couple of energy performance classes, in the Energy Performance Certificates (EPCs).

- This alone makes it evident that the energy performance of a building cannot be specified without specifying at the same time, the IEQ to be reached.
- In the situation of establishing a minimum requirement for IEQ, cost-benefit analyses will make it salient and justified how far the IEQ should be improved depending on the building category e.g. calculated:
  - through increased productivity in workplace,
  - improved learning performance in schools,
  - reduced harm to health (expressed in DALY[1]) in residential buildings.

The minimum IEQ level holds significant importance as an input parameter in assessing building energy performance, both in terms of calculated and measured energy. Consequently, IEQ must be explicitly addressed.

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[1] https://www.who.int/data/gho/indicator-metadata-registry/imr-details/158

- It is essential to always have knowledge of and report IEQ parameters connected with energy, such as thermal comfort, air exchange / carbon dioxide / indoor pollutant / relative humidity levels & external pollutants, lighting levels, acoustic levels & external noise pollution
- Without comprehensive information of the IEQ aspects, comparability of calculated energy performance values becomes challenging, and reliance on measured energy should be approached with caution.

Assessing and monitoring IEQ alongside energy performance serves multiple purposes:

- Firstly, it allows for an assessment of whether improved energy efficiency ratings have been achieved at the expense of IEQ deterioration, for example, in buildings lacking cooling systems.
- Furthermore, it provides visibility to exemplary designs that utilize energy-efficient solutions and contribute to building climate change resilience
- Reporting IEQ also helps prevent the risk of post-renovation IEQ deterioration due to factors like decreased air exchange rates or compromised solar factors
- Lastly, it ensures the appropriate utilization of financial instruments and Minimum Energy Performance Standards (MEPS). It safeguards against misleading energy savings claims resulting for example from underheated or overheated buildings, where fictitious energy savings are reported due to a reduced IEQ level.

GUIDANCE FOR THE EPBD RECAST IMPLEMENTATION AND MONITORING IN EU'S MEMBER STATES

Defining and Establishing a Coherent Framework for IEQ

i. Strengthening the Definition for IEQ

ARTICLE 2, §66: DEFINITION OF INDOOR ENVIRONMENTAL QUALITY
ARTICLE 5
ARTICLES 7 & 8
ARTICLE 13

'indoor environmental quality' means the result of an assessment of the conditions inside a building that influence the health and well-being of its occupants, based upon parameters such as those relating to the temperature, humidity, ventilation rate and presence of contaminants"

The definition of indoor environmental quality (IEQ) is being introduced for the very first time. It holds particular significance in the context of Article 13, Paragraph 10, capability (d) of the Building Automation and Controls capabilities listed, as well as Article 13, Paragraphs 4 & 5, which requires Member States to establish optimal Indoor Environmental Quality Standards and require monitoring and regulation of parameters in buildings. The definition outlines several parameters that impact IEQ and can serve as the basis for minimum national monitoring or standard requirements. However, these parameters are not exhaustive, and the definition needs to be strengthened by the Commission's guidelines.

The following parameters should be monitored to ensure optimal IEQ with reference to EN 16798-1, the ALDREN TAIL index and Level(s) European framework for sustainable buildings objective 4 on Healthy and Comfortable spaces:

- Temperature (T)
- Ventilation Rate
- Relative Humidity (RH)
- CO_2 levels
- Volatile Organic Compounds (VOC)
- Particulate Matter (PM2.5)
- Lighting, specifically Daylight Illuminance Level (DIL)

It would be practical to make any reporting consistent with EN 16798-1 (anticipating its ongoing update) and the other standards included in that series and harmonise requirements between EPBD and the measurable indicators based on those of the LEVEL(s) framework. Level(s) is the European framework for sustainable buildings[2], providing IEQ indicators in User Manual 3, under Macro-Objective 4: Healthy and comfortable spaces, where indicators 4.1 to 4.4 can be found for IAQ, thermal comfort, lighting and acoustics. Regarding to numeric values, LEVEL(s) indicators 4.1[3] and 4.2[4] (IAQ and thermal comfort) refer to EN 16798-1 standard which uses Categories I to IV to describe IEQ level. As EPBD refers to 'healthy indoor climate' and 'optimal indoor environmental quality', it can be recommended to use the normal level of Category II specified in EN 16798-1 which values will not only ensure avoiding adverse health effects but also ensure comfort and well-being of occupants. Effective facility management should also be explicitly referenced as a key enabler of optimal IEQ. When setting minimum requirements (design), conducting commissioning (handing over) and continuous monitoring in operation or inspection (regular check), relevant IEQ parameters are different as illustrated in Table 1.

[2] https://environment.ec.europa.eu/topics/circular-economy/levels_en

[3] Dodd N., Donatello S. & Cordella.M., 2021. Level(s) indicator 4.1: Indoor air quality user manual: introductory briefing, instructions and guidance (Publication version 1.1)

[4] Dodd N., Donatello S., & Cordella M., 2021. Level(s) indicator 4.2: Time outside of thermal comfort range user manual: introductory briefing, instructions and guidance (Publication version 1.1)

		Design	Commissioning	Monitoring[1)]	Inspection	Comment
Thermal	Operative temperature	x				At representative points in the occupied zone to ensure occupant comfort
	Air velocity	x				At representative points in the occupied zone to ensure the design and control of the HVAC system for occupant comfort
	Air temperature			x		At 1.1 m above the floor in occupied zones
	Relative humidity	x		x		At 1.1 m above the floor in occupied zones
Acoustics	Sound pressure (A- and C-weighted)	x	x			Equivalent continuous sound pressure level (A- and C-weighted) at representative points in the occupied zone
	Sound reverberation time	x	x			Evaluation of noise at the design stage is found in EN 12354–5. Sound insulation parameters are not included in this document
Indoor air quality	Carbon dioxide	x		x		At 1.1 m above the floor in occupied zones, the extracted air
	PM2.5	x[2)]		x[3)]		At 1.1 m above the floor in occupied zones
	Formaldehyde				x	Near potential sources such as furniture and flooring
	Nitrogen dioxide				x	Near potential sources like kitchens and garages
	Carbon monoxide				x	Alarm sensors in buildings with combustion sources
	Radon	x			x	In the lowest occupied level of the building
	Ventilation rate	x	x		x	Outdoor airflow rate supplied and extracted from rooms, typically measured from supply and extract terminals
Light	Daylight provision	x		x	x	Daylight can be evaluated in accordance with EN 17037
	Glare probability	x				At workstations and near windows (EN 17037)
	Illuminance	x	x	x	x	The quality of lighting can be evaluated in accordance with EN 12464–1

