

Healthier living spaces through background ventilation

Health and well-being indoors

With mounting evidence suggesting that coronavirus is airborne and no clear end to the pandemic in sight, we should be “concerned in indoor environments, especially in confined spaces,” according to Dr. Dennis Yang¹, an epidemiologist at the University of Florida in Gainesville.

People spend 60 to 90% of their time indoors. Even before the COVID-19 pandemic struck, the World Health Organization had stated that insufficient indoor ventilation can increase the risk of respiratory disease in children and adults by 50%.²

Reducing the risk of transmitting COVID-19 indoors hinges on three actions: “maximizing ventilation and improving indoor air quality, sanitizing high-touch surfaces, and minimizing close person-to-person contact”.³

Ventilation is key

Given this increased sensitivity to air quality⁴, HVAC system upgrades are recommended for commercial spaces. For residential spaces, the focus is shifting to controlled natural ventilation, accelerating the trend to make indoor environments healthier by design.

Along with the requirement for purge ventilation through openable windows, national and European regulations, norms and standards also require residential buildings to have background ventilation – constant, 24/7 air exchange at a low flow rate that balances indoor and outdoor humidity and oxygen levels.⁵

Conflicting requirements

However, these background (hygienic) ventilation requirements conflict with energy efficiency regulations that aim to minimise heat losses. This has led to an emerging market demand for ventilation devices that can be integrated in the building façade to facilitate

controlled and effective background ventilation, optimise air flow patterns and reduce energy loss.

To understand current practice, codes and requirements for background ventilation in residential buildings, Arup’s Research and Innovation team has thoroughly researched the literature and has conducted interviews with Arup experts from the Benelux region, Germany, France and the United Kingdom, all of which have minimum air exchange requirements in residential buildings. However, in Germany these requirements are not legally binding.⁶ As Frank Walter, a Façade Designer and Associate from Arup Germany, indicates: “It is required that ventilation is to be user-independent; users should not be able to close or open it. It should operate even when there is nobody in the building”.

Given most European member states’ extensive energy efficiency regulations, building codes in the Netherlands, Germany and France endorse the use of mechanical systems with integrated heat exchangers. According to Jacco Paauw, Associate and Team Leader of Building Physics at Arup Netherlands, “In the Netherlands, it is difficult to comply with background ventilation regulations without heat recovery systems.”

In the UK, mechanical ventilation with heat recovery is the traditional solution for background ventilation. Joshua Bird, a Senior Engineer of Building Engineering at Arup London, illustrates a key challenge: “In the UK, and especially in an urban setting, we always have the same challenge: how do we achieve sufficient natural ventilation to combat overheating, whilst maintaining comfortable acoustics?”

1 D. Lewis, 8 July 2020, “Mounting evidence suggests coronavirus is airborne—but health advice has not caught up,” Nature, <https://www.nature.com/articles/d41586-020-02058-1>.

2 World Health Organization, 2014, Burden of Disease from Household Air Pollution for 2012.

3 Cousins et al., “The future of buildings will be healthy,” <https://www.arup.com/perspectives/the-future-of-buildings-will-be-healthy>.

4 Dietz et al., 2020, “2019 Novel Coronavirus (COVID-19) Pandemic: Built Environment Considerations To Reduce Transmission,” mSystems 5, no. 2, e00245-20, <http://msystems.asm.org/content/5/2/e00245-20.abstract>.

5 Kunkel et al., 2015, Indoor Air Quality, Thermal Comfort and Daylight: Analysis of Residential Buildings Regulations in Eight EU Member States.

6 Kunkel et al., 2015, Indoor Air Quality, Thermal Comfort and Daylight: Analysis of Residential Buildings Regulations in Eight EU Member States.

Summary

Given the growing need for background ventilation in the residential sector, natural ventilation devices integrated with the opening elements of building façades have the potential to be a new market in the post-COVID economy. Such a device should be automated, with smart, low-cost sensors and actuators capable of reducing airborne noise. Flow rates should be optimised to minimise heat loss, and combining natural ventilation with mechanically operated air extracts should be considered. User interfaces should communicate air quality and create confidence that the indoor environment is healthy, in addition to meeting local regulations.

Further research is needed to validate the effect that natural ventilation devices have in reducing transmission rates of airborne respiratory diseases such as COVID-19.

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