IEQ is intrinsic to the EPBD

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Federation of European Heating, Ventilation and Air Conditioning Associations (REHVA)

https://www.rehva.eu

REHVA, founded in 1963, is a European professional federation that joins national associations of building services engineers. Today REHVA represents more than 120.000 HVAC designers, engineers, technicians, and experts from 26 European countries. REHVA is dedicated to the improvement of health, comfort, energy efficiency in all buildings and communities. REHVA provides its members with a platform for international networking and knowledge exchange, contributes to technical and professional development, follows EU policy developments, and represents the interests of its members in Europe and in the world. REHVA's mission is to promote energy efficient, safe and healthy technologies for mechanical services of buildings by disseminating knowledge among professionals and practitioners in Europe and beyond.

Why IEQ is intrinsic to the EPBD

While the EPBD primarily focuses on reducing energy consumption and greenhouse gas emissions, it is crucial to highlight the significance of including Indoor Environmental Quality (IEQ) within its scope. IEQ refers to the conditions inside a building that affect occupants' health, comfort, and productivity.

Why IEQ should be considered an essential component of the EPBD?

- **Human Health and Well-being**: Buildings are where people spend a significant portion of their time, and poor indoor environmental conditions can have a detrimental impact on their health and well-being. Factors such as indoor air quality, thermal comfort, lighting, and acoustics directly influence occupants' physical health, productivity, cognitive abilities, and overall comfort. By including IEQ standards in the EPBD, policymakers can prioritize creating healthier indoor environments that promote well-being and reduce health risks.
- **Occupant Productivity**: Numerous studies have shown that improving IEQ can lead to increased occupant productivity and performance. Optimal indoor air quality, comfortable temperatures, appropriate lighting, and reduced noise levels positively affect cognitive abilities, concentration, focus, and overall job satisfaction.
- **Energy Efficiency and Building Performance**: Energy efficiency and IEQ are interconnected. Energy-efficient measures, such as better insulation, airtightness, and advanced HVAC systems, can improve both energy performance and IEQ. By integrating IEQ requirements into the EPBD, policymakers can ensure that energy-efficient measures are implemented in a manner that maintains or enhances indoor environmental conditions.
- **Sustainability and Long-Term Benefits**: Including IEQ within the EPBD promotes a more holistic and sustainable approach to building design, construction, and operation. By considering factors beyond energy consumption, such as indoor air quality, thermal comfort, lighting comfort and acoustics, buildings can deliver long-term benefits in terms of occupant satisfaction, reduced sick leave, increased property value, and enhanced reputation.
- Legal Compliance and Market Transformation: Integrating IEQ into the EPBD ensures that building regulations and standards keep pace with evolving societal expectations and scientific knowledge. It sets a legal framework that obliges stakeholders to prioritize IEQ in building projects. By doing so, the EPBD can act as a catalyst for market transformation, encouraging innovation, research, and the development of new technologies and materials that improve both energy efficiency and IEQ.

In conclusion, incorporating IEQ within the scope of the EPBD is of utmost importance. By considering the indoor environmental conditions of buildings, policymakers can ensure that energy efficiency efforts go hand in hand with the well-being, productivity, and health of building occupants. The inclusion of IEQ enhances the overall effectiveness and long-term sustainability of the EPBD, contributing to healthier, more comfortable, and energy-efficient buildings throughout the European Union.

IEQ and EPB

The main function of buildings is to provide shelter from external environment. How well this is done (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 specially design to address the IEQ issues:

- 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 (with productivity and learning performance benefits) also need more heating and cooling energy than wider and uncomfortable temperature ranges (with less productivity and decreased learning performance).
- Daylighting use to increase the photobiological 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 it can be as high as a couple of energy performance classes (in the EPC).

- This alone makes it evident that the energy performance of a building cannot be specified without specifying at the same time the IEQ.
- In the situation of establishing a minimum standard 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 DALY[1] in residential buildings.

LEVEL(s)

The EU has established LEVEL(s) as 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.