[1)] *In addition to indoor values, monitoring of outdoor values for air temperature, humidity, CO_2 and PM2.5 is needed. The importance for IAQ is the difference between indoor-outdoor CO_2 and PM2.5.*

[2)] *For non-residential buildings filters are specified in EN 16798-3.*

[3)] *PM 2.5 continuous monitoring is not needed if particulate matter is controlled with filters in the ventilation system or outdoor levels are below recommended AQG levels (see EN 16798-3 for non-residential buildings), and there is no significant infiltration through the building envelope. Overall, for residential and non-residential buildings alike, PM filtration should only be made compulsory in areas where the outside PM pollution is above a certain level (10μg/m^3/year).*

Table 1. An example of the prioritisation of IEQ parameters. Minimum requirements specify design targets which compliance can be assessed with commissioning procedures. IEQ and energy performance can be assessed with continuous monitoring and inspection.

EPBD introduced a new principle of optimal indoor environmental quality. When setting minimum energy performance requirements, Article 5 states that “those requirements shall take account of optimal indoor environmental quality, in order to avoid possible negative effects such as inadequate ventilation…”. Revised Articles 7 and 8 for new and existing buildings stress IEQ for both new buildings and major renovations by stating that the issues of optimal indoor environmental quality shall be addressed.

Article 13 calls to establish national IEQ requirements: “Member States shall set requirements for the implementation of adequate indoor environmental quality standards in buildings in order to maintain a healthy indoor climate.” These requirements should be referred to when recommendations to improve IEQ are provided in EPC-s which is a new provision in Article 19 (5). It is advised that Member States shall bear in mind the above parameters when setting requirements for IEQ and could report the requirements according to EN 16798-1.

ii. Setting, Monitoring and Controlling IEQ Requirements

ARTICLE 13, §4, §5 & §10 INDOOR ENVIRONMENTAL QUALITY

“Member States shall set requirements for the implementation of adequate indoor environmental quality standards in buildings in order to maintain a healthy indoor climate.”

“Member States shall require non-residential zero-emission buildings to be equipped with measuring and control devices for the monitoring and regulation of indoor air quality. In existing non-residential buildings, the installation of such devices shall be required, where technically and economically feasible, when a building undergoes a major renovation. Member States may require the installation of such devices in residential buildings.”

“The building automation and control systems shall be capable of: (d) by 29 May 2026 monitoring of indoor environmental quality”

Member States should establish IEQ requirements that prioritise maintaining a healthy indoor climate for building occupants. Policy makers should focus on setting performance levels for the key IEQ parameters described above and adapted to different building types and uses. Authorities should always consult all related stakeholders, including facility management professionals and their representative bodies when developing these performance levels. This collaboration ensures that requirements are ambitious and achievable within the operational frameworks of buildings.

Furthermore, Member States should use methods recognised in international standards like EN 16798-1* to set targets[5], which provides benchmarks for acceptable indoor air quality and thermal comfort levels in buildings, and preferably harmonise the selected targets to recognized labels and indexes like the ALDREN TAIL index and Level(s) European Framework for Sustainable Buildings objective 4 on Healthy and Comfortable spaces. This should be accompanied by a tiered system where monitoring and regulation requirements are adjusted

[5] Currently being updated within CEN, thus the content of the revised version shall be anticipated

based on the building type, occupancy levels, and potential risks associated with indoor environmental quality issues.

Member States shall require non-residential zero-emission buildings to be equipped with measuring and control devices for the monitoring, communication and regulation of indoor air quality. In existing non-residential buildings, the installation of such devices shall be required, where technically and economically feasible, when a building undergoes a major renovation based on a predefined action plan, distinguishing between monitoring, communication and regulation. Member States may require the installation of such devices in residential buildings.

The requirement of Article 13(5) to monitor and control indoor air quality in new non-residential buildings is mandatory. This is different to further and outlined hereafter, requirements for BACS of Article 13(10), which according to Article 13(9) should be applied where technically and economically feasible. For the sake of facilitating the attainment of the objectives of the Directive, it should be noted that based on technical and economic feasibility either BACS or commonly available monitoring functionalities and integrated controls of mechanical ventilation systems (as explained in section 'Ventilation') are capable of meeting the mandatory requirements for IAQ monitoring and regulation. Therefore, it is important to prescribe detailed requirements for monitoring and controls systems of mechanical ventilation systems and combined ventilation and air-conditioning systems, which are to be installed in new buildings to enable the latter meet IAQ requirements, as they can provide support with the other provisions of Article 13(10) on building automation and control systems[6].

In addition to the monitoring capability under BACS requirements for non-residential buildings, Member States are required to set monitoring and control requirements in a broader scope of non-residential buildings. This needs to be considered in relation to the Article 2 Paragraph 66 definition outlining several parameters that impact IEQ and can serve as the basis for minimum monitoring and regulation requirements: temperature, humidity, ventilation rate and presence of contaminants. The member states should also consider this requirement in relation to the capability (d) of the BACS capabilities under Article 13, Paragraph 10 and coordinate the approach with the capability of decentralised technical building systems to ensure, at their level, monitoring and regulating functionalities.

