OWNER-OCCUPIER MOTIVATIONS FOR ENERGY EFFICIENCY REFURBISHMENT

THESIS

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SAMANTHA ORGAN

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2 – WIT TRANSACTIONS ON ECOLOGY AND THE ENVIRONMENT (SUSTAINABLE CITIES CONFERENCE 2013)

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GLOSSARY

BCC – Bristol City Council

BSA – British Sociological Association

BSHF – The Building and Social Housing Foundation

CO_2 – Carbon dioxide

DCLG – Department of Communities and Local Government

DECC – Department for Energy and Climate Change

DEFRA – Department for Environment, Food and Rural Affairs

EER – Energy Efficiency Refurbishment

EPBD – Energy Performance of Buildings Directive

EPC – Energy Performance Certificate

EST – Energy Saving Trust

EU – European Union

IMD – Index of Multiple Deprivation

PPE – Personal Protection Equipment

RICS – Royal Institution of Chartered Surveyors

LSOA – Lower Social Output Area

SAP – Standard Assessment Procedure

SRA – Social Research Association

TRV – Thermostatic Radiator Valve

UK – United Kingdom

ABSTRACT

The changing global climate and weather patterns, increasing fuel prices, and dwindling resources have resulted in climate change and carbon reduction targets to be set both nationally and internationally. The focus on the built environment as a comparatively easy way of contributing to these targets has also led to an increasing focus on the United Kingdom's existing housing stock. Existing research has already investigated the technical aspects of how to improve the energy efficiency of the existing housing stock, but in recent years there has been an acknowledgement of the importance of owner-occupier behaviour. Although behaviour in relation to energy is recognised as unequivocally important in reducing energy use in the home, there appears to be a missing link – motivation. The precursor to any behaviour is motivation.

Owner-occupied housing is the predominant tenure in the UK. Although it has the greatest potential to deliver larger carbon reduction targets and reduce fuel poverty, it is the most difficult to ensure energy efficiency refurbishment. In the absence of legislation such as consequential improvements, this thesis investigates how owner-occupiers could be motivated in relation to home energy efficiency refurbishment. Importantly, it also explores whether motivations differ between neighbourhood deprivation levels, property types, and socio-demographic characteristics.

A critical realist approach was adopted where a multiple case study method bounded by Bristol was used, incorporating in-depth interviews with owner-occupiers, a physical survey of their home and a questionnaire. Observations were also recorded and documentary analysis performed where available. Data were analysed using thematic coding (qualitative data), and descriptive and non-parametric tests (quantitative data) to refine the conceptual model of owner-occupier motivations for domestic energy efficiency refurbishment. This was then validated through telephone interviews with experts.

The findings of this research were that owner-occupier motivations for energy efficiency refurbishment are multiple and complex. Action is opportunistic, and people will not act for the sake of action where it would be perceived as a waste of time, money, and energy. However, the manifestation of energy efficiency action reflects both the opportunity to act

and the motivation, and without the latter action would be focused on different outcomes (e.g. aesthetics).

Motivations can be categorised under four principal themes – economic, environmental, social and waste. Social motivations incorporate comfort and social interaction within the home. Owner-occupiers are usually motivated by two or more motivation themes. Further, an owner-occupier's internal factors, particularly their values, play an important role in shaping motivation and action. Internal and external factors interact, although external factors such as grants, available products, and so on (i.e. the general context) will change more rapidly than the internal factors. Internal factors are not static and will interact and change in strength and order over time, between projects, and between products.

The original contribution to knowledge of this thesis is the introduction of a new model for energy efficiency refurbishment motivation. This could be used by policymakers to better understand energy efficiency refurbishment motivation and to frame policy, information and incentives to better encourage energy efficiency uptake in the existing owner-occupied housing stock. It could also be used by industry to better understand clients, tailor services according to the principal motivation of an owner-occupier, and to foster and/or stimulate further and/or deeper energy efficiency refurbishment action. It is also relevant to theory, contributing new knowledge to a rarely explored field, emphasising that a linear approach without reflecting the dynamic process of owner-occupier motivation is an inaccurate perception.

