

When buildings are used

A new **BRE** guide looks at the common discrepancies between how buildings are designed and how they are used in reality. **Ella Taylor** considers its messages.

Humans are naturally adaptable, and will react to uncomfortable environments by changing whatever they can, whether by overriding an automated ventilation system or simply adjusting the lighting in a building. The BRE guide *The Move to Low-Carbon Design: Are Designers Taking the Needs of Building Users into Account?* emphasises this point, based on a study of new buildings judged highly sustainable when built, which the researchers found to be suffering from unsustainable occupier behaviour.

“New regulations and a drive to reduce energy bills and CO₂ emissions have meant that new buildings are being designed to be as energy efficient as possible and many use advanced, innovative technical systems to heat, cool and light the building. However, it has been frequently found that these new buildings are not meeting their proposed targets,” say the report’s authors, **Mindy Hadi** and **Chloe Halfhide**.

In fact, they go on to cite a 1998 study by the **American Council for an Energy-Efficient Economy** as an example of research which they say “has shown that building users frequently behave in ways that actually increase energy use above that expected, and that as a consequence occupant behaviour is a key determinant of energy consumption.” This aspect of a building’s design – its performance once occupied – is one that the authors suggest designers may not be fully sensitive of.

The BRE study detailed in the guide focused on eight new non-domestic buildings. All of them, if assessed, had achieved a BREEAM Excellent rating or equivalent. A common theme across them was the inclusion of automated systems to control aspects within the building, with the intention of saving energy.

These systems in practice were found to be the most problematic. Researchers carried out “observational walk-throughs” to note specific inefficient practices, interviewed facilities managers to see how the buildings were managed and maintained, and ran focus groups with the occupants to establish how easy they found it to control their environment, what they understood of the controls and their views of the buildings.

The greatest source of complaints in the focus groups, and one of the most striking,

was that many systems made it difficult to control the temperature and ventilation. In many cases, temperature sensors were located in inappropriate areas of the building, such as by a heat source or window, thermostats and opening windows were physically hard to reach, mechanical ventilation systems were irritating or heating controls were frustratingly slow to respond.

People coped with these difficulties by turning heating controls right up or right down, resulting in further problems and wastage from the massive fluctuations. They also propped open fire doors to circulate air, causing dangerous fire risks, and locked windows that were important to the ventilation strategy.

Hadi and Halfhide stress that: “Designers of buildings, systems and controls are not always aware of the impact of their decisions on the ordinary occupant, and fail to realise that if they do not adapt their design to meet the occupant needs and behaviour then building users will adapt it themselves.”

Automated systems for lighting were also a major source of inefficiency, wasting electricity without the users interfering in the controls. All of the buildings studied used passive infra-red (PIR) lighting systems, and in every case the researchers found that lights were automatically switched on by these systems when they sensed movement, regardless of whether or not they were needed. In some cases, Hadi and Halfhide say, a room would be filled with bright natural light but the electric lights would still be switched on, although some systems did automatically dim them if they sensed daylight.

The Move to Low-Carbon Design follows each detailed complaint with recommendations for designers, facilities managers and occupants, all of which focus on finding a balance between comfort and sustainability.

In the case of the lighting problem, it recommends that designers specify an automatic system based on “absence detection”, reversing the current trend. This would not turn lights on but would allow occupants to do this, and to adjust the brightness to the levels that they find suitable. The system would simply detect if

Background

The study’s findings echo a similar project last year by **Stewart Milne Group** and **Oxford Brookes University** (*SB*, June 2009). Their project monitored a series of different families living in a prototype of a *Code for Sustainable Homes* level 5 house, which Stuart Milne built in the BRE Innovation Park.

It found that the building in use was far less sustainable than had been envisaged at design stage, as residents didn’t know how to work complicated systems. One such problem lay with understanding how to adjust the thermostat, so families adapted by opening windows to cool the house down, wasting energy. The behaviour of users, along with build quality factors and problems with the microgeneration systems installed, contributed to an actual energy use of 140kw/m²/year, whereas it was designed to use 86kw/m²/year.

Studies such as these link to the BREEAM In-Use assessment scheme, launched last summer (*SB*, June 2009), which aims to improve the efficiency of existing buildings by recognising their actual performance.

no movement had been sensed for a period, ie if people had left the room without switching of the lights, and would then turn lights off, conserving electricity.

Issues arising from the study also included glare, draughts and water wastage, all detailed in full in the report. Sustainable construction materials, renewables and water efficiency measures all featured in the buildings’ designs, but weren’t perceived to be a direct source of frustration. Although the research focused mainly on internal components of the buildings, many of the lessons apply to the whole design, as a common recommendation was that the users should be considered more fully during the early design stages. It also said that simple ideas are often most effective, and that whatever the strategy chosen, training and guidance, regular checks and problem solving once in use will go far to improve sustainability.

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