[6] Eurovent PP-2024-07-12 'Capability of mechanical ventilation control systems in non-residential buildings to support Article 13(10) of Directive 2024/1275 (EPBD). https://www.eurovent.eu/publications/capability-of-mechanical-ventilation-control-systems-in-non-residential-buildings-to-support-article-1310-of-directive-2024-1275-epbd/

Capability (d) is a new addition to the already existing Building Automation and Control Capabilities and shall apply by 29 May 2026. It needs to be considered in relation to the Article 2 Paragraph 66 definition outlining several parameters that impact IEQ and can serve as the basis for minimum monitoring requirements: temperature, humidity, ventilation rate and presence of contaminants, and illumination. However, these parameters are not exhaustive and can be supplemented by Member States as deemed necessary. Temperature (T), relative humidity (RH), and CO_2 levels are considered the minimum list of parameters to be monitored to meet the capability (d) functionality. Additionally, Volatile Organic Compounds (VOC), Particulate Matter (PM2.5) as well as Daylight Illuminance Level (DIL) should be monitored to ensure optimum Indoor Environmental Quality with reference to EN 16798-1 and Level(s) European framework for sustainable buildings objective 4 on Healthy and Comfortable spaces.

Monitoring and control design and implementation plans should include actions outlining how the monitored data will be made available/communicated to the relevant stakeholders.

The Essential Role of Facility Management in Maintaining IEQ

Facility management plays a crucial role in this context, as it is responsible for the day-to-day operation and maintenance of building systems that directly affect IEQ. Effective facility management ensures that HVAC systems, lighting, and other essential building services operate optimally, maintaining a healthy indoor environment while also achieving energy efficiency targets.

Facility managers play a pivotal role in shaping the quality of indoor environments where people live, work, and interact daily. As the individuals responsible for the upkeep and functionality of buildings, their influence extends far beyond mere maintenance. Facility managers are responsible for all the parameters contributing to the IEQ, which in turn directly reflects the effectiveness of facility management practices.

Given the critical connection between facility management and ensuring optimal IEQ, the following should be considered:

- **Recognition of Facility Management in national legislation**: In national transposition of the EPBD, ensure that facility management is explicitly referenced as a key enabler of IEQ. National governments should consult with facility management professionals and their representative bodies when developing harmonized standards for IEQ. This collaboration ensures that standards are ambitious and achievable within the operational frameworks of buildings.

- **Accessible training and certification schemes**: In each Member State, facility management training and certification schemes must be accessible. These programs should include comprehensive training on the new EPBD requirements, particularly the use of the Smart Readiness Indicator (SRI). Additionally, they should cover best practices for ensuring optimal IEQ. Supporting technical education, apprenticeships, and upskilling or reskilling initiatives in the facility management field will be crucial to preparing a workforce that can meet these new challenges. Post-training, facility managers should have access to ongoing operational support at the local level to ensure successful implementation.
- **Funding continuous professional development of facility managers**: Given the rapid evolution of technologies in facility management and the new provisions of the EPBD, continuous and specific training for facility managers is crucial. The European Commission should develop targeted funding programs specifically aimed at the continuous professional development of facility managers. Additionally, local governments should also allocate resources to support certification and training initiatives at the regional level.

Thermal comfort

Indoor environmental parameters for thermal comfort are specified in EN 16798-1 standard. These include parameters for general thermal comfort and local thermal discomfort (draught, radiant temperature asymmetry, floor temperatures, vertical air temperature differences). The minimum requirements in the regulation shall include at least acceptable room temperature[7] ranges for winter and summer. Requirements may be split between non-residential and residential buildings where higher adaptation is possible.

In winter, the correct indoor temperature in residential buildings, and typically in non-residential buildings is provided by a separate space heating system. Where applicable, in summer, the correct indoor temperature is provided by a separate space cooling system. Summer thermal comfort requirements may be specified as overheating prevention requirements.

[7] In EN 16798-1 room temperature is specified as operative temperature that is calculated based on air temperature, mean radiant temperature and air velocity. In new and deeply renovated buildings, the operative temperature is almost equal to the air temperature.

For compliance assessment, it is important to specify during how many percent of the occupancy time the temperature can be out of the required range (excess hours) and which climatic data and internal heat gains this is evaluated with.

i. Temperature control

ARTICLE 13, §3 SELF-REGULATING DEVICES AND HYDRONIC BALANCING

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

Member States should promote these requirements sufficiently in advance for professionals to consider them early enough in the design of new buildings and in the preparation of replacing heat generators in existing buildings.

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

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

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

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

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

- **Room thermostat** for rooms heated by surface heating as part of a hydronic system. These will connect to the mixing valve for each room to adjust the flow temperature to the surface heating for that room, therefore automatically adjusting heat output into the room to maintain the setpoint temperature.
- **Fan coil unit regulating devices** that control water and airflows automatically to maintain/achieve the desired room temperature.
- **Individual device controls** for stand-alone heaters. Where rooms are heated by individual heaters that are not connected to a heat generator serving multiple rooms, it is likely that these heaters would have built-in controls to maintain a set-point temperature in the room. Ecodesign requirements for local space heaters should ensure that all replacement electric panel heaters, for example, will incorporate such controls. However, in some circumstances, it may be necessary to install a room thermostat wired into a local space heater to provide self-regulating room temperature control.

Hydronic systems operate by circulating warm or cool water throughout buildings. The process of "balancing the system" involves ensuring that heating or cooling is distributed efficiently and effectively to meet the building's needs. Hydronic balancing can be performed at room/emitter level and or at building level (typically risers). can be mechanical and or digitally delivered. Unbalanced systems can result in inadequate comfort and increased energy consumption. Hydronic balancing ensures that every room in a building receives the appropriate amount of energy, which reduces pipework losses and pump power consumption and increases heat generator efficiency. Given the growing demand for low-carbon heating systems, such as heat pumps, hydronic balancing is becoming increasingly important to maintain high coefficient performance.

Balancing a hydronic system is typically done in one of two ways:

- The more basic “static balancing,” where the installer must carefully set up the system. Static balancing is performed only for fixed conditions. A statically balanced system might become unbalanced when use or needs vary.
- The more advanced “dynamic balancing”, where special valves are installed to provide automatic balancing, which is much easier to set up and, because the valves can continuously react to changing conditions in the system, will result in perfect balance under all operating conditions.