DECLARATION

Save for where expressly acknowledged or referenced, I, the undersigned, confirm that the intellectual content of the present thesis – '*Owner-occupier motivations for energy efficiency refurbishment'*, is the result of my own efforts and no other person. A full list of the references used is included.

The right of Samantha Elizabeth Organ to be identified as author is asserted in accordance with sections 77 and 78 of the Copyright, Designs and Patents Act 1988. At this date copyright is owned by the author.

Signature

Samantha Elizabeth Organ (PhD Researcher)

Date

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Author

The author obtained a First Class Degree in Building Surveying BSc. (Honours) and Masters modules (Applied Social Research) (MA) from the University of the West of England (UWE), Bristol. In completing the Masters modules, she fully complied with the postgraduate training required by UWE. During her PhD studies she worked both as a lecturer and a researcher at UWE. Research included work for the University on behalf of a social housing provider investigating Air Source Heat Pumps, and for learning materials for the Construction Website, a resource sold internationally to educational establishments. Lecturing included modules such as Energy Efficiency in Existing Housing and Dissertation. In the final phase of her PhD, she secured a position at UWE as Senior Lecturer in Building Surveying.

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CHAPTER ONE: GENERAL INTRODUCTION

1.1 INTRODUCTION

It is widely accepted that atmospheric carbon dioxide (CO_2) and other greenhouse gases must be stabalised to prevent global temperatures from rising more than 2°C. This is necessary to avoid 'dangerous climate change' (Bows *et al.*, 2005) which would have an effect on global ecosystems and a significant impact on the human population.

The current drive towards a reduction in the energy consumption and carbon emissions has led to a focus on the energy efficiency performance of buildings (Boardman, 2007). The existing housing stock, much of which is owner-occupied, has been recognised as a significant contributor to total carbon emissions (Bichard and Kazmierczak, 2012; Mansfield, 2011; Banfill and Peacock, 2007; Boardman, 2007), and has a vital role in meeting national and international reduction targets.

Housing is seen as a comparatively 'easy win' for contributing to the necessary carbon and energy consumption reductions. Further, maintaining and improving the performance of our housing in relation to climate change has been identified as essential for the health and comfort of occupants (Arup, 2008; Costello *et al.*, 2009). In the United Kingdom (UK), the energy and carbon performance of new housing is governed by the Building Regulations. The Regulations also apply to existing buildings in the case of extension (beyond the allowances for 'permitted development'), structural alterations or significant renovation of an existing component (e.g. wall, floor, roof), and alterations affecting means of escape and change of use. New housing contributes annually to around 1% of the existing housing (Swan *et al.*, 2013; Power, 2008). Therefore, an improvement in the performance of existing housing is imperative to improve the performance of housing stock overall.

The refurbishment of existing housing has increasingly become a primary focus in a response to "*the long-term challenges of climate change and resource constraints*" (Eames *et al.,* 2013, p.505). An improvement in the existing housing stock's performance would contribute to both national (e.g. Climate Change Act 2008) and international targets (e.g. the extended Kyoto Protocol). It would also potentially reduce the environmental impact of housing, improve fuel security, prevent or attenuate fuel poverty across housing, and improve occupant health and comfort. It is also essential that the resilience of the existing housing stock to climate change be improved, giving consideration to overheating, water stress and flooding (Arup, 2008; Sustainable Development Commission, 2005).

The most significant reductions in building energy consumption will be achieved from retrofitting the existing building stock (Gultekin *et al.*, 2014). The greatest proportion of the existing housing stock in the UK is owner-occupied. Owner-occupiers have the greatest potential to act and to reduce carbon emissions and energy consumption (Arup, 2008) and have expressed the greatest willingness to act (Department for Communities and Local Government, DCLG, 2011a). However, although people favour the idea of improving the energy efficiency of their homes, energy efficiency measures are not being installed in many properties (Energy Saving Trust, EST, 2010a), and much of the potential for improving the energy efficiency of the housing stock has yet to be 'tapped into' (Uihlein and Eder, 2010).

