



Design for Thermal Comfort

Social housing and communal heating charges

Aragon V., Bahaj A.S., Bourikas L., Gauthier S., James P.A.B., Stephen J.O., Teli D.

Executive Summary

Reducing energy demand in dwellings is an important component of meeting carbon reduction targets. The drivers of this demand are linked to occupant practices, varying greatly between people and locations. Heating is the main component of energy demand in dwellings in the UK and it is often associated with thermal comfort. In order to achieve thermal satisfaction occupants may interact with the building systems and controls to adjust their living environment to their liking. This research shows that occupants' thermal preferences can adapt to prolonged high indoor air temperatures, raising their expectations. It also points out that in absence of communal heating charges, several households are unlikely to afford to heat their homes to the recommended healthy standards.

Success Metrics

Local Authorities have been informed about the environmental conditions in tower blocks and their implications to occupants' thermal comfort and energy use.

The analysis has supported refurbishment approaches and "soft" management decisions regarding billing choices, energy metering and building controls.

About

Reducing energy demand in dwellings is an important component of meeting carbon reduction targets and to reduce costs to consumers and Local Authorities.

This case study investigates the relationship between indoor environmental conditions, thermal expectations, individual heat-

ing control settings and heating charges. It is addressing the interactions between these heating demand drivers and their implications for the energy demand for heating in buildings.

The research is based in three social housing buildings (Figure 1.1). In two of these buildings indoor temperatures have been maintained at high levels for years and they have communal heating charges. The third building has no communal heating charges. The research used a mixed-methods approach consisting of data collection using environmental monitors, semi-structured interviews and questionnaires.



Figure 1.1. Social housing tower blocks built in the 1960s.

Challenges

The occupants' adaptation to high temperatures could pose a great challenge to the implementation of energy use reduction strategies, if recommended thermal criteria were to be met.

Low-cost heating supply to some occupants may have led to constantly high indoor air temperature, which in turn may result in thermal adaptation to these high temperatures and raise occupants' current and future thermal expectations (Figure 1.2).

Goals

The aim is to understand how people interact with heating and building controls according to their comfort levels. A human-centric approach on the design of social housing will inform policy so that management solutions that promote energy

saving and people's well-being can be established.

How has this research helped?

This study shows the need to consider established occupancy conditions and occupants' thermal comfort related processes prior to any decisions on energy efficiency measures and any changes to heating management. Simplified, generic occupancy related assumptions usually don't represent the real conditions and they disregard the expected thermal comfort levels and satisfaction of the occupants.

Results

Results show that there is a relationship between indoor air temperature profiles in living rooms and communal heating management strategy and the choice of individual heating control settings. This implies that the low-cost heating supply to some occupants may have led to constantly high indoor air temperature (Figure 1.2).

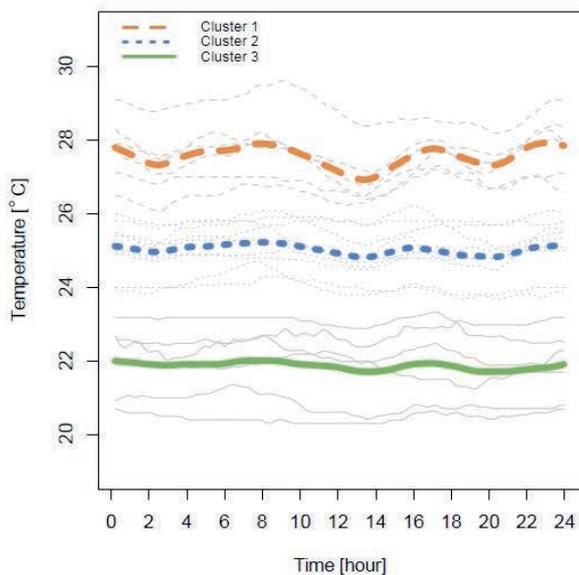


Figure 1.2. Living room average air temperature profiles for weekdays, separated in three clusters. Buildings with communal heating charge (Figure adapted [1])

Occupants in the building without communal heating charges appear unable to afford the high costs of heating in their poorly insulated homes (Figure 1.3).