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

- *“Technical feasibility generally refers to possible technical barriers that can prevent or make technically irrelevant the obligations,*
- *Economic feasibility generally relates to the upfront price (including installation) and the running costs of self-regulating devices and hydronic balancing, as well as how these costs compare to the expected benefits and other costs borne by the investor. In the context of these provisions, only the upfront price is relevant, as running costs of self-regulating devices and hydronic balancing will be negligible.”*

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

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

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

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

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

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

ii. Humidity

ARTICLE 2 §66
ARTICLE 5 §1
ARTICLE 13 §4

The correct indoor relative humidity range, in addition to its significance for the human health and well-being, has a major impact on safety and counteracting the degradation of the building structure. Guidance on the correct range of indoor humidity to be maintained and, where appropriate, monitored is given in EN 16798-1[8].

For relative humidity (RH) in buildings with no other humidity requirements than human occupancy (e.g., offices, schools and residential buildings), EN 16798-1 states that humidification or dehumidification of room air is usually not required. Examples of recommended design criteria for the humidity in occupied spaces are given if the humidification and dehumidification systems are installed. This illustrates the complexity of regulating RH values because the humidity criteria depend on many factors: health, thermal comfort, indoor air quality, condensation, mould growth etc. Poor ventilation and excess humidity can create ideal conditions for microbial growth, especially in kitchens and bathrooms as well as on surfaces cooled by thermal bridges. Microbial growth, in turn, can provoke respiratory or allergenic health issues, while very low RH (< 20%) can irritate the eyes, nose and throat[9]. It is also recommended to avoid RH below 20% because the respiratory tract and mucous membranes are then more sensitive to infections[10].

Thus, it is advisable that relative humidity be kept in the range of 30 to 70%. The upper limit can be relevant in summer in southern humid climates. If the lower limit requirements of RH are set, they should be specified using the building/building type.

Relative humidity should be controlled and monitored:

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[8] Currently being updated within CEN, thus the content of the revised version shall be anticipated

[9] Dodd N., Donatello S. & Cordella.M., 2021. Level(s) indicator 4.1: Indoor air quality user manual: introductory briefing, instructions and guidance (Publication version 1.1)

[10] Kurnitski J, Wargocki P, Aganovic A. Relative humidity effects on viruses and human responses. REHVA Journal, December 2021 https://www.rehva.eu/rehva-journal/chapter/relative-humidity-effects-on-viruses-and-human-responses

- For non-residential buildings: in all continuously occupied spaces and wet rooms.
- For residential buildings: necessarily in wet rooms such as kitchen, bathroom, laundry and occupied spaces.

iii. Air conditioning

ARTICLE 2, §42 THE ROLE OF AIR-CONDITIONING ON HUMIDITY CONTROL

'air-conditioning system' means a combination of the components required to provide a form of indoor air treatment by which temperature is controlled or can be lowered;

Implementation should acknowledge the effect of air conditioning on relative humidity levels. It would be relevant to refer to thermal comfort and the EN 16798-1. Although the EPBD definition may not explicitly mention dehumidification, it does recognise that air conditioning systems can control temperature, which in turn affects relative humidity. The EPBD Recast, which prioritises Indoor Environmental Quality (IEQ) and requires Building Automation and Control Systems (BACS), makes it mandatory for certain buildings to manage both temperature and humidity for occupant health and comfort. This enables facility managers to utilise, in addition to ventilation systems, air conditioning to manage relative humidity while ensuring overall IEQ.

Indoor Air Quality (IAQ)

ARTICLE 2 §66
ARTICLE 5 §1
ARTICLE 13 §4

Indoor air pollution originates from both indoor and outdoor sources, and the interaction of pollutants and oxidants from both[11]. Indoor sources are building materials or cleaning products emitting volatile organic compounds[12], respiratory effluents and body odours emitted by humans themselves, but also combustion, cooking, products with fragrances and resuspending floor dust[13]. It has been shown that the most harmful contaminants in dwellings are PM2.5, PM10, NO2, formaldehyde, radon, and ozone[14]. Good IAQ requires controlling indoor emission sources and concurrently reducing the entry of outdoor pollutants indoors which can be done by filtering outdoor air pollutants and reducing infiltration. The remaining pollutants indoors must be ventilated out. It is also to be noted that a high level of humidity results in the spread of mould with very negative impacts on building occupants' respiratory system. Multiple origin of indoor air pollutants makes IAQ monitoring complicated. Monitoring for all six pollutants included in WHO AQG[15] has shown to be infeasible because of the cost and complexity of compliance monitors to be deployed to all indoor spaces[16].

[11] Weschler, C. Chemistry in indoor environments: 20 years of research. Indoor Air 2011;21:205-218

[12] Harrison, P.; Crump, D.; Kephalopoulos, S.; Yu, C.; Däumling, C.; Rousselle, C. Harmonised regulation and labelling of product emissions–a new initiative by the european commission. Indoor and Built Environment 2011;20:581-583

[13] Qian, J.; Peccia, J.; Ferro, A.R. Walking-induced particle resuspension in indoor environments. Atmospheric Environment 2014;89:464-481

[14] Morantes, Giobertti and Jones, Benjamin and Molina, Constanza and Sherman, Max Howard, Harm from Indoor Air Contaminants. Available at SSRN: https://ssrn.com/abstract=4409736 or http://dx.doi.org/10.2139/ssrn.4409736

[15] WHO Global Air Quality Guidelines: particulate matter (PM2.5 and PM10), ozone, nitrogen dioxide, sulfur dioxide and carbon monoxide. World Health Organization. Geneva, Europe; 2021c

[16] Salthammer, T. TVOC-revisited. Environment International 2022:107440

In addition to pollutants in WHO AQG many other harmful pollutants are common in the indoor air. Low-cost and of adequate accuracy[17] sensors for routine IAQ monitoring are available for CO_2, Relative Humidity, particulate matter PM2.5, and CO that originate from combustion.