In social and private rented housing this difficulty is potentially less challenging than in owner-occupied housing as it is possible to legislate for basic energy efficiency levels. The failure to incorporate consequential improvements into the Building Regulations to facilitate performance improvements in existing housing, particularly owner-occupied dwellings, means that the bulk of the task of improving home energy efficiency falls to the owner-occupier. Although there has been some drive towards encouraging owner-occupiers to act to improve home energy efficiency, there is limited knowledge about the motivation of owner-occupiers to act in relation to the energy efficiency of their homes. In spite of the various attempts to encourage action

through information campaigns, and grants and subsidies, it is recognised that generally people have still not acted (EST, 2010a). This is despite a variety of research on behaviour in relation to the home and to pro-environmental behaviour (Kollmuss and Agyeman, 2002; Barr, 2003; Stern, 2000).

1.2 BACKGROUND

The existing housing stock annually contributes to around 27% of the UK's carbon emissions (Affinity Sutton, 2011; Peacock *et al.*, 2010; HM Government, 2006). Therefore, it is potentially a key contributor to the UK's national and international carbon reduction targets (Summerfield *et al.*, 2010; DCLG, 2006; Johnston *et al.*, 2005). The heterogeneous housing stock consists of over 26 million houses, 70% to 90% of which is estimated to still exist in 2050 (Wright, 2008; Boardman, 2007; Lowe, 2007) and around 68% is owner-occupied (DCLG, 2010).

There are multiple advantages of improving the energy efficiency performance of housing, owner-occupied housing in particular. Improvements would contribute to national carbon reduction targets (i.e. Climate Change Act 2008 targets), maintain the habitability of homes (Grosche and Vance, 2009), improve the health of occupants (Kavgic *et al.*, 2010; Gyberg and Palm, 2009; Wright, 2008), mitigate further increases in fuel poverty as the price of fuel to heat and power our homes continues to increase in the long term, and prevent global warming from rising more than 2°C (van de Wetering and Wyatt, 2010).

Despite the advantages for owner-occupiers, the government and the environment, the uptake of energy efficiency refurbishment (EER) in owner-occupied housing has been slow. The term 'refurbishment' has been used extensively without precise definition (Davies and Oreszczyn, 2012; Jenkins, 2010; Pellegrini-Masini *et al.*, 2010; Sumerfield *et al.*, 2010; Grosche and Vance, 2009; Munro and Leather, 1999). Here, it is defined as a substantial renovation of a property rather than minor maintenance and improvement works, to provide a performance not incorporated in the original design (adapted from Douglas, 2002). An EER, thus, means a substantial renovation

deliberately incorporating works to improve the energy efficiency performance of the building.

Low uptake of measures is despite rising fuel prices, information campaigns (Bichard and Kazmierczak, 2012) and numerous refurbishment exemplars through 'green home' open days throughout the country (e.g. Bristol, Brighton, Cambridge, Cheltenham, London, Stroud, Suffolk, Surrey). Government initiatives have principally focused on the installation of 'cost effective' energy efficiency measures such as loft and cavity wall insulation. At the current rate of such measures the reduction targets are unlikely to be achieved (Davies and Osmani, 2011). However, studies and reports have shown the importance of taking an 'all measures' approach over a 'business as usual' approach in relation to attaining carbon and energy reduction targets (WWF, 2008; Natarajan and Levermore, 2007; Peacock *et al.*, 2007; Johnston *et al.*, 2005). This low uptake has been described as the 'apparent disconnect' (Christie *et al.*, 2011); that is, homeowners may recognise the benefits of energy efficient technology and want the technology, but they are still not motivated to adopt it. Consequently, it is questionable whether the necessary carbon emission reductions are achievable. How can owner-occupiers be motivated to improve their home energy efficiency beyond low-cost measures such as energy lightbulbs and loft insulation?

