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## **The Benefits of Occupant User Guides in Achieving Low Energy Homes.**

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### **Abstract**

Levels of fuel poverty are at an all-time high, particularly in Scotland, therefore the thermal performance of the housing stock and associated energy consumption of the residents are critical in reducing fuel bills and lowering CO<sub>2</sub> emissions. User habits are a significant contributory factor to high energy use within the home and this can be partly attributed to a lack of knowledge and inappropriate use of heating and ventilation systems. The recent introduction of Section 7 into the Scottish Technical Standards provides an optional award for Sustainability which recognises the need to inform residents of how to use their homes in an energy efficient manner via an occupant guide.

This paper highlights the need for an occupant guide identified through previous post occupancy research work and proposes a template for a bespoke 'quick start' guide which communicates energy efficient practices through clear visual instructions for operating a new house. This paper also identifies challenges to the production of such a guide within the current house building industry and proposes a range of methods of gathering this bespoke house type information. Likewise the distribution of the guide is critical to the success of the resident's commitment and application of the guidance. It has been tested in both social housing and private sector housing within the West of Scotland and survey data taken from residents have been analysed to review the success of the guide. In addition to resident's comments, feedback from professionals in the Scottish house building industry have been a valuable source of data. Addressing occupant habits by communicating low energy practises to residents will not only help homes meet their predicted energy consumption but should also reduce fuel bills and assist the UK Government meet their ambitious CO<sub>2</sub> emission targets.

**Key words-** User Guide, occupant control, energy efficient

This paper discusses the need for occupant guides highlighting previous research work which identifies problems with predicted energy usage within new homes and actual recorded monitored data once the building is in use. It examines the reasons for excessive energy consumption due to user habits and places this in the context of Scotland which is currently experiencing high levels of fuel poverty. The paper also describes findings from a pilot project whereby a template for an occupant guide based on the new Section 7 guidelines of the Scottish Building Regulations was designed, produced and tested in both the private and social housing sectors. Finally the paper identifies the problems and opportunities that may be applied in occupant guides in future new housing.

### **Context**

Both new and refurbished housing in Scotland is subject to enhanced energy performance via regulatory controls in the Scottish Building Regulations and through voluntary certified awards such as the BRE's 'Ecohomes' accreditation and 'Passivhaus' certification. The intention of these measures is to reduce home energy consumption and consequent fuel bills. Whilst an increasing number of energy efficient new homes have been built with mandatory Energy Performance Certificates (EPC) and SAP assessments to predict the annual energy use of a home there is increasing evidence that the performance of these homes once occupied does not necessarily meet the predications calculated at the design stage. Modern living has led to a detachment from the physical interaction with buildings, aided in part by the technological complexity of contemporary systems. At the same time users expectations about performance and response have been raised. This trend is likely to continue with the development of low carbon housing, particularly in respect of reliance on new technologies.

Recent work in Scotland looking at the monitored performance of housing by the Mackintosh Environmental Architecture Research Unit (MEARU) has confirmed that predicted energy consumption levels in new homes are not being met, and vary significantly across similar homes. In addition to energy consumption, monitored environmental data also indicates that poor air quality is evident. These studies have identified that significant contribution to this performance gap is due to the ways in which residents are using their homes trend in both a lack of knowledge of heating and ventilation systems.

An example of a lack of knowledge of ventilation systems both in the use of mechanical systems (such as extract vents in kitchens and bathrooms) and simple methods of controlling background ventilation through trickle vents in windows to ensure good air quality was seen in a recent study in Glasgow (Menon and Porteous 2012) undertaken as part of the EPSRC funded project titled Environmental Assessment of Domestic Laundering. Both these strategies are entirely ubiquitous in housing but the study found that out of 100 residents in social housing in Glasgow, 49% respondents never used their window trickle vents and of the 51% who said they used them only 31% claimed to regularly adjust the vents. In addition, 34% did not know if the mechanical extract fans in their home were manual or automatic. A trend of opening windows to regulate temperature which in turn impacts on the heating requirements within the home was also evident from the anecdotal evidence gathered from residents during the survey process.

