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Ventilation and the effect of residents behaviour within Passivhaus dwellings

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Supplementary information

Introduction

In the UK, over 40% of energy consumption is building related. The energy used in homes alone is responsible for more than a quarter of CO₂ emissions. CO₂ is the main greenhouse gas and the most significant cause of climate change. Most of the energy used in homes is produced using processes that release CO₂ into the air. Studies have found that a building's energy use for space heating is significantly influenced by occupant's behaviour such as the opening of windows and the selected thermostat setting. This influence is greater in energy efficient dwellings designed for low energy use. The aim of this paper is to facilitate a better understanding of how occupant behaviour may effect ventilation within Passivhaus buildings in particular.

Passivhaus



Figure 1 Wimbish Passivhaus (North side) (picture courtesy of Martin Ingham)

Passivhaus design focusses on reducing the need for space heating. Very high levels of insulation, minimal gaps in the insulation materials or other thermal bridges and an airtightness barrier are essential in achieving the challenging standards. Certain design characteristics are also typically employed such as south facing orientation, triple glazing, and highly efficient mechanical ventilation with heat recovery (MVHR). The low space heat demand can be met via the ventilation system, which serves a dual function (fresh air and heating) and reduces the investment required for heat distribution since radiators are no longer required. These cost savings can then be reinvested in energy efficiency measures, including the ventilation system itself.

The role of occupant behaviour

The on-going improvements to system efficiency, materials and construction methods leads to the significant reduction in the amount of energy used for space heating. As buildings become more energy efficient, the behaviour of occupants play an increasingly important role in the energy consumption.

There have been several myths regarding allowable behaviour in a Passivhaus building. One of the biggest is that residents are not able to (or maybe just discouraged from) opening windows. During the winter heating season, there is no reason why a window cannot be opened but most people will feel less inclined to do so in a Passivhaus building because heat recovery ventilation ensures the internal air is fresher in a Passivhaus than a typical modern build.

The Wimbish houses are one of the first UK Passivhaus homes to be monitored in detail under the UK Technology Strategy Board BPE programme. The University of East Anglia, as a partner in the EU Build with CaRe project, worked with Hastoe Housing Association to create a successful bid for funds for this two-year evaluation study. Martin Ingham, an associate consultant for UEA's Adapt Low Carbon Group, has been running the study since the homes were occupied in June 2011. The Building Performance Evaluation Interim report¹ published in March 2012 describes the homes and their construction and gives detail not just of the energy and environment monitoring but also about the

¹ http://www.buildwithcare.eu/images/pdfs/wimbish_passivhaus_interim_report_march_%202012.pdf

handover process and the engagement with the occupants and their learning about living in a Passivhaus home.

Comments by the occupants indicate a very high level of satisfaction with their new homes and an occupant survey shows that this development at Wimbish scores highest on most metrics of all the domestic properties so far surveyed. Gas use to date indicates that heating energy is likely to comply with the Passivhaus limit of 15kWh/m²/year although the report notes that the rates charged by energy supply companies are financially disadvantageous to low usage customers such as Wimbish occupants.



Figure 2 MVHR controls (picture courtesy of Martin Ingham)

Temperatures in the homes, humidity and air quality all indicate good performance of ventilation and shading, and the properties all remained warm during the unusually cold winter. The report suggests that the transition to a property with no visual heating system, but with the addition of a ventilation system, might be considered similar in nature to the change from open fires to central heating. However, the main obstacle is quite simply that the technologies used in new Passivhaus dwellings are not comparable to the residents' previous homes. Therefore, their previous experience does not, by itself, sufficiently equip them with the knowledge required to achieve the expected project benefits. The handover period is when these 'different' technologies are encountered for the first time, and is

especially insightful. The Wimbish Interim Report in March concluded several key recommendations, including support in the adjustment to new technologies. It is also necessary to provide different support in different seasons, as different behaviours are likely to be needed throughout the year. Residents are likely only to take in lessons pertinent to them in the short term and this might mean that further advice may be needed when the season changes.

Another study which highlights the relationship on how technology and occupants' behaviour might shape the performance of practices was also underlined in a working paper carried out at UEA by Chris Foulds et al². This working paper concluded that changing practices to save energy cannot be stimulated by introducing technology alone. A significant change to the technology element (moving into a Passivhaus) altered the inter-element relationships that bind everyday practices together.

Fundings and business support for East of England SMEs

The Centre for the Built Environment, (a Centre that draws upon a cluster of expertise within and outside UEA and is responsible for delivery of ERDF outputs and, through Adapt Commercial, the provision of low carbon consultancy services) provides free business support which will be delivered in a series of bespoke CPD accredited seminars, webinars and other support. As part of the ERDF funding, SMEs in the East of England are eligible for up to 12 hours support free of charge. Non SMEs will be charged £30 plus VAT per half day session. The seminars are CPD accredited and suitable for architects, contractors, planners, M & E consultants and other built environment professionals. It will be delivered by a combination of professionals, other built environment specialists and CBE consultants and will have a maximum capacity of 15 people per session. Ventilation in Passivhaus and Low Carbon Buildings will be one of the topics covered. Speakers for this seminar includes leading experts from BRE, Airflow and BDP. This seminar focuses on the technologies and processes involved in the design, delivery and maintenance of ventilation systems in Passivhaus and low carbon buildings. For the latest events, please visit our website: www.adaptcbe.co.uk/CBE/events

² <http://www.3s.uea.ac.uk/sites/default/files/3S%20WP%202012-09%20Foulds%20et%20al.pdf>



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