Substantial intervention in our homes is essential to meet targets and provide habitable homes in an increasingly adverse climate, but the heterogeneity in terms of construction type, age, condition, energy performance and tenure makes wide-scale intervention difficult. Programmes such as the Green Deal risk not enabling the level of action needed to deliver the required targets due to the cap on available finance and therefore typically focus on lower cost measures. The general emphasis on low-cost' or 'quick win' interventions and behavioural changes has over-shadowed the necessity for substantial EER. Yet neither maintenance nor modest refurbishment will achieve the necessary reductions (Killip, 2006). However, government initiatives – which are typically based on economic models to motivate owner-occupiers – have

typically focused on a piecemeal approach. To achieve greater energy and carbon savings which go beyond 'low-cost' measures, the bulk of the task is left in the hands of owner-occupiers who are provided with limited or no subsidies.

Despite this there is limited knowledge about owner-occupier motivation to undertake EER. As motivation is a precursor to action, before greater action can be facilitated it is essential to understand what motivates owner-occupiers to undertake EER.

1.3 RESEARCH CONTEXT AND JUSTIFICATION

The research cuts across a number of different disciplines including social science such as the perceptions and decisions of occupants in relation to their homes; surveying in relation to building energy performance and other technical aspects; and motivation psychology. The present study is broadly positioned within the general area of motivation and housing, but is placed within more of the social science discipline.

EER research has typically focused on the incentives and barriers to this form of refurbishment, the potential energy and/or carbon savings which could be made and the measures which could be installed to deliver these savings. Such studies miss social aspects such as decisions, personal preferences, and most importantly, the motivation to act. Existing social science studies have tended to focus on energy consumption behaviour, home-buying choices, and refurbishment and maintenance decisions. Motivation studies have not been undertaken in the area of EER.

Recent studies have focused more on technical interventions and occupant behaviour (e.g. Housing Forum, 2009; WWF, 2008; Johnston et al., 2005), rather than motivation. It is already known that building occupants and users have an essential role in meeting carbon, energy and financial improvements (EST, 2010b; Schweiker and Masanori, 2010; Housing Forum, 2009; Meijer *et al.*, 2009; Aune, 2007; IPCC, 2007). Indeed, occupant behaviour has been considered an important factor in energy

consumption and efficiency since at least the 1970s (Schweiker and Masanori, 2010; Rosa *et al.*, 1988). Despite this, a gap still exists in terms of owner-occupiers taking action within their home. Behaviour (i.e. action) is the result "*of the dominance and relative strength of any particular motive or set of motives*" (Hague, 1985, p.164). Therefore, for owner-occupiers to act, motivation first must be present – even before an individual's ability to act is considered. Motivation theory is required to explain why individuals act in the way they do (Reeve, 2005). "*If it is in the public interest to encourage home improvements…then a better understanding of household motivation can help increase the likelihood that improvements will be undertaken*" (Baker and Kaul, 2002, p.566).

The findings from this study contribute to a better understanding in owner-occupier motivation for EER. This improved understanding will inform external groups such as the government and organisations to enable future improvements in EER uptake by informing policy and incentives.

1.4 RESEARCH AIM

To develop a new model of motivation for owner-occupier motivation for 'energy efficiency refurbishment' (EER) in existing housing.

1.5 RESEARCH OBJECTIVES

To explore motivation theory and its application to domestic EER.

To acquire insight into the motivation for owner-occupied domestic EER through an extensive literature review of home improvements, energy efficiency, drivers for pro-environmental behaviour, home decision-making and motivation theory in the built environment.

To create a new model of motivations for owner-occupied domestic EER based on the literature review.

To develop and deploy a suitable methodology for primary data collection on owner-occupier motivation for EER.

To analyse and appraise the relationship between owner-occupiers' motivation for EER and the motivation themes in relation to the conceptual model.