Interviews were carried out with tenants, asking about their views on the indoor environment, the use of environmental controls and their thermal sensation at the time of the survey. In most flats heating is provided with electric storage heaters.

The results show that most people were satisfied with the temperature in their flat, regardless of it being most of the time much higher than recommended levels (Figure 1.4).

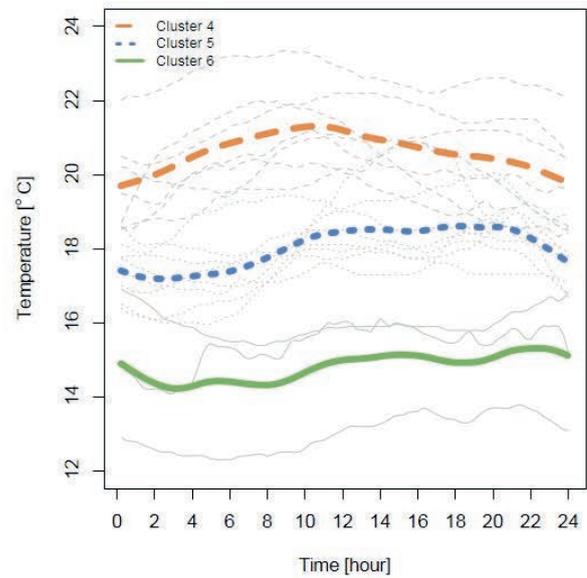


Figure 1.3. Living room average air temperature profiles for weekdays, separated in three clusters. Building with individual heating charge (Figure adapted [1])

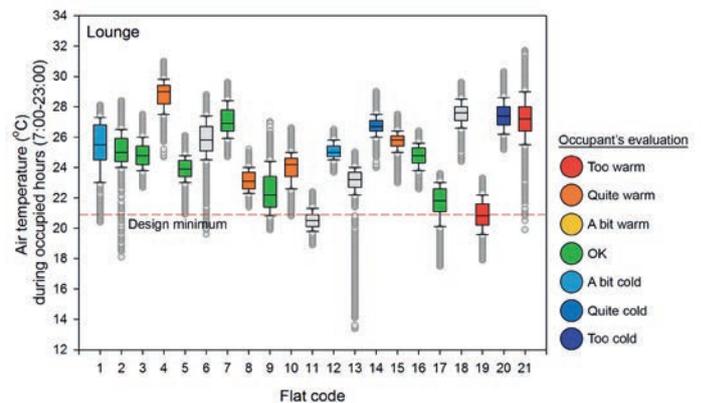


Figure 1.4. Monitored living room air temperature box plots between 07:00 and 23:00 in the investigated heating period. Occupants' thermal evaluation (grey fill: no interview given). Box: the 50% of the measured air temperatures; whiskers: the 10th and 90th

The comparison between the building with communal heating charge and the building without showed that in the first case the occupants hardly turned off the heaters while those who paid for heating separately to their rent were most likely to switch off the storage heaters due to the increased costs incurred.

'A human-centric approach is required to achieve energy savings without compromising people's health and well-being.'

References [1] Gauthier, S., Aragon, V., Bourikas, L., James, P., & Teli, D. (2016). Investigating the impact of communal heating charges on internal temperature profiles, thermal expectation and excess in energy demand. Paper presented at DEMAND 2016 Conference, Lancaster, United Kingdom. Teli, D., Gauthier, S., Aragon, V., Bourikas, L., James, P., & Bahaj, A. (2016). Thermal adaptation to high indoor temperatures during winter in two UK social housing tower blocks. In Proceedings of The 9th Windsor Conference: Making Comfort Relevant. UK: The Windsor Conference.