Direct measurement of all indoor air pollutants is impossible in practice because it generally requires sampling and subsequent chemical analysis. However, CO_2 concentration can be continuously monitored as a good indicator for air replacement which is an important factor for good IAQ. With PM2.5 monitoring, it can be ensured that outdoor air for air replacement is clean or adequately filtered and indoor sources originated by cooking are properly extracted. In the design of buildings, control of pollutant sources and ventilation rate requirements must be applied for good IAQ. To control particulate matter from outdoor sources, air filtration requirements are also needed. The following minimum requirements can be recommended to be established to control IAQ:

- Source control must be applied for pollution sources from building materials and interior design using low-polluting building materials as defined in EN 16798-1, which means that the values for very low-polluting materials can be used only in the case of labelled/certified materials.
- Ventilation rates to maintain an acceptable level of pollutants in the indoor environment are to be specified according to EN 16798-1 requirements at the design stage and effectively implemented in buildings, regular inspection allowing to ensure this throughout time.
- To control particulate matter, ventilation systems with filters is one way of meeting the requirements in areas where the WHO limits for outdoor air are exceeded. To be effective, the building envelope needs to be airtight. For non-residential buildings filters are specified in EN 16798-3. Guidance on the proper selection of filters is provided in Eurovent 4/23[18]. If no ventilation system with filters is used, other measures need to be considered to control PM2.5.

As EPBD requires in Article 13 the installation of measuring and control devices for the monitoring and regulation of indoor air quality, where technically and economically feasible,

[17] For example defined in existing national regulations (Belgian Royal Decree of 7 February 2024 - CO2 meters or Dutch building code Artikel 3.5 | Bouwbesluit Online) based on EN 50543.

[18] Eurovent 4/23 - 2022 - Selection of EN ISO 16890 rated air filter classes. Brussels; 2023

this requirement shall be included in national regulation. Through this requirement, it has to be ensured that minimum requirements of ventilation rates are set as nominal (design) ventilation rates which under some circumstances can be reduced or increased. In the operation, ventilation rates should at least be controlled according to occupancy and expected permanent pollutant sources to maintain adequate IAQ and temperature setpoints.

IAQ monitoring in non-residential buildings means continuous measuring of parameters in spaces designed for human occupancy, such as classrooms, offices, meeting rooms, restaurants, kitchens, shops, gyms, etc. It can be implemented with the capacity of integrated monitoring and controls of ventilation systems, which include sensors in rooms or through, in the case of complex buildings, centralised BACS. The minimum set of parameters to be monitored are CO_2, temperature, relative humidity, and also PM 2.5, especially if filters are not used according to the recommendations of 16798-3 in non-residential buildings and that the building is in a polluted area (e.g. above 10µg/m^3/year).

In residential buildings, monitoring and regulation of some IAQ parameters is economically feasible. If the requirement is extended to cover residential buildings (EPBD does not require the monitoring and regulation of IAQ in residential buildings) it would be meaningful to monitor CO_2 in living rooms and bedrooms, and relative humidity in wet rooms such as kitchens, toilets and bathrooms. PM 2.5 can be also monitored in areas where the outside pollution is above a certain level (e.g. 10µg/m^3/year).

i. Ventilation

ARTICLE 13, §5, §9, §13

The most typical ventilation system, in recent non-residential buildings, comprises a central ventilation unit (air handling unit) that serves several rooms or zones of similar requirements via ductwork for supply and extract air. For large buildings, this layout is replicated in individual parts or zones of the building, meaning that several air handling units can be installed in a building.

Nowadays, most air handling units are equipped with an integrated control system, including controllers capable of advanced regulation and monitoring functions. According to Eurovent Market Intelligence[19], the rate of AHUs with integrated controls in the EU 27 market in 2023 was 67, 3%.

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[19] https://www.eurovent-marketintelligence.eu/

Unidirectional ventilation units are also more and more fitted with electronic monitoring and control of their functionalities. It is also to be mentioned that demand-control ventilation systems based on humidity adapt ventilation rates to what is needed in a totally passive way.

ii. Indoor air quality and ventilation in non-residential buildings

Elements of the ventilation system, usually offered as a package from a HVAC supplier, typically have the following features supporting the new EPBD provisions:

- **Air Handling Units**
  - Continuous measurement of ventilation air flow rate (supply and exhaust air).
  - Continuous adjustment of ventilation air flow rate to the actual demand.
  - Continuous measurement of ventilation air parameters (temperature, CO_2 level, relative humidity).
- **Variable Air Volume devices (VAV)**
  - Continuous adjustment and measurement of ventilation rate for individual rooms and/or zones.
- **Room controllers with integrated sensors or/and separate room sensors**
  - Continuous monitoring of room temperature, CO_2 and relative humidity
- **Integrated AHU control system**
  - Continuous monitoring and logging of ventilation rate, temperature, CO_2 and relative humidity at the AHU and room level.
  - Adjusting system operation to the actual demand to regulate IAQ/IEQ and optimise energy consumption.
  - Communication with other connected technical building systems, in particular heating and cooling generators, to adjust their capacity to the actual ventilation needs in order to optimise energy use.
- **User interface of AHU integrated control system:** The integrated AHU controls, extended with additional system modules on site, if needed, are capable via user interface (e.g. online cloud applications) of:
  - Analysing energy use for ventilation and allowing for its adjustment

- Detecting losses in efficiency of ventilation and air conditioning systems, and informing the person responsible for the facilities or technical building management about opportunities for energy efficiency improvement

To set ventilation airflow rate requirements as outdoor air flow rates, the methods in EN 16798-1 can be used. Typically, it is suggested to use the method based on predesigned air flow rates. The method based on design air flow rates is applicable in indoor spaces where the criteria for indoor environments are set by human occupancy and where the production or process does not have a significant impact on the indoor environment, such as non-specifically polluted non-residential buildings.

More specifically, the following recommendations shall be duly considered:

- For occupied spaces: 7l/s/person as recommended by the category 2 of table B.6 relative to “the design of ventilation rates for sedentary, adults, non-adapted persons for diluting emissions (bio effluents) from people” of the annex B of the EPB standard EN 16798-1. The category 2 level was chosen as it is described as a normal level of expectation for indoor environmental quality. It can be, in our view, considered as a balanced choice,
- For non-occupied spaces: when a room of the building is not occupied throughout the day, the ventilation rate can be lowered but not below the minimum of 0,15 l/s/m^2 of floor area to continue to dilute emissions from the building (construction material, furniture). This value is mentioned in paragraph B.3.1.5 relative to “ventilation air flow rate during unoccupied periods” of the annex B of the EPB standard EN 16798-1,
- When the building is closed: in case the ventilation is shut off, the minimum amount of air to be delivered prior to occupation is by default: 1 volume within 2 hours of the zone to be ventilated. This value is mentioned in paragraph B.3.1.5 relative to “ventilation air flow rate during unoccupied periods” of the annex B of the EPB standard EN 16798-1.

