2-page Summary – AIVC-Fraunhofer IBP Workshop 2025

Indoor Environmental Quality in Sustainable Buildings

Stuttgart, Germany | April 1–2, 2025

The 2025 international workshop, jointly organized by the Air Infiltration and Ventilation Centre (AIVC) and the Fraunhofer Institute for Building Physics (IBP), convened experts from across Europe and beyond to explore critical themes at the intersection of indoor environmental quality (IEQ), ventilation, health, and energy performance. Held in Stuttgart, Germany, the 1½-day event offered a platform for researchers, policymakers, engineers, and practitioners to share their latest findings and approaches toward creating sustainable and healthy indoor environments, particularly within the evolving framework of the recast Energy Performance of Buildings Directive (EPBD).

The workshop opened with contributions from Gunnar Grün, Arnold Janssens, and Christine Roßkothen, setting the stage with perspectives from Fraunhofer IBP, AIVC, and the Heinz Trox Foundation. Grün discussed current IBP work on balancing energy efficiency and occupant well-being, while Janssens highlighted AIVC's role in facilitating international collaboration and dissemination of best practices. Roßkothen emphasized the foundation's commitment to improving indoor air quality, particularly in educational settings.

A major theme throughout the workshop was the health impact of indoor environments. Ulrich Zissler provided insight into how pollutants like particulate matter and microbial contaminants affect cellular functions and the human immune system. Benjamin Jones introduced a novel health-based metric that uses Disability-Adjusted Life Years (DALYs) to prioritize indoor pollutants, offering an alternative to conventional exposure limits. Complementing these approaches, Peiman Pilehchi Ha shared findings from a study linking indoor conditions in home offices to subjective discomfort and measurable physiological stress responses.

The exploration of innovative ventilation strategies was a core focus. Lukas Schmitt presented a method to dynamically manage ventilation in offices based on occupant distribution, demonstrating potential energy savings without sacrificing IAQ. Douaa Al-Assaad's investigation into personalized ventilation (PV) and chair-integrated fans illustrated how such systems could enhance thermal comfort and IAQ, though careful design is required to avoid undesired air mixing. Bjarne Olesen discussed the broader challenges preventing the widespread adoption of personalized environmental control systems, noting practical limitations despite their proven benefits. In a complementary perspective, Lukas Siebler proposed a control approach that uses CO_2 concentration as a proxy for infection risk, optimizing ventilation efficiency in schools.

On the polic**y** front, Marco Morini from DG ENER detailed the key updates in the EPBD 2024 recast, emphasizing new obligations related to HVAC inspections and IEQ integration in both new and existing buildings. Claus Händel discussed the complexity of aligning EPBD with related regulatory frameworks such as the Construction Products Regulation (CPR) and the Energy-related Products Regulation (ESPR), cautioning against fragmented national implementations. Tools to support compliance were also showcased, including the Fraunhofer EPC Software suite presented by Simon Wössner, which offers adaptable simulation capabilities for multiple European contexts. Thomas Hartmann elaborated on the revision of EN 16798-1, highlighting its shift toward performance-based metrics and real-time KPIs. From North America, Iain Macdonald

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described Canada's tiered building code system, which integrates energy and greenhouse gas performance through simulation-based pathways.

Real-world applications featured prominently through a series of **school and care facility case studies**. Dirk Müller presented a renovation concept for rapid IEQ improvement in classrooms for which the design and construction can be planned using a web-based tool. Cécile Caudron reported on a large-scale project examining the performance of both mechanical and natural ventilation systems, finding that implementation and user behavior play a critical role. In Canada, MacDonald investigated the use of portable air cleaners in schools, noting reductions in particulate matter but limited effects on pathogens and absenteeism. Meanwhile, Henry Burridge shared findings from the UK's SAMHE project, a national citizen science initiative that has collected IAQ data in over a thousand schools, offering valuable insight into seasonal trends and pollution sources.

Further contributions enriched the picture. Susanna Bordin compared various school ventilation systems in a long-term study, noting trade-offs between ventilation and thermal comfort. James McGrath's work in Irish schools and offices identified frequent exceedances of air quality thresholds, particularly during colder months. In parallel, Andreas Schmohl developed a realistic test environment using bioaerosols to evaluate air purifier effectiveness, while David Goecke applied psychoacoustic analysis to assess heat pump noise—a growing concern in denser residential areas. Yanaika Decorte expanded the environmental conversation with a detailed life cycle assessment of HVAC systems, showing how simplified calculations can underestimate embodied carbon by a significant margin.

On the strategic and methodological side, several international collaborations were presented. Pawel Wargocki introduced the TAIL IEQ rating scheme, which aims to assess all aspects of indoor environmental quality—thermal, acoustic, luminous, and air—without trade-offs. Jelle Laverge and Gaëlle Guyot discussed developments from IEA-EBC Annex 86, focusing on harmonizing IAQ performance assessments and validating smart ventilation strategies across multiple countries using common indicators. Peter Holzer presented IEA-EBC Annex 97, which is set to address sustainable cooling in urban environments by integrating building performance with outdoor climate resilience.

Urban adaptation in the face of climate change was also examined through research by Bassam Moujalled, who used modeling and behavioral analysis to assess how occupants respond to heatwaves. Their findings underscore the importance of adaptive strategies, such as responsive shading and window management, in improving thermal comfort. The NudgeFlow project, led by Hilde Breesch and colleagues, closed the workshop with a forward-looking concept for decentralized, demand-driven residential ventilation, offering a low-infrastructure solution for future retrofits.

The 2025 AIVC-Fraunhofer IBP workshop underscored the growing alignment between public health, regulatory evolution, and sustainable building design. Across all sessions, presenters advocated for integrated solutions that prioritize human well-being while supporting decarbonization and resilience. The wealth of shared experience and research promises to shape the next generation of standards and strategies in indoor environmental quality.

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