Given that household energy costs in the UK have risen 71% in just over 5 years, energy efficiency is a priority for both residents and housing providers. This research has been carried out predominantly in the context of the social housing sector in Scotland and these trends are particularly worrying when statistics show that fuel poverty in Scotland is at an all-time high with fuel poverty running at 32.7% while the rate in the UK as a whole is 20.1% (Department of Energy and Climate Change, 2011).

There is clearly a need to provide a better method of communicating energy efficient strategies and clearer guidance on how to use specific heating and ventilation systems to residents not only when they first move into their new home, but that it is also available for future tenants/ owners.

In May 2011 the Scottish Building Regulations changed to include Section 7 'Sustainability'. This section in the Building Regulations outlines optional standards for Gold, Silver and Bronze 'awards' for sustainability for new housing- the higher levels all include the need for straightforward user information for homes including a 'quick start' or occupant guide to the building fabric, mechanical systems, ventilation strategies and any other energy efficient features. In January 2011 MEARU were commissioned by Building Standards Directorate (BSD) to develop a template of a guide for occupants of low energy homes. This work now forms part of Section 7 (Scottish Building Standards Technical Handbook 2010,). This paper reports on the principles and intentions of this work, the process of developing a template for such an occupant guide and a subsequent project undertaken with The Home Log Book Company (HLB) that evaluated this guidance in use.

## **Methodology**

The initial project for BSD was based on the need to develop robust, effective and long term solutions to the problem of inefficient energy use in homes. The guidance needs to provide practical, effective solutions that will gain the support of the construction industry, designers and developers, owners and occupants. This will require imaginative and creative ways of approaching the problem. Contemporary experience of manuals for domestic situations suggests that information that is not

absorbed in the first reading is never gained. At the same time, current educational theory suggests that memorisation of complex information is not possible, and that location and retrieval of information is a critical skill. The project considered the type of operations that need to be addressed, such as heating and ventilation, water use, maintenance and controls, with the emphasis placed on those aspects that have the most effect on energy and carbon. As well as written information, consideration was given to graphical and visual information and mechanisms to deliver this in the home, including both printed but also digital material. The project concluded with an outline set of recommendations and templates for a) content, b) visual communication and c) delivery mechanisms for simple, effective guidance for occupants that can be included in Building Standards.

The recommendations identified included the need for the guide to be specific to each individual dwelling. The purpose is not to explain details of how or why a home is designed to work environmentally, but rather what occupiers need to know to make a home work efficiently. It should describe the overall performance of the house as a system itself and the focus should be on maintaining internal comfort in an efficient manner.

MEARU advised that the guide should be as compact and graphic as possible to aid rapid comprehension, making it more likely to be kept available, used for future reference and be capable of being passed on to future owners or residents. It should include plans, locating key items of equipment and information only on the systems installed. Illustrations do not need to be to scale, but should show relationships and explain things quickly and easily. In addition the guide should provide a brief description of the basic features of the house, including insulation, building fabric, heating, ventilation, hot water use and any major equipment that make a difference to how the house operates. Finally a brief list of up to 5 essential DOs and DON'Ts for occupant interaction with each system (heating, ventilation etc) is critical to the success of the guide.

The majority of the recommendations identified in the study were then incorporated into Section 7 Sustainability of the Building Standards Technical Handbooks (Annex 7.B 'Optimising Performance' 2011).

A further study tested the use of these occupant guides in practice. The study was undertaken in conjunction with The Home Logbook Company and was funded by a CIC Start consultancy award. The aim was to test the template and the series of recommendations identified in the previous study and then to gain feedback from the residents. During the study, examples of housing currently under construction were identified in both the public and private sector in Scotland. Occupant guides were created for 6 house types within a private new build development of detached homes and apartments in Stirling by a volume house builder. Similar guides were also created for 5 house types within a new development of terraced homes and apartments in Anniesland by Glasgow Housing Association (GHA). The guides were issued to the new residents within 4 weeks of them gaining entry to the house and feedback on their effectiveness to new residents was gathered via face to face interviews and postal questionnaires.

Information including floor plan layouts and heating and ventilation systems for each house type was gathered from the house builder and architect and parameters for the occupant guide were identified. The process also involved a graphic designer which helped to clarify effective presentation methods for the technical information. As a key requirement emerging from the original study is that guidance should be specific to each house, the information regarding building fabric construction, heating systems and location of services within floor plan layouts required significant clarification from the

housing providers, architects and contractors to ensure the correct house type layout was reflected in the guide.