CO_2 concentration

IAQ requirements can be set also with performance-based methods, relying on dedicated CO_2 limit values. For non-residential buildings, it is recommended that the level of 800 ppm of the category 2 of table B.9 relative to “default design CO_2 concentrations above outdoor concentration assuming a standard CO_2 emission of 20 l/h/person” of the annex B of the EPB standard EN 16798-1. With the outdoor concentration being around 450 ppm, this would bring the indoor environment CO_2 limit to 1250 ppm. The category 2 level was chosen as it is described as a normal level of expectation for indoor environmental quality. It can be considered as a balanced choice.

To make it possible to assess compliance with IAQ requirements, acceptable deviation from airflow rates and CO_2 requirements shall be specified for instance as a percentage of occupancy hours out of the accepted range.

It is crucial that Member States make available comprehensive training and certification schemes for building professionals, including facility managers, to ensure they are fully equipped to work with these advanced technologies and ventilation features. Properly trained building professionals, including facility managers, play a pivotal role in maintaining optimal indoor air quality, particularly in non-residential buildings where the complexity and scale of systems require skilled oversight.

iii. Indoor air quality and ventilation in residential buildings

According to Article 13(5), Member States may require installation of devices for the monitoring and regulation of indoor air quality in residential buildings. Ventilation requirements for residential buildings may be set based on EN 16798-1.

More specifically, the following recommendations shall be duly considered:

- For occupied habitable spaces (living-rooms, bedrooms, etc.): 0,63 l/s/m² corresponds to the value of 0,42 l/s/m² of the category 2 of the table B.11 of paragraph B. 3.2.2 on "design supply air flow rates" from the annex B of the EPB standard EN 16798-1 multiplied by a factor of 1,5 to express it in a metric of square meters of floor area of habitable spaces from an initial metric of air flow rate per square meters of heated floor area. This 1.5 multiplier is a typical ratio between the heated floor area, the whole surface of the dwelling, and the habitable spaces area (living room, bedrooms, study...) of the dwelling. The category 2 level was chosen as it is described as a normal level of expectation for indoor environmental quality. It can be considered as a balanced choice. Depending on the effective occupation of the room, it should be made possible to adjust the ventilation rate accordingly.
- For non-occupied habitable spaces (living-rooms, bedrooms, etc.): 0,13 l/s/m² is recommended, which represents 20% of the rate when the space is occupied. This allows to continue to deal with pollutants emitted inside the habitable space by construction material, furniture, etc... while even further minimising thermal losses. Paragraph B.3.2.5 regarding "design ventilation air flow rate during unoccupied periods"

from the annex B of the EPB standard EN 16798-1 recommends that it be comprised between 0,1 and 0,15 l/s /m^2.

- For occupied exhaustible spaces (kitchen, bathroom, toilets): kitchen 20l/s, bathroom and toilet 10l/s. These values are mentioned in table B.13 of paragraph B.3.2.3 on "design extract air flow rates" of the annex B of the EPB standard EN 16798-1. Depending on the effective occupation of the room, it should be made possible to adjust the ventilation rate accordingly.
- For non-occupied exhaustible spaces (kitchen, bathrooms, toilets) the reference flow rate during absence should amount to 20% of the one when the room is occupied: kitchen 4l/s, bathroom and toilets 2l/s. As for non-occupied habitable spaces, we recommend retaining 20% of the occupied space air renewal value as proposed in paragraph B.3.2.5 regarding "design ventilation air flow rate during unoccupied periods" of the annex B of the EPBD standard EN 16798-1. This allows to continue to deal with pollutants emitted inside the habitable space by construction material, furniture, etc... while even further minimising thermal losses.

The ventilation supply airflows to the bedrooms and living rooms should be expressed as outdoor airflow rates which shall be supplied primarily to living rooms and bedrooms. The ventilation air for the kitchen, bathroom and toilet must transfer air from the bedrooms and living rooms. Doors or specific openings must allow transfer air flows without significant pressure loss. From wet rooms extract airflows shall be used to remove pollutants and humidity.

CO_2 concentration

The CO_2 level for residential buildings is to be defined based on indicators from standard prEN 15665:2024 and the indicator relative to the average concentration of CO_2 in an occupied room. This standard is under public enquiry.

Monitoring IAQ in individual rooms

Extract air devices (air outlets) of ventilation systems can be equipped, depending on the room type, with different IAQ sensors (CO_2 and relative humidity) and thus monitor IAQ directly in the room they are installed in. Alternatively, IAQ may be monitored via sensors installed in the room controllers, or via separate sensors in the room, which can also be part of the complete ventilation system.

Adjustment of ventilation rate in individual rooms

Based on the measured actual IAQ values, the system adjusts a ventilation rate in individual rooms by means of either airflow control valves installed directly on a ventilation unit's duct connection that serves a particular room or control valves for individual rooms, installed in an air distribution box within the ductwork (see Figure 1). The total air flow rate of the ventilation unit fan is adjusted accordingly to optimise energy consumption.

Demand-controlled ventilation systems regulating the airflow to maintain acceptable CO_2 and humidity levels are recommended. It is possible to locate CO_2 and relative humidity sensors in the rooms or at the extract ductwork. The latter option enables to detection of occupancy and for instance operate a ventilation unit in 'at home'/'out of the home' mode during which the ventilation rate will be reduced.

