Reducing global energy use in buildings while improving occupant comfort and well-being:

Reversing the growing trend toward energy-intensive air-conditioning

GLOBAL INNOVATION INITIATIVE - 2014

Loughborough University

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Aims

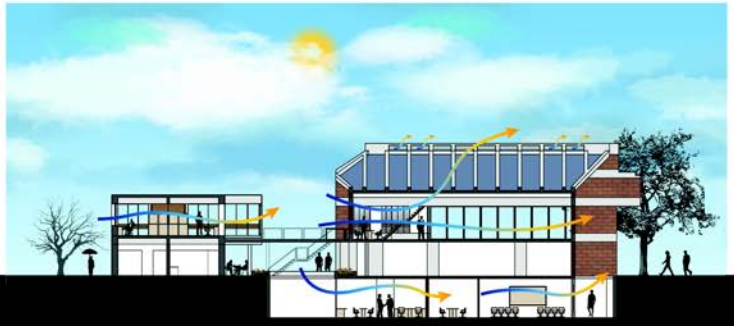
Buildings contribute to greenhouse gas emissions more than the industrial or transportation sectors, primarily due to high energy demand and usage in air conditioning, heating and ventilation, driven by the basic human need for thermal comfort and good indoor air quality.

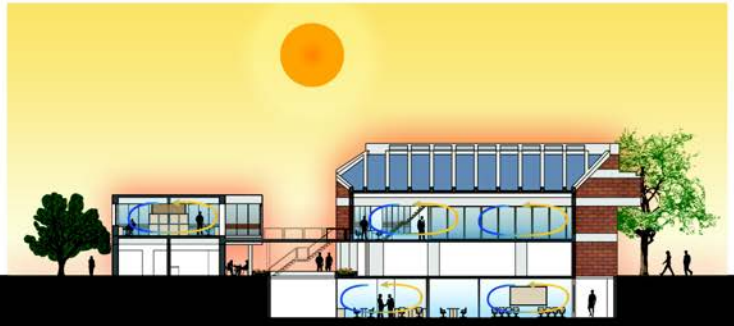
The projects aims:

- to achieve a better understanding of human thermal comfort in residential and commercial buildings
- to explore opportunities for reducing energy demand through natural ventilation, mixed mode practices and other low energy techniques that provide air movement.

Objectives

1. Gather data on thermal conditions, thermal comfort and occupant responses in residential and commercial buildings (mixed mode: where both natural ventilation and air conditioning is used) in UK, US and India, and compile a database.
2. Use gathered data and simulated models on thermal comfort/airflow to assess a range of low energy techniques that deliver comfort and energy savings.
3. Utilize research outcomes to propose revision of standards on conditions for thermal comfort to reduce the use of energy-intensive cooling, heating and ventilation.





Task Schedule

Task 1 - Data gathering:

- Literature review of existing field studies of mixed-mode residential and commercial buildings
- Collect data, identify gaps in surveyed building types and select further buildings for survey (August 2014)

Task 2 - Field work:

- Perform surveys in selected buildings in UK, US, India as required to fill identified gaps
- Share experience and knowledge on techniques for doing this (June 2014 – Oct 2015)

Task 3 - Construct an international database:

- Construct a database using data gathered from tasks 1 and 2 for mixed mode residential and commercial buildings
- Conduct surveys, both quantitative (physical measurements: air and mean radiant temp, % relative humidity, etc) and qualitative (subjective: sensation, comfort, etc.)
- Establish thresholds for quality control of data (Aug 2014 – Oct 2015)

Task 4 - Analysis of comfort and adaptation:

- Perform analysis using database to obtain trends in thermal comfort, behaviour
- Evaluate current prediction tools (PMV, etc.)
- Convene discussion groups regarding analysis and representation and provide evidence for standards revision (Nov 2014 – Oct 2015)

Task 5 - Modelling and validation:

- Validate by using simulations that predict comfort, air flows, indoor air quality of existing model for mixed mode residential and commercial buildings surveyed in Task 2
- Assess low energy techniques for maintaining comfort in UK buildings regarding current and future summer overheating
- Estimate energy savings compared with standard air-conditioning (Nov 2014 – Oct 2015)

Task 6 - Model application:

- Training course in model usage for team
- Predict comfort, indoor air quality and energy saving in typical residential and commercial mixed-mode buildings in Indian context
- Quantifiability of low energy techniques to maintain comfort in India, including energy saving with respect to air-conditioning and identifying techniques with maximum potential (July 2015 – Jan 2016)

Task 7 - Scale up:

- Determine building stock composition of a selected Indian region
- Use results of Task 6 to estimate potential energy savings for that region
- Inform local (regional) policy as required (July 2015 – Feb 2016)

Task 8 - Informing international standards:

- Combine outcomes from Tasks 1-7 to inform revision of relevant standards with respect to potential of low energy techniques to deliver comfort (Oct 2015 – March 2016)

Funding Agency

British Council 'Global Innovation Initiative' Programme

Project Period

1 April 2014 – 31 March 2016

Funding Available

£149,000

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