



## **Side Event: Distinguished Lecturers Seminar by ASHRAE “Thermal Comfort and IAQ in High Performance Buildings”**

**Date & Time:** 21 July 2017 (Friday) 9:00am – 6:00pm

**Venue:** Suntec Singapore

The concept of “one-size fits all” is pretty much the standard norm with the design and operation of air-conditioning systems in buildings worldwide. Actually many of the basic designs are quite complex, however, it would appear that when Local Design Institutes (LDI) are involved a majority of designs shrink back to a standard AHU or even a simple fan coil system. In particular, tropical buildings suffer from the inevitability of being either too cold or too warm and stuffy, resulting from one large central air-conditioning system with very little flexibility and control. The reason for this is much the same as in the US when the so called Project Management Teams are involved and carry out value engineering before the designs are finished and decisions are based on rather poor previous decisions. This often leads to an energy penalty besides the obvious discomfort. When comfort isn’t really included in the design, how are the clients and users to be aware of what occupant comfort is? This could be seen as a big failure of international thermal comfort standards, such as ASHRAE standard 55. Wouldn’t it be nice if individual occupants in a building were to have control over their immediate microenvironments, creating their own Personalised Environments? Can the occupants control the thermal comfort and indoor air quality (IAQ) of their individual spaces in a building, irrespective of the size, shape and layout of the building? In the context of Climate Change, can personalized environments be possible in modern buildings with attractive energy benefits leading to the notion of Energy Efficient Healthy Buildings? The answers to such questions lie in how we look at the integrated design, installation and operation of the HVAC and BAS systems.

### **Program Outline**

<b>Time</b>	<b>Item</b>
9.00 – 9.30 AM	Welcome and Introductions & Workshop Overview
9.30 – 11.00 AM	<p><b>High Performance buildings and Occupant Comfort by Dr. Peter Simmonds</b></p> <p><i>This lecture illustrates that the Predicted Mean Vote/Percentage Persons Dissatisfied (PMV/PPD) can be used to produce optimal designs for a number of different applications. One application was to evaluate an existing building to provide the owner with information on how to improve occupant comfort and improve building efficiency.</i></p> <p><i>Previous work by Simmonds have shown that the effects on comfort results when varying clothing levels and metabolic rates of occupants is relatively small compared to changes in the engineered variables such as dry bulb temperatures, humidity, air velocity and mean radiant exchange. This lecture will show the results of the design process for each of the buildings explaining the intricacies of each solution and show that the new ASHRAE standard 55 can be used as an effective design and analysis tool for modern designs.</i></p> <p><i>This lecture uses some of the building designs I have employed in Asia, so hot and Humid climate, a higher occupancy density and running nearly all space at 21-22C. The lecture also shows the practical applications of Standard 55 and ISO standards.</i></p>
11.00 – 11.30 AM	<b>COFFEE BREAK</b>
11.30 – 1.00 PM	<p><b>Oversized air-conditioning systems and overcooled buildings in hot and humid climates by Prof. Chandra Sekhar</b></p> <p><i>Why are air-conditioned buildings in hot and humid climates so cold that one gets reminded of carrying a jacket when going to office? Would raising the set point temperatures in these buildings do the trick? What are the engineering challenges that necessitate a relook at the</i></p>