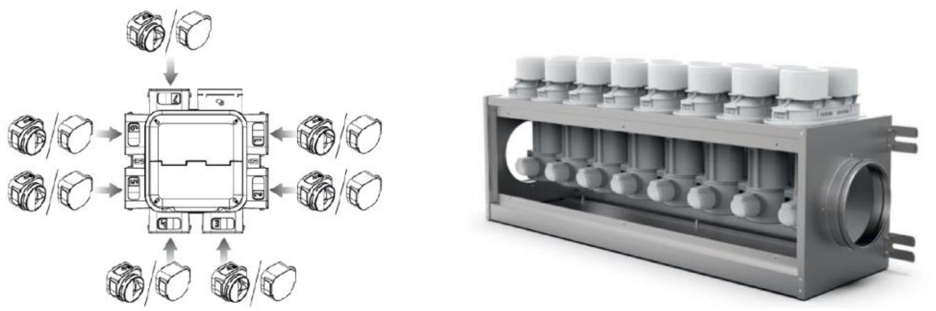

Figure 1. Extract fan with flow air controllers on duct connections (left). Distribution box with air flow controllers to individual rooms (right)

Lighting

In today's environmentally conscious world, energy efficiency is crucial. By incorporating energy-efficient lighting solutions, such as LED luminaires and lighting control systems that automatically adjust electric lighting based on factors like occupancy and daylight availability, refurbished buildings can significantly reduce energy consumption and operating costs. This not only benefits the bottom line but also aligns with sustainability goals, reducing the building's carbon footprint and contributing to a greener future.

Lighting directly impacts visual comfort, ensuring that occupants can perform tasks without straining their eyes, which is crucial for productivity and overall well-being. Good lighting helps occupants navigate spaces safely, identify potential hazards, and maintain security by minimizing dark areas where unauthorized activities could occur. Dark or poorly lit areas increase the risk of accidents and may create opportunities for security breaches. Additionally, lighting significantly enhances the aesthetic appeal of indoor spaces. Well-designed lighting can accentuate architectural features, highlight focal points, and create a pleasant and inviting ambiance.

Additionally, recent years have seen a growing appreciation for the critical role lighting plays in non-visual effects, including the regulation of human circadian rhythms. Natural light, or lighting that mimic natural light, can synchronize our internal body clocks, promoting better sleep patterns and enhancing mood and alertness during the day. Conversely, poor lighting quality, such as excessive flickering or glare, can cause headaches, eye strain, and fatigue, negatively impacting occupants' health and productivity. Refurbishment provides a unique opportunity to incorporate these better-understood 'new' components of good lighting into the design.

Furthermore, setting, monitoring, and controlling of IEQ requirements are crucial for the effectiveness of better lighting. Monitoring and inspection must ensure that illumination levels are suitable and correct for the tasks performed in indoor spaces. Following restructuration or reorganization, the obstruction of control sensor must be avoided. Monitoring and inspection must further ensure that lighting control strategies and zoning remain suitable for the space layout and use, while also ensuring that luminaires are clean and undamaged.

To grasp the full benefits of better lighting, the transposition of the EPBD Recast at the national level shall consider the following:

- A focus on non-residential buildings (public and commercial buildings), as already set out in the Energy Performance of Buildings Directive. Public buildings should lead by example. For non-residential buildings,
    - Buildings must be equipped with electric lighting according to building type, use and occupants.
    - Lighting for indoor workplaces must be designed according to EN 12464-1, unless it is not technically feasible. If not technically feasible, it shall be demonstrated that the lighting installations come as close as possible to the EN 12464-1 requirements.
    - The lighting system design process must be in accordance with CEN/TS 17165.
- Mandatory minimum requirements for lighting in Indoor Environmental Quality (IEQ). Recommendations for the required lighting of workplaces are covered by the European standard EN 12464-1. Public buildings should lead by example in all Member States. The design process shall consider application conditions such as the age of occupants, daylight provision, and the demands of specific tasks.
- While minimum requirements for visual comfort are established at the consensual level in the EN 12464-1:2021 according to the required visual task, the use of daylight as much as possible respect to artificial lighting has two positive effects: energy saving for lighting and increased photobiological comfort. EN 15193-1:2017 defines the methods for estimating the amount of energy required for lighting in buildings considering the effect of daylighting and introducing the daylight availability classes (none, low, medium, strong). EN 17037:2018 extends the concept to recommended minimum daylighting levels split in three classes (minimum, medium, and high). The minimum requirements in the regulation shall include a minimum daylighting level.

The use of LED lighting, in combination with controls and sensors. A full renovation lighting installation should include LED based luminaires, combined with controls and sensors, with a minimum Smart Readiness Indicator (SRI) level. A simple replacement of a lamp or luminaires should be avoided. Introducing a whole new lighting system, as required in EPBD, will lead to greater energy savings, a better indoor environment for occupants of buildings and ability to exchange lighting data. Spaces shall be divided into zones or smaller areas, minimizing zone size to allow localized control based on activities and daylight conditions, where technically and economically feasible. Occasionally used spaces must be equipped with occupancy control. This also applies to spaces such as shower rooms and toilets adjacent to workrooms. The use of automated occupancy or vacancy controls to extinguish lighting shall be avoided if switching off the lights might pose a risk of accidents. In such areas, dimming to a preset minimum, such as 20%, can be a suitable alternative. The lighting system must be commissioned and tested before being put into use. The purpose of this testing is to confirm and document that the system complies with the design requirements for lighting and that occupancy control, daylight control, and zoning are functioning according to their purpose and design

ARTICLE 13, § 12 AUTOMATIC LIGHTING CONTROL

Member States shall lay down requirements to ensure that, where technically and economically feasible, non-residential buildings with an effective rated output for heating systems, air-conditioning systems, systems for combined space heating and ventilation, or systems for combined air conditioning and ventilation of:

(a) over 290 kW are equipped with automatic lighting controls by 31 December 2027;

(b) over 70 kW are equipped with automatic lighting controls by 31 December 2029.

The automatic lighting controls shall be suitably zoned and capable of occupancy detection.

The EPBD mandates BACS installation in certain non-residential buildings. EN ISO 52120-1, the relevant standard for BACS, already defines automatic lighting control functionalities for Class B and Class A systems, which are also the recommended BACS classes for achieving the capabilities outlined in Article 13, paragraph 10 of the EPBD. This standard should also clarify the automatic lighting control requirement.