To validate the findings of motivations for domestic EER, confirming whether the results reflect reality.

To draw conclusions about the motivation of owner-occupiers and develop recommendations for theory, policy and professional practice, and for future research.

The purpose of these objectives is to better understand key factors affecting owner-occupiers' motivations to undertake an EER. The improved understanding of what motivates domestic EER will be useful to policy-makers, industry professionals and advisors.

1.6 KEY RESEARCH QUESTIONS

Why do owner-occupiers perform domestic EERs?

What are the principal motivations for EER in the owner-occupied housing stock?

What are the drivers influencing owner-occupiers' motivations for EER?

To what extent do owner-occupiers' values influence their motivation for EER?

Which motivational theory or hybrid of theories 'best fits' domestic EER?

Where the principal motivations are the categories by which the drivers (sub-motivation themes) can be sub-divided.

These questions flow from the research aim and objectives, each contributing to the development of the conceptual model. Question one is directly related to their motivation and, therefore, an essential question to aid the development of a conceptual model. Question two focuses on the primary categories of motivation, incorporating the important elements in model development. Question three attempts to establish the key drivers, whether micro or macro (e.g. national/international policy-driven, or community- and individual-driven), as well as drilling down to investigate the range of drivers (sub-motivations) which can affect EER motivation, whether internal or external. Question four builds on question three to investigate whether owner-occupiers' values will influence their EER motivation. Finally, question five proposes to identify whether or not there is an existing motivation theory or hybrid of theories which can be applied to owner-occupier motivation for EER.

The purpose of the research questions is to facilitate attaining the research objectives. A better understanding of motivation for EERs will be produced through the investigation of why domestic EERs are performed and how EERs are influenced. The aim is to improve understanding to enable future work to encourage owner-occupiers to go beyond the 'cost effective' measures already being encouraged by government. Research has shown that 'cost effective' measures such as draughtproofing, and cavity and loft insulation will be highly unlikely to deliver the carbon reductions necessary – the greatest reductions will only be met if all possible measures are installed (WWF, 2008; Natarajan and Levermore, 2007; Peacock *et al.*, 2007; Yates, 2006; Johnston *et al.*, 2005). Therefore, more must be done to understand how to motivate owner-occupiers to go beyond what is deemed as 'cost effective'. It is intended that this improved understanding should contribute to the knowledge of government and industry to inform how they can improve future uptake of EER, and to inform future research.

1.7 PROPOSITION

Owner-occupier motivation for EER can be categorised as predominantly economic, social or environmental. The predominance of this will be governed by internal and external factors.

1.8 RESEARCH METHODOLOGY

The research methodology is the philosophical worldview underpinning the research (Sapsford, 2006). The nature of the study forms the basis of the methodology selection rather than the advantages and disadvantages of a particular method (Creswell, 2009). As the variables and the theory base are relatively unknown, a predominantly qualitative approach has been undertaken (Creswell, 2003) to provide understanding of the concept of EER motivation based on the critical realist paradigm.

1.8.1 Research Design and Methods

The research uses a case study approach using multiple neighbourhoods distributed within three Bristol wards, investigating whether owner-occupier motivations and variables differ between cases. The case study approach was selected due to the ability to investigate the phenomena in its context and in greater depth to generate greater understanding. Bristol offers diversity in terms of its socioeconomic profile, demographic profile, architectural styles (including Listed buildings and Conservation Areas), and also has environmental credentials.

The methods by which the data was gathered included semi-structured interviews, a physical survey of the properties, a participant questionnaire and documentary evidence. This is discussed in more detail in chapter four.

1.9 STUDY DELIMITATIONS

The delimitations of a study are the boundaries in which the study is set. This study focuses on Bristol specifically, and England more generally rather than the UK as a

whole, or internationally. This decision was to enable greater depth and due to potential differences in local or national policies.

