Sustainable air-conditioning and air distribution systems during a pandemic and beyond

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BIOGRAPHY
Prof Sekhar is a tenured Professor and Co-Director (Centre for Total Building Performance) in the Department of Building, National University of Singapore. He is also a Founding Director of Enhanced Air Quality Pte Ltd., a NUS Spin-off Company, incorporated in June 2004, arising out of his research in the fields of indoor air quality (IAQ) and energy. His research interests include thermal comfort, ventilation/IAQ, energy efficient HVAC systems and building energy analysis, with about 275 publications in these fields in international journals and conferences. He is a co-inventor and holds 3 US and other patents. He is a Fellow of ASHRAE and ISIAQ. He has delivered 9 Keynote talks in international conferences around the world. He has been an ASHRAE Distinguished Lecturer since 2006 and is regularly invited as a speaker around the world (60 invited presentations to date). He has been recognised through several awards, including: Environmental Health Award, Exceptional Service Award and Distinguished Service Award from ASHRAE; Uichi Inouyi Memorial Asian International Award from SHASE, Japan; SPRING Singapore Merit Award, ASEAN Energy Award and The Enterprise Challenge (TEC) Award of the Prime Minister’s Office. He is currently a Director-At-Large on the ASHRAE Board of Directors. He is active in Standards and Technical committees in ASHRAE and is also actively involved in local standardization activities in Singapore.

ABSTRACT
Resilience, in every phase of human life, is an important keyword that the recent pandemic has made us realize. When it comes to the built environment, the role of the HVAC system during a pandemic goes beyond the fundamental principles of thermal comfort, IAQ and energy efficiency. Occupant health becomes paramount and the micro-environmental quality around every individual in a building becomes the single most significant factor. In this context, both “source control” and “exposure control” principles will be discussed. Advanced room air distribution strategies, enabled by the concept of decoupling “ventilation air” from “supply air”, play an important role in the mitigation of the spread of infectious aerosols. This offers an inherently effective engineering control strategy towards protecting occupants from both short- and long-range transmission. Filtration and disinfection are other strategies that would complement ventilation in the overall quest for occupant protection against airborne transmission. The attributes of enhanced ventilation, filtration and disinfection, coupled with energy conservation, could be seen as salient features of resiliency of the building HVAC system. Going beyond a pandemic situation, it is this resiliency and ability of the HVAC system to revert to a normal mode of operation and adapt to a new operational mode as and when the need arises that will determine how buildings can effectively cope with future challenges of the outdoor and indoor environments in ensuring the comfort, health and well-being of occupants in a rapidly and dynamically changing world.