The booklet is divided into colour coded key sections including Heating, Ventilation, Hot Water and Energy Saving Features. Information was presented predominantly through easy to read floor plans and diagrams reflective of each house types rather than text based information (Fig 1.).

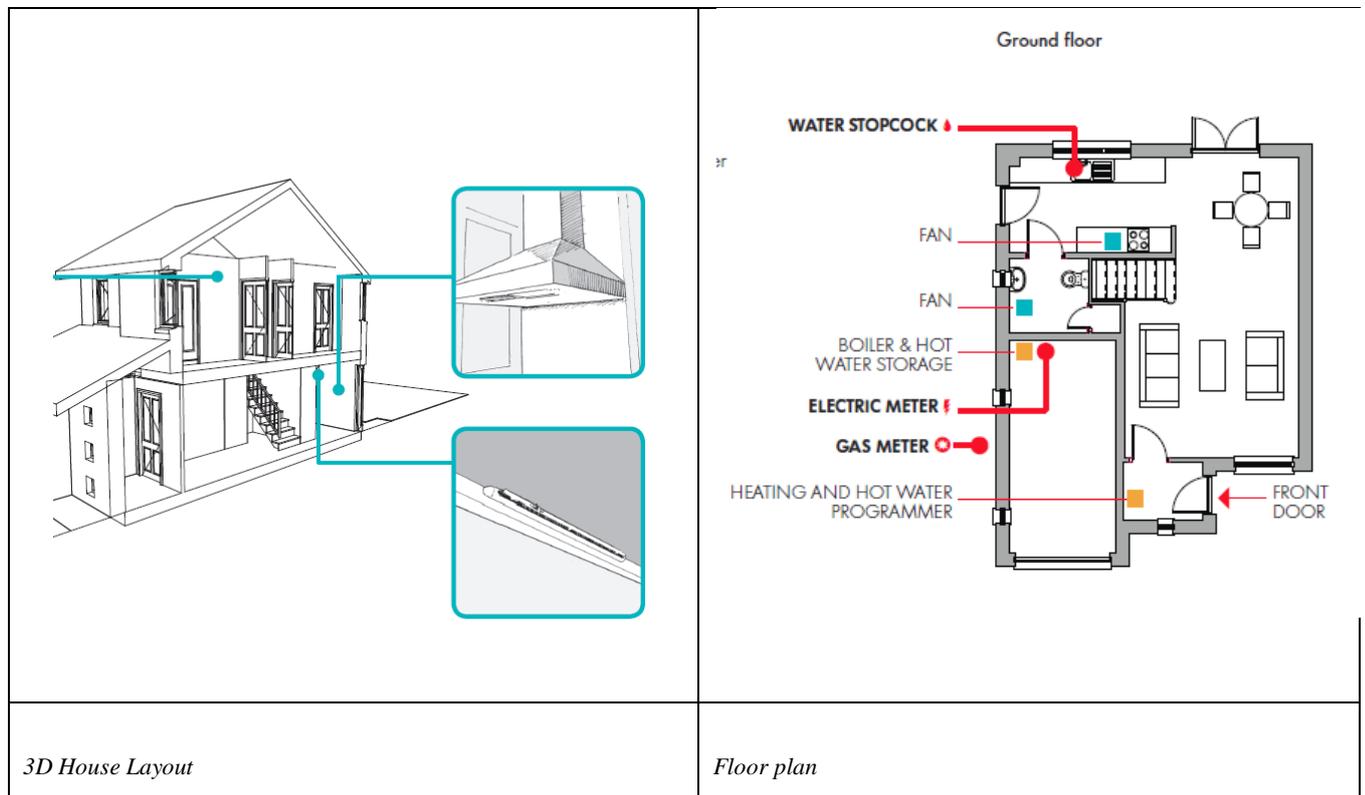


Figure 1- Typical pages from the occupant guide used in the pilot study

Easy to read floor plans indicating locations of key services and controls including the boiler, heating timer are highlighted in red while a series of 3D diagrams of the house type allowed an opportunity to provide exact location of items such as ventilation extracts. Simple bullet points indicating how to work the heating system in the most energy efficient manner aimed to provide the home owner with basic principles rather than overly technical material. Information was selected to ensure that it was not over complicated, but provided sufficient technical information to give the resident confidence in the basic requirements of their house. The template gave a clear breakdown of wall, floor and roof constructions. The pages to the rear of the guide presented straightforward advice regarding ongoing maintenance to the property highlighting a series of bullet points for ‘every week’, ‘every 6 months’ and ‘every year’.