The focus of this study is on owner-occupiers rather than social rented housing, private rented properties or a combination. Owner-occupied housing, although potentially a 'hidden' research population contributes to a much greater proportion of the housing stock in the UK and in England more specifically. This section of the housing stock also has greater autonomy regarding the decisions they are able to make in relation to their homes than the other housing tenancy types. Research has and is being undertaken into improving the performance of social housing (e.g. Swan *et al.*, 2013; Reeves *et al.*, 2010).

The decision was made to focus on motivation rather than behaviour (action). Behaviour is essential but it has already been investigated through academic research and through government and organisation reports. Although it continues to be a focus of current research (e.g. University College London (UCL), ongoing-a and b; The Cabinet Office, 2011; Dolan *et al.*, 2010; Department for Environment, Food and Rural Affairs, DEFRA, 2008), as explained above, motivation is the precursor to action and as such, a gap still exists in terms of making the move from inaction to action.

1.10 STUDY LIMITATIONS

Some limitations in relation to the present study exist. The methodology seeks to minimise these wherever possible. The study involves making contact with a potentially 'hidden' population. However, this introduced 'gatekeeper' risks (Atkinson and Flint, 2003), these were overcome by not restricting contact through just one method. EER and non-EER properties were contacted through snowball sampling, and where this was not possible, flyers were distributed amongst the neighbours of EER properties, advertisements placed in community magazines, posters placed in community buildings, e-newsletters, and a blog.

Interviews require researcher skill as well as interviewee cooperation and articulation (Dale Bloomberg and Volpe, 2008). Also, there can be significant differences in interviewee perspectives (*ibid.*). The decision to use semi-structured interviews enabled the researcher to adapt the interview to interviewees' levels of comprehension and articulacy, and to aid in identifying themes in each case for analysis purposes. To avoid inaccurate accounts, the basic building survey and documentary evidence were used to corroborate the interviewees' accounts.

The presence of the researcher (Creswell, 2003) and the potential role of 'power' (Chrzanowska, 2002) (defined below) could affect the response of the interviewees. To minimise the effect of this, owner-occupier interviews were performed in participants' homes. The researcher also dressed in neat, clean and inoffensive clothes (Mauthner *et al.*, 2002) which also aimed to temper any 'power' relationship.

Traditionally in research, the researcher has been expected to gather accurate information from the participant which should, as much as possible, be untainted by 'relationship factors' (King, 2004). Qualitative researchers, however, do not perceive that interviews can be 'relationship-free'; rather the relationship created forms part of the research process (*ibid.*). 'Power' is a factor exercised within the relationship formed between interviewer and interviewee.

1.10.1 Power

Power is an important, complex, and much discussed topic in social science (McGettigan, 2008). Although there is no consensus over the definition of power (*ibid.*), it has been described as a "*multiplicity of force relations*" and the process by which these force relations result in effects (Flyvberg, 2001, p.120). It is a dynamic and omnipresent "*process which via struggles and confrontations transforms, supports, or reverses these force relations"* (*ibid.*). Rather than simply being a repressive force, power can also be productive (*ibid.*). It is local, changeable and unstable (*ibid.*). As a term, 'power' can be generally categorised as 'power to' and

'power over', where the former refers to the ability of an individual to do things (move, dream, proceed through life) and the latter refers to domination or command over others (McGettigan, 2008). Although both are inherently connected, here the focus is on 'power over'.

There are arguments over whether power is possessed, exercised or is an effect (Smith, 2006). It is always met with resistance (Alex and Hammarstrom, 2008), can dominate and repress, but can also be productive. Despite being recognised as a complex and unstable process (Smith, 2006), power is critical (Williamson, 2006). It is present in interviews as well as all human interactions (Alex and Hammarstrom, 2008). Although power is a contentious concept in social science, (*ibid.*), Foucault suggests that "*there is power in all moments*" and it is changeable (Alex and Hammarstrom, 2008, p.170).

According to the Foucauldian stance, power cannot be appropriated (Smith, 2006). A frequent power issue is that *"the most powerful