Simple changes to ventilation systems decrease transmission of COVID-19, reduce energy consumption

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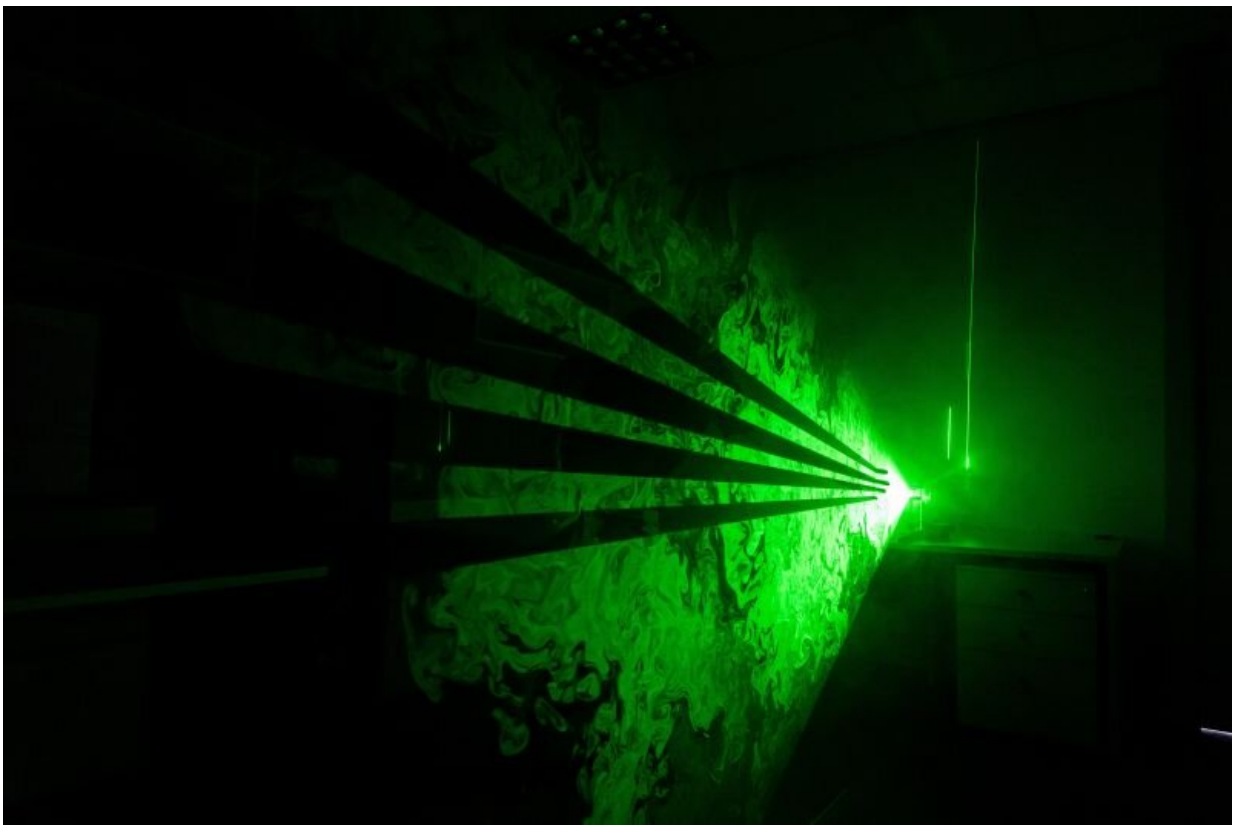

The BREATH project tested and evaluated three different ventilation systems in a vacant CBD building over three months. Credit: Andrew Bott

Simple changes to ventilation systems can significantly decrease the

transmission of COVID-19 and reduce energy consumption in office buildings, a pilot research project led by the City of Melbourne in partnership with the University of Melbourne and Cbus Property has found.

The BREATH project tested and evaluated three different ventilation systems in a vacant CBD building over three months: Displacement ventilation air conditioning, in-ceiling air filters and natural airflow through open windows.

