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Article

The Effects of Air Permeability, Background Ventilation and Lifestyle on Energy Performance, Indoor Air Quality and Risk of Condensation in Domestic Buildings

Arman Hashemi [1,†,*] and Narguess Khatami [2,†]

[1] Centre for Sustainable Development, Department of Engineering, University of Cambridge, Cambridge CB2 1PZ, UK

[2] School of Civil and Building Engineering, Loughborough University, Loughborough LE11 3TU, UK, E-Mail: n.khatami@lboro.ac.uk

† These authors contributed equally to this work.

* Author to whom correspondence should be addressed; E-Mail: a.hashemi@eng.cam.ac.uk; Tel.: +44-(0)-1223-760-561.

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Abstract: Effective and efficient ventilation is essential when improving energy performance and Indoor Air Quality (IAQ) of buildings. Reducing air permeability can considerably improve the energy performance of buildings; however, making the buildings more airtight may result in lower rates of natural ventilation which may in turn increase the risks of condensation and unacceptable IAQ. This study evaluates the effects of different air permeability rates, background ventilation and occupants' lifestyles on the energy performance as well as the risk of condensation and CO_2 concentration in domestic buildings. Dynamic computer simulations were conducted in EnergyPlus. Results indicated direct relations between the ventilation rates, energy performance and IAQ. Higher air permeability along with background ventilation resulted in considerably better IAQ while energy consumption increased by up to four times. Occupants' lifestyles were identified as a major contributor to the risk of condensation.

Keywords: energy efficiency; air permeability; airtightness; natural ventilation; indoor air quality; condensation; lifestyle; domestic buildings