### **Survey feedback**

Feedback on the effectiveness of the occupant guides was then gained via a combination of postal survey questionnaires and face to face interviews with residents in their new homes shortly after they had moved in. The face to face interviews gave a more qualitative feedback and allowed an opportunity to go through the guide with the resident to point out which sections were clear and identify those which were less easy to comprehend.

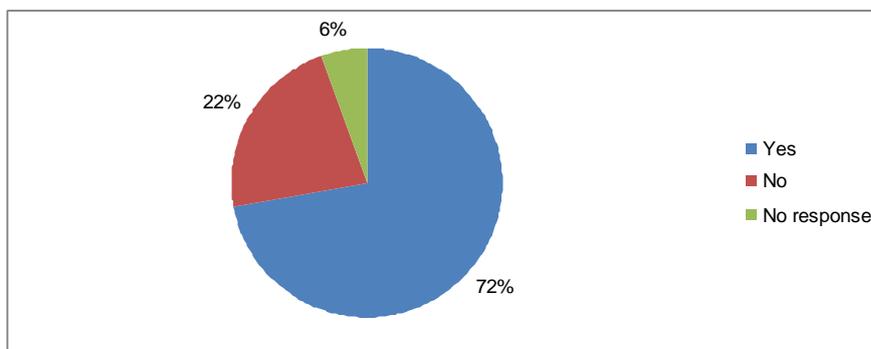
The timing and distribution of the guide is critical to the success of the guide. Most respondents agreed that obtaining it along with the keys was preferable and 91% agreed that certainly within the 1<sup>st</sup> week of moving in. During this pilot study 2 residents obtained the guide several weeks after moving in and as a result omitted to read it at all. The occupant guides were distributed by hand by the site agent or housing officer, or were posted directly to the resident. As indicated in Fig 2 most respondents agreed that the best placed person to distribute would be the sales person, site manager or housing officer.

*Survey Question- Who do you think is the best placed person to issue the occupant guide?*



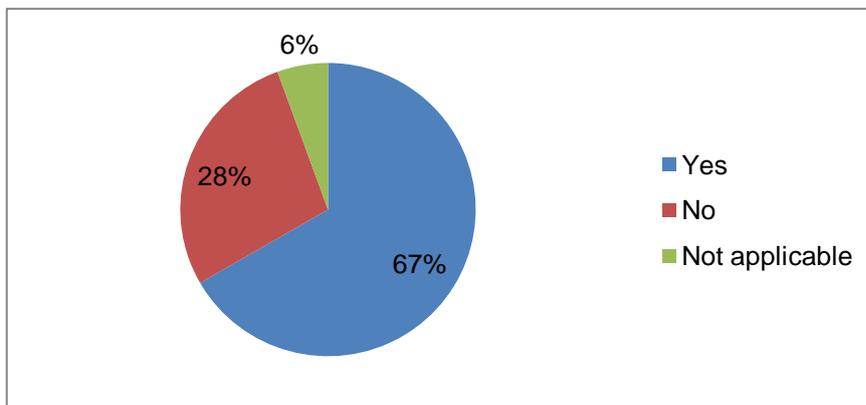
**Figure 2. Method of Distribution of Home Starter Guide**

100% of respondents noted that the information was ‘clear and easy to read’ and all also noted that the diagrams were easy to understand (Fig.3). This was particularly significant many of the residents in the social housing development did not have English as their native language. One of the major aims in the design of the guide was to ensure that it was very different from a technical manual which may require extensive reading and be technically complex. The guide aimed to direct residents to the location of controls within the home and the survey results again highlight that the guide had largely been successful in this respect. Those who answered ‘no’ indicated that they had already located the controls before consulting the guide. The usefulness of the guide to them was therefore limited but critically this information can be retained for the next resident which is particularly significant in properties where there is a high turn over of owners/tenants. Unfortunately 2 residents noted that the guide they were given didn't accurately reflect the floor plan of their house. In this pilot study, each house had a bespoke guide generated so it is most likely that the resident was issued with the wrong guide. This highlights the importance of distributing the guide and ensuring that the person issuing it knows clearly which house type matches with which house number.



