

Special issue of the “Journal of Building Engineering: climate responsive solutions to heating and cooling of buildings”

Book

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As living standards, aspirations and expectations rise across the world's different climate regions, it has never been more important to research the possibilities of delivering energy efficient, low or zero emissions heating and cooling at the scales of the individual building, blocks of buildings and whole cities and their hinterlands. Certainly in the UK and Europe generally, policy has been almost entirely directed towards saving in the energy consumption associated with heating processes during the winter but as the climate changes summer peak temperatures and their duration are rising and it is predicted that this trend will continue through the century. Cooling building environments may yet take centre stage and it appears that some of the measures recommended to increase resilience in winter to low temperatures may reduce resilience in summer to high temperatures. The expectation that in a growing economy there is a right to expect a mechanically cooled workplace, place of entertainment, school or higher education environment is a mid Twentieth Century social phenomenon. This derived from the West and driven by a highly entrepreneurial air conditioning industry vigorously promoting the cooling effects of their products. Market share was built before the energy crises of the 1970s and the subsequent revelation that carbon emissions may be accelerating warming of the global environment. The current context is very different and intense inter- and multi-disciplinary research is required to break through the comfort-sustainability conundrum. Buildings need to be safe in hot weather but artificial environments are energy intensive and at the current rate of construction globally, if the new building stock is conditioned to Western standards, the energy consumption and consequent emissions will be at an unimaginable scale. As a consequence researchers in building environments and designers who consume their findings have never been so central to global policy-making. These issues rank with the other great conundra facing the globe in health, antimicrobial resistance, affordable transportation in emissions terms, the provision of basic life sustaining utilities at the continental scale.

The successful implementation of appropriate technologies, methods and processes has been limited by a lack of integration and understanding across the various disciplines involved. Delivering low energy buildings needs a systemic approach in which regional, local and microclimates are considered, identifying the opportunities of passive design, improving system performance sufficiency, utilising renewable energy and optimizing end-user management. It requires guidance from complex systems that encompass policy and regulation, the integration of technology and its users, and, most importantly, an evaluation of the delivered performance of the whole process.

This Special Issue attacks this conundrum head on. It aims to rigorously pursue the research question, 'how can building and energy systems provide high quality indoor thermal environments which respond to local climatic characteristics, while minimising energy consumption', the essential challenge of our time.

Guest Editor

C. Alan Short

University of Cambridge, Department of Architecture, England

Guest Editor

Baizhan Li

Chongqing University, School of Urban Construction and Environmental Engineering, China

Guest Editor

Mehdi Shahrestani

University of Reading, School of the Built Environment, England