Occupancy detection, a key component of automatic lighting control, is also relevant for optimising other building systems, as outlined in EN ISO 52120-1. Integrating these functionalities within a unified framework can improve efficiency and avoid unnecessary device duplication.

A clearer connection between these requirements would ensure that automatic lighting control contributes to a more efficient and integrated building automation ecosystem:

- Encourage building owners to leverage BACS capabilities for automatic lighting control, aligning with existing standards and best practices.

Foster a holistic approach to BACS utilisation, optimising not just lighting but also other building systems based on occupancy data.

IEQ and the Smart Readiness of Buildings

ARTICLE 15

§1 *The Commission shall adopt delegated acts in accordance with Article 32 to supplement this Directive concerning an optional common Union scheme for rating the smart readiness of buildings. The rating shall be based on an assessment of the capabilities of a building or building unit to adapt its operation to the needs of the occupant, in particular concerning indoor environmental quality and the grid and to improve its energy efficiency and overall performance.*

In accordance with Annex IV, the optional common Union scheme for rating the smart readiness of buildings shall lay down: (a) the definition of the smart readiness indicator; (b) methodology by which it is to be calculated.

The SRI indicator integrated in the frame of the revised EPBD 2018 was not sufficiently considering the need for building occupants to benefit from a qualitative indoor environment. It was primarily focusing on the capacity of the building to offset its consumption to reduce the power demand on the network. It must be noted that, although mechanical ventilation systems are more and more smart by extracting the amount of indoor air when and where it is necessary and only to the extent which is needed, with also the capacity to recover heat and cold from extracted air, this technical building system must function continuously in residential buildings. For instance, this is mandatory by regulation in France. In non-residential buildings, following the COVID sanitary crisis, the operating time goes beyond the strict presence of people at the beginning and the end of a typical day but can be stopped overnight. These particularities regarding the operation of mechanical ventilation systems must be considered when defining the future smart readiness indicator. It is also important to note that mechanical ventilation systems account for less than 1% of the typical annual energy consumption of a building. As such, their impact on reducing power demand on the network is negligible.

For the two above reasons, it is advisable that, in the frame of the SRI, mechanical ventilation systems be considered for their contribution to ensuring an appropriate indoor environmental quality but not to reduce the electricity consumption of the building for network stabilisation purposes especially as far as residential buildings are concerned but not only.

§2 *By 30 June 2026, the Commission shall submit a report to the European Parliament and the Council on the testing and implementation of the smart readiness indicator on the basis of the available results of the national test phases and other relevant projects.*

Taking into account the outcome of that report, the Commission shall, by 30 June 2027, adopt a delegated act in accordance with Article 32, supplementing this Directive by requiring the application of the common Union scheme for rating the smart readiness of buildings, in accordance with Annex IV, to non-residential buildings with an effective rated output for heating systems, air-conditioning systems, systems for combined space heating and ventilation, or systems for combined air-conditioning and ventilation of over 290 kW.

SRI is a key tool for measuring performance and raising awareness among building owners and occupants of the value behind building automation and electronic monitoring of technical building systems. It should give occupants confidence about the actual savings of those new enhanced functionalities.

The scheme is established and being tested in several Member States based on the previous revision of the EPBD in 2018. Maintaining the existing SRI assessment methodology, the Commission shall, by 30 June 2027, adopt a delegated act setting out the mandatory application of the scheme in large non-residential buildings. This act will specify the procedure for how Member States should implement the scheme, as well as guidance on the scope, trigger points, and final deadline for application.

The Smart Readiness Indicator (SRI) application is strongly linked to the scope and capabilities of the Building Automation and Control System requirements under Art. 13, paragraphs 10 and 11. Ambitious implementation of BACS requirements is necessary to achieve higher SRI scores and can help with the SRI assessment.

Member states should use synergies with other provisions and assessments to streamline the assessment procedures, for example, by checking buildings' compliance with the BACS requirements in non-residential buildings and the Energy Performance Certificate assessments.

It is essential that the Member States follow the common SRI methodology across the EU for investment and planning clarity. The SRI technical elements should follow internationally recognised standards. Ensuring that SRI is similarly valued across the EU would drive the necessary investment in smart technologies and ensure that it doesn’t instead become an obstacle for the industry by creating 27 separate rating schemes.

Ensuring compliance

While it is easier to ensure compliance with requirements for new buildings (thanks to the provisions related to the Building Code), it would be more difficult to do this in existing buildings. According to Article 13, Paragraph 6, every time a new Technical Building System is installed, the new energy performance should be assessed and documented. This documentation needed for Paragraph 6 could also be used to check compliance with mandatory requirements under the broader Article 13 and for Paragraph 8 of Article 23.

For existing buildings that already comply with the requirements under Article 13 (and therefore do not have any documentation, as they did not have any installation, replacement or upgrade of TBS), a possibility for verifying the compliance with these requirements is to use a structure like the one that is currently used by Article 21 "Inspection of Heating and Air-Conditioning System". The competent authorities (or bodies to which the competent authorities have delegated the responsibility for implementing the independent control system) shall make a random selection of at least a statistically significant percentage of buildings in scope to the requirements and subject these installations to verification. Additionally, this check could be performed when issuing an Energy Performance Certificate.

Also, it would be advisable for Member States to provide immediate notification of the deadlines and consider financial incentives for early adopters, with the enforcement of penalties for non-compliers. Member States are encouraged to prepare and promote compliance verification checklists on different aspects of the new requirements to serve as a reference for stakeholders to prepare and implement the Directive's measures.

Indoor Environmental Quality Gathering Signatories

EPB CENTER · EPEE · eu.bac european building automation controls association · EUROVENT EUROPEAN INDUSTRY ASSOCIATION · EVIA European Ventilation Industry Association

GCP EUROPE The voice of efficient building engineering services · EMEA IFMA International Facility Management Association · LIGHTINGEUROPE THE VOICE OF THE LIGHTING INDUSTRY · REHVA Federation of European Heating, Ventilation and Air Conditioning Associations