*Survey Question- Did the floor plan layout help you to understand the location of heating and ventilation controls within your home?*

**Figure 3. Location of Heating and Ventilation Controls within the Home.**



*Survey Question- Was the information about the heating system easy to understand?*

#### Figure 4. Heating System Controls

67% of respondents confirmed that the information about the heating was easy to understand however, the one issue which several residents identified was a problem was setting the thermostat and the timer on the heating and hot water system. Given the variety of electronic timers on heating systems it is a highly specific item and whilst basic guidance could be given in the occupant guide, this may be an occasion when a resident has to consult the technical manual for their particular digital control unit. It should be noted that the quick-start guide does not provided detailed information about how to set the programmer for example, and in some situations system complexity would remain a problem. A note to this effect and clear guidance as to the correct section of the manual to refer to would require being included in the occupant guide.

94% of respondents indicated that they feel more informed about energy efficiency in their home after having read the occupant guide. 5 residents commented on the use of the thermostatic radiator valves and their previous lack of knowledge whilst feedback comments also noted that the function of trickle vents had been unknown to 15% residents prior to reading the user guide. Significantly 89% confirmed that they were confident in knowing how their house was designed to be ventilated and given that using appropriate methods of ventilation has an impact on energy efficiency this is a noteworthy result.

*Survey Question-How helpful was the Home Starter Guide overall?*

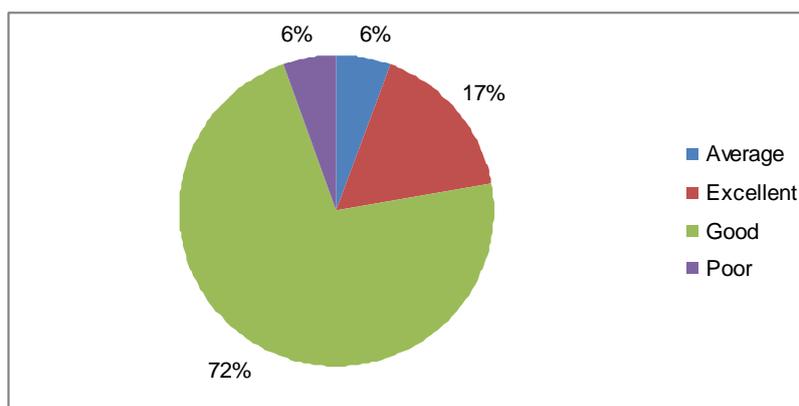


Figure 5. Effectiveness of Home Starter Guide

Overall the feedback on the guides has been very positive with 100% of respondents saying the guide is easy to read and the diagrams were clear and understandable. 72% rated the guide as 'Good' and 17% 'Excellent'. The aim of the occupant guide was to help owners and tenants improve their understanding of how their home was designed to operate and how to maintain it- the feedback from residents in this pilot study certainly indicates that it has accomplished this.

## **Project conclusions**

This project successfully designed and delivered a template for an occupant guide meeting the requirements and standards set by Section 7- Sustainability which has been tested on both the private house developer and social housing sectors.

Overall the results of this research reinforce previous studies which indicate that residents need information about how their home was designed and constructed in order to be able to operate the house in the most energy efficient manner. Using this highly graphic format allows residents a greater understanding of the guide however this requires time and resource to collate but overall it offers the greatest potential to reduce the running costs of the house. Whilst the process of collating the information needed time and commitment from the housing provider to prepare the necessary layouts and diagrams, the feedback indicated that the presentation of clear information in simple diagrams was most effective. This research confirms that guides are most useful within the 1st week of moving into a property therefore it is suggested that handover procedures for housing associations and developers should be adjusted to reflect this to maximise the impact of these guides.

The occupant guide successfully provides direction enabling occupants to understand and operate their home efficiently and it certainly helps ensure that home owners and tenants can better run and manage their home leading to improved energy efficiency and environmental performance. However, further to this research there is a clear opportunity for future research to assess the resultant energy impact in homes 'with' and 'without' an occupant guide to assess the extent to which residents habits do indeed change as a result of being more informed about the energy systems within their home.

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