Reducing energy use and providing comfortable indoor environments for occupants are both key objectives of the building sector globally. However, establishing the appropriate balance between these often competing issues is challenging. Is it possible to achieve thermal comfort in buildings without increasing energy use? To answer this, this project is focussed on:

- creating a scientifically based explanation of the underlying mechanism of adaptive thermal comfort for people in buildings, and
- the application and evaluation of the thermal adaptation concept to reduce building energy consumption through design and control strategies.

The concept of adaptive thermal comfort is not new, but there are still existing problems to be solved in this field of research:

- Although the adaptive effect has been observed by many researchers, the mechanism of the adaptive process is still unclear, especially the psychological and behavioural influences.
- The thermal adaptation responses of people in diverse climatic regions can be quite different, which may result in different building design strategies and indoor environment solutions. Current understanding of occupants’ adaptive responses in different climate regions is still limited.
- Apart from purely free-running buildings or air-conditioned buildings, mixed-mode buildings are the most common type. In existing standards there are no evaluation criteria for this kind of building. Most clients refuse to accept low energy building design with an indoor thermal environment outside the comfort range defined in current standards.

In air-conditioned buildings, personal control systems play an important role in thermal adaptation.
Source: Edward Arens, University of California at Berkeley
ACHIEVEMENTS

This project produced a database with a user interface including information about human thermal reactions, together with occupant behaviour and building energy consumption, a model and criteria for the application of adaptive thermal comfort in buildings, guidelines for low energy building design based on the adaptive thermal comfort concept, and guidelines for personal thermal comfort systems in low energy buildings.

The following reports have been published as the official project deliverables:
- Development of the ASHRAE Global Thermal Comfort Database II
- Models and Criteria for the Application of Adaptive Thermal Comfort in Built Environment
- Guidelines for Low Energy Building Design Based on the Adaptive Thermal Comfort Concept
- Guidelines for Personal Comfort Systems in Low Energy Buildings

Project duration
Completed (2014 - 2022)

Operating Agents
Prof Yingxin Zhu
Department of Building Science
Tsinghua University
P.R. CHINA
zhuyx@tsinghua.edu.cn

Prof Richard de Dear
School of Architecture
The University of Sydney
AUSTRALIA
richard.deear@sydney.edu.au

Participating countries
Australia, Canada, P. R. China, Denmark, Germany, Japan, R. Korea, the Netherlands, Norway, Sweden, UK, USA

Observer: India

Further information
www.iea-ebc.org