	<p><i>way air-conditioned buildings in such climates are designed? This talk will review some of the fundamental issues of cooling and dehumidification facing the HVAC designer and the inevitable and inherent design of an oversized system and its undesirable consequences in terms of an overcooled indoor environment. It will provide an understanding of the psychrometric challenges involved in cooling and dehumidification at peak and part loads in hot and humid climates. Possible solutions to creating a more thermally comfortable and healthy indoor environment that can also save energy will be discussed.</i></p>
1.00 – 2.00 PM	<b>LUNCH</b>
2.00 – 3.30 PM	<p><b>Evaluating Occupant Comfort in Naturally Ventilated Buildings by Dr. Peter Simmonds</b></p> <p><i>There would appear to be a continual request for naturally ventilated spaces. Portions of the building are either commercial offices, residential or hotel, all of which can be naturally ventilated, depending upon owner or client requests. Analyzing these different spaces to determine space conditions can be rather complex as is the analysis of the results. Not only are there the dynamics of wind conditions but also variations ambient temperatures. The prediction of natural ventilation in spaces is also complex, whether the natural ventilation is wind driven or buoyancy driven can also influence the results.</i></p> <p><i>This presentation will present several case studies of simulating and evaluating natural ventilation in buildings, in several cities around the world. The results are evaluated for thermal comfort compliance with ASHRAE Standard 55-2013 and other International thermal comfort standards. Analysis of the results will show “true” space conditions and will highlight improvements that can be made to the compliance method which presently only includes operative temperature, a single metabolic rate and two clothing values. But how is the operative temperature calculated and what is the air speed in the naturally ventilated spaces? What will be the “true” comfort conditions in these spaces?</i></p> <p><i>In addition to comfort there are also environmental conditions such as humidity and air quality which should be considered. Several comments on these environmental conditions will be discussed in this lecture.</i></p> <p><i>The analysis methodology and results provided in this analysis will provide basis information to judge compliance with various thermal comfort standards.</i></p> <p><i>This lecture contains design work for spaces in hot and humid climates, such as Malaysia, Hong Kong and southern areas of chins and the US. It raises the question on how comfortable are naturally ventilated buildings and how responsible are the spaces when related to “true” occupant comfort.</i></p>
3.30 – 4.00 PM	<b>COFFEE BREAK</b>
4.00 – 5.30 PM	<p><b>Emerging HVAC technologies for energy efficient healthy buildings in hot and humid climates by Prof. Chandra Sekhar</b></p> <p><i>In recent times, clear associations are being established between ventilation rates, Indoor Air Quality (IAQ) and the productivity of workforce in various types of buildings, most significant of which is the commercial and office building sector. It is also an established fact that HVAC systems do consume a significant proportion of national energy budget in any country irrespective of whether the HVAC design is “Cooling Driven” or “Heating Driven”. Hence, the notion of Energy Efficient Healthy Buildings is gaining popularity worldwide in the context of sustainable design and it is even more challenging in hot and humid climates that have all-year air-conditioning demand in the form of energy intensive cooling and dehumidification. It is quite apparent that Climate Change effects are only going to make the HVAC designer’s job even more challenging in the future. Whilst SOURCE CONTROL is commonly advocated as the fundamental approach to eliminating or containing the contaminant levels inside the building, a more practical and often necessary approach is likely to be EXPOSURE CONTROL. Thus, ventilation plays an important role in providing a quality built environment. Two considerations are highlighted in order to achieve “good” indoor air quality (IAQ) and energy efficiency – the enhanced dehumidifying performance of cooling coils and the effectiveness of air distribution strategies. The concept of decoupling “ventilation air” from “supply air” is fast emerging as an ideal solution to combat thermal comfort and indoor air quality (IAQ) issues in a sustainable manner. This talk will highlight some of the current and future technologies for air-conditioning and air-distribution that can collectively contribute to the design of energy efficient healthy buildings. The air-conditioning</i></p>

	<i>technologies reviewed include the Low Face Velocity-High Coolant Velocity (LFV-HCV) system; outside air pre-treatment system; single coil twin fan (SCTF) system employing a compartmented cooling coil; desiccant dehumidification system and heat pipe. The air-distribution systems reviewed include SCTF system with independent “ventilation” and “thermal cooling” on zone-based demand; personalized ventilation system coupled with secondary ambient air distribution system and dedicated outdoor air system (DOAS) coupled with chilled beams or radiant chilled ceiling.</i>
5.30 – 5.50 PM	SUMMING UP
5.50 – 6.00 PM	CLOSING REMARKS

## Speaker Profile



**Peter Simmonds, Ph.D.**

**ASHRAE Fellow  
Managing Director/Principal  
Building and System Analytics LLC**

Peter Simmonds has a Bachelor of Science degree in Mechanical Engineering and another in Research and Development from Reading Technical College, and a Master’s degree from HTS, Den Bosch, The Netherlands and a Ph.D. from T.U. Delft. He has been a member of ASHRAE since 1989. Dr. Simmonds is a recognized authority in the field of Radiant heating and cooling systems. The main goals of his research and applications have been to understand the heat transfer and performance of radiant systems for both heating and cooling. His studies related to thermal performance of these systems led to a unique way to enhance in these systems. Publications of his work led to the development of radiant systems in the USA and are included in the ASHRAE Handbooks. He has received the Carter Bronze Medal from the Chartered Institution of Building Services Engineers in 1993.

