

Energy Efficient Humidity Control in Hot-Humid Climates

What is the issue?

Air-conditioning system designs in hot humid climates typically employ a high level of recirculation rates owing to the high energy penalty involved in cooling and dehumidification. Typical recirculation rates are in the order of 80-90% and sometimes even higher. The challenge is not so much in being able to dehumidify but do so without having to overcool. This is best understood through the concept of Room Sensible Heat Ratio (Room loads) and the associated Coil Sensible Heat Factor. The problem is further exacerbated by a relatively higher latent cooling requirement at part load operating conditions. Based on considerations provided in ASHRAE Standards 55, 62.1 and 90.1, it is imperative that the efficiency dimension associated with cooling and dehumidification process must involve an absolute improvement in component/system efficiency as well as some means of energy recovery strategies.

Whilst the fundamental focus is “indoor humidity levels” and the means to achieve acceptable RH levels in an energy efficient manner, the relevance to EHC is apparent in that adequate ventilation at all times of HVAC operation is strongly dictated by outdoor climatic conditions. If the humidity control is addressed, it offers the possibility of enhanced thermal comfort, ventilation and IAQ.

What does it mean to ASHRAE?

Energy efficient humidity control in hot humid climates has a very strong bearing on thermal comfort, IAQ and eventually on the health and productivity of occupants in air-conditioned buildings. The following are some of the objectives that are either already being addressed by ASHRAE or could be considered in the context of energy efficient humidity control:

	Item	Remarks
1	Air-conditioned buildings in hot humid climates are invariably cold. Is this due to occupant preference or an inevitable outcome of current design practices?	<ul style="list-style-type: none"> Existing data New Research needed
2	Thermal comfort acceptability of tropically acclimatized subjects. Can a warmer and drier thermal environment be more acceptable? Can a cooler micro-environment (immediate breathing zone) coupled with warmer ambient conditions be more acceptable?	<ul style="list-style-type: none"> Existing data On-going research New Research needed
3	Humidity issues at design and part loads.	<ul style="list-style-type: none"> Existing information and data New Research needed
4	Energy efficient air-conditioning and air distribution systems: a) Desiccant dehumidification system b) Dedicated Outdoor Air System c) Decoupled Ventilation/Recirculation Systems d) Personalized Ventilation system e) Displacement Ventilation system f) Under floor Air-conditioning system	<ul style="list-style-type: none"> Existing data On-going research New Research needed
5	Energy recovery features a) Run-around-coil systems b) Heat Pipe system c) Other technologies	<ul style="list-style-type: none"> Existing data On-going research New Research needed

What action should be considered?

Research: Strongly recommend Items (1) and (2). It should lead to new knowledge and, perhaps, a more fundamental understanding of the response of tropically acclimatized persons to thermal comfort, ventilation and IAQ. Item (2) should also possibly lead to technological innovations in micro-environment design and control, which could play a crucial role in the mitigation and control of air-borne spread of infectious agents in the future (In January 2007, WHO has reiterated the need to be vigilant of Pandemic Flu). This is also closely associated with the Position Document on Ventilation and Infectious Disease”.

Note: Emerging Issue Reports are developed and approved by the ASHRAE Environmental Health Committee (EHC). The Energy Efficient Humidity Control in Hot-Humid Climates Emerging Issue Report was approved by EHC in June 2007.

Items (4) and (5) can be seen as an on-going and evolving exercise. The significant contribution will be from long-term monitored data and success stories of these technologies that could eventually become common practice aimed at having the basic elements of a sustainable HVAC design.

Outreach/Programs: EHC should initiate and lead Symposium/Seminar sessions at AHSRAE meetings as and when new findings are made available through new research projects initiated by EHC. For existing scientific information and for on-going projects (that are not necessarily driven by EHC) in the above table, EHC could co-sponsor with relevant TCs etc for a potential outreach activity. Some of the more attractive program presentations could also be developed into self-contained “seminar packages” that could be used for chapter talks by members of the EHC. The ASHRAE DL platform is another means by which information could be disseminated. The idea is to go for a wider dissemination beyond those attending the two ASHRAE meetings.