The project found:

- All three ventilation systems reduced the potential transmission of airborne viruses when compared to mixed ventilation, improving safety for office workers.
- Displacement ventilation air conditioning—which supplies air from floor level—was the most effective and energy efficient system tested, reducing COVID-19 transmission by 83 percent, while also reducing energy consumption by 20 percent.
- Displacement ventilation is the most expensive to install, but there are no additional ongoing maintenance costs.
- In-ceiling air filters reduced virus transmission by 49 percent but resulted in a minor increase in energy consumption.
- Opening windows reduced virus transmission by 53 percent, but increased energy use by up to 20 percent with seasonal temperature variations.
- Opening windows is not available to all office buildings and is not a viable solution due to Melbourne's climate.

Table: BREATH project key outcomes

System	Impact on transmission	Installation cost per m^2	Energy use – cost per m^2/yr	Changes to energy use and NABERS
Open windows, standard heating, ventilating and air conditioning operations	Approximately 53% less infections	Nil	Costs $\$6/m^2$ per year	10-20% increase in energy use, loss of up to ½ NABERS star
In-ceiling air cleaner, HEPA filtration units	Approximately 49% less infections	$\$28m^2$ with maintenance costs of $\$1.5 - \$3m^2$ per year	Saves $\$4.21/m^2$ per year	2% increase in energy use, no impact on NABERS
Displacement ventilation air conditioning	Approximately 83% less infections	$\$170m^2$ with no additional ongoing maintenance costs	Saves $\$10.67/m^2$ per year	10-20% reduction in energy use, addition of up to ½ NABERS star

NABERS is a simple, reliable sustainability rating for the built environment, which measures buildings' efficiency across energy, water, waste and the indoor environment. NABERS provides a rating from one (making a start) to six (market leading) stars. Credit: University of Melbourne

University of Melbourne Head of Mechanical Engineering Professor

Jason Monty said the collaboration between local government, industry and academics is a world-first.

"BREATH has given us the knowledge to predict the best type of retrofit to simultaneously reduce carbon footprint and infectious disease transmission. Since the majority of city energy cost goes to ventilation of our buildings, the outcomes from BREATH will improve our ability to reach net zero carbon faster," Professor Monty said.

University of Melbourne Vice-President (Strategy and Culture) Dr. Julie Wells said the project shows how the University tackles problems of local and global significance with its partners.

"This collaborative pilot demonstrates the positive impact that the University of Melbourne's research can have on human health and energy consumption," Dr. Wells said.

"The findings provide a great basis for building owners to proceed with an informed approach to ventilation options. We look forward to more great results arising from partnership projects developed with the City of Melbourne and industry partners."

Lord Mayor Sally Capp said: "Bringing people back to the city safely remains a key priority for the City of Melbourne, and that's why we have undertaken this pilot study."

"This industry-leading research has identified simple but effective changes that can be implemented in office buildings to help workers feel safe, comfortable and protected."

"The research findings are publicly available online and free for any organization to access. We encourage building owners, tenants and partners to take them on board, and to help us create more healthy and

sustainable workspaces in the CBD."

University of Melbourne research engineer and technical lead on the project Dr. Grant Skidmore thanked the City of Melbourne and industry partner Cbus Property.

"We are extremely grateful for the opportunity to conduct this research. We give our thanks to both the City of Melbourne and Cbus, for arranging and accommodating the work. We would also like to thank Aurecon for their peer review throughout the experimental design and report writing process," Dr. Skidmore said.

City of Melbourne Sustainable Building portfolio lead Councilor Elizabeth Doidge said: "We're proud to be leading the way with this research, which will not only help to protect Melburnians from the transmission of airborne viruses but can also benefit businesses by helping to reduce their environmental footprint and operating costs."

"We're committed to working closely with our partners and will continue to support the creation of buildings that are more sustainable for our environment and for the future of our city, its businesses and its people."

Provided by University of Melbourne

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