- Therefore, it is essential that IEQ indicators specified in LEVEL(s) are followed in the EPBD Recast, addressed in the amendment by the EP on Article 11a stating that national requirements shall be set according to measurable indicators based on those included in the LEVEL(s) framework.
- More specifically, regarding to numeric values, LEVEL(s) indicators 4.1[3] and 4.2[4] (IAQ and thermal comfort) refer to EN 16798-1:2019 standard (set of CEN/ISO EPB standards[5]) which

[1] https://www.who.int/data/gho/indicator-metadata-registry/imr-details/158
[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)
[5] https://epb.center/epb-standards/

uses Categories I to IV to describe IEQ level. For daylight in buildings, LEVEL(s) 4.3 refers to EN 17037:2018 specifying parameters which are categorised as Minimum, Medium and High.

This approach provides national flexibility, following the EU's principle of subsidiarity, to select suitable performance levels depending on local conditions and climate, by following one of specified categories. For instance, by following the normal level of Category II values specified in EN 16798-1:2019, will not only ensure avoiding adverse health effects but also improve comfort and well-being of occupants clearly above the minimum acceptable level.

Energy performance implications of IEQ indicators

Regarding the energy implications, the most essential IEQ indicators are related to IAQ and thermal comfort, while also lighting comfort can have an important impact. In other words, to conduct meaningful energy calculation, target values for IAQ and thermal comfort, and also lighting comfort, shall be available.

Indoor Air Quality (IAQ)

IAQ deals with control of indoor air pollution that originates from both indoor and outdoor sources, and from the interaction of pollutants and oxidants from both of these[6].

- Indoor sources are building materials or cleaning products emitting volatile organic compounds[7], and respiratory effluents and body odours emitted by humans themselves, but also combustion, cooking, products with fragrances and resuspending floor dust[8].
- Good IAQ requires controlling of indoor emission sources and concurrently reducing the entry of outdoor pollutants indoors which can be done by filtering of outdoor air pollutants and reducing infiltration.

To do this, the following minimum requirements are to be established to control IAQ:

- Source control must be applied for pollution sources from building materials and interior design through the use of low polluting building materials as defined in EN 16798-1:2019,
- Ventilation rates to maintain an acceptable level of pollutants in the indoor environment are to be specified according to EN 16798-1:2019 requirements,
- To control particulate matter, ventilation with filters is one way of meeting the requirements in areas where the WHO limits[9] for outdoor air are exceeded. For non-residential buildings filters are specified in EN 16798-3. If no ventilation with filters is used, other measures need to be considered.

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

[7] 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

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

[9] 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

Thermal comfort

IEQ parameters for thermal comfort are specified in EN 16798-1:2019 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 room temperature[10] ranges for sedentary activities. Requirements may be split between non-residential and residential buildings where higher adaptation is possible.

Lighting comfort

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 taking into account 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.

Further guidance and REHVA's commitment

Further guidance about how IEQ provisions can be straightforwardly implemented in national regulation is provided in the common IEQ guidance document co-prepared by REHVA, Nordic Ventilation Group and EUROVENT: **Proposed modifications and guidelines for implementation of Article 11a 'Indoor environmental quality' in EPBD Recast**[11].

REHVA fully supports transparent energy performance definitions including IEQ specification as currently proposed in Article 11a.

- We see that the current approach provided in Article 11a is straightforward to implement in national regulation with reasonable effort.
- It will avoid manipulation in energy calculations and energy performance certificates and will ensure that energy calculations and energy performance certificates would be realistic and will correspond to expected energy use in real operation that would support achievement of EPBD energy saving targets.

REHVA, as building professionals' organisation, remains committed to provide unconditioned and technology neutral support during the EPBD Recast Trialogue and the subsequent EPBD Recast transposition and implementation in the EU's Member States.

[10] In EN 16798-1:2019 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.

[11] https://www.rehva.eu/fileadmin/user_upload/2023/EPBD_IEQ_Guidance.pdf