He has authored or co-authored more than 60 technical papers, articles and books and currently is a Research Promotion Chair for the Southern California Chapter. He is a member of several ASHRAE Technical Committees. Peter also teaches Graduate and Post Graduate Architectural students at the Southern California Institute for Architects in Los Angeles.



**Prof. Chandra Sekhar, Ph.D.**

**Professor  
National University of Singapore  
Department of Building**

Dr Chandra Sekhar is currently a Professor and Programme Director (M.Sc – Building Performance and Sustainability) and Co-Director (Centre for Integrated Building Energy and Sustainability in the Tropics) in the Department of Building at the National University of Singapore (NUS). 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. He has been an IAQ consultant in Singapore since 1993. He received his PhD in Mechanical Engineering from the University of Adelaide, Australia, in the area of energy efficient cooling and dehumidification systems. In 1992, he joined NUS as a Faculty and has since been teaching and conducting research in the areas of thermal comfort, ventilation and indoor air quality, energy efficient air-conditioning and mechanical ventilation systems, building energy analysis and has published about 225 papers in these areas in several international journals and conferences.

Prof Sekhar is an Associate Editor of ASHRAE HVAC&R Research journal, Regional Editor (South East Asia) Indoor and Built Environment and an editorial board member of Energy and Buildings journal (Elsevier), International Journal of Ventilation and International Journal of Sustainable Built Environment. He is a regular reviewer of articles for several international journals, such as, ASHRAE Science and Technology for the Built Environment (formerly HVAC&R Research) Journal and Transactions; Indoor Air; Energy and Buildings; Building and Environment; Energy; Indoor and Built Environment. He is a co-inventor and holds 3 US and other patents in the area of energy efficient air-conditioning system with zonal ventilation control for enhanced indoor air quality. He is actively involved in the development of local IAQ, ventilation and energy standards in Singapore and received the SPRING Singapore Merit Award 2012 in recognition for his contributions towards Quality and Standards in Singapore. He is a member of the International Scientific Committee of the Healthy Buildings, Indoor Air, ROOMVENT, CLIMA and IAQVEC series of conferences and was the Technical Co-Chair and member of the organising committee of the Healthy Buildings 2003, the Seventh International Conference in Singapore in 2003. He was the Chair of the Steering Committee for ASHRAE IAQ2010 conference in Kuala Lumpur in 2010 and continues to be on the steering committee of subsequent ASHRAE IAQ conferences (Vancouver, 2013 and Washington DC, 2016).

Prof Sekhar is a Fellow of ASHRAE and a Fellow of ISIAQ. He has been an ASHRAE Distinguished Lecturer since 2006 and is regularly invited as a speaker around the world. He is a recipient of the Environmental Health Award (2014), Exceptional Service Award (2013) and the Distinguished Service Award (2010) from ASHRAE. He is a co-recipient of The Enterprise Challenge award of the Prime Minister's Office, Singapore in 2004 and ASEAN Energy Award in 2011. He is also a member of the Institution of Engineers, Australia (CPEng, IEAust). Within ASHRAE, he is a past Chair of the Environmental Health Committee (EHC), was a member of the IEQ-Global Alliance Ad Hoc Committee (2013-2016) and is currently a member of SSPC 62.1, TC 2.1, EHC and TC 4.3. He has also served the ASHRAE Singapore Chapter in various capacities, including as its President during 2010-2011 and as a BOG member.

## Registration

Online registration via <https://wes-cue2.e-reg.asia/>

Fee:

Full Conference Pass (Apply promo code: <a href="#">WESCUEASC</a> ) or One day Pass (either 19 or 20 July)	S\$ 800 + GST S\$ 400 + GST
Add on ASHRAE Distinguished Lecturers Seminar on 21 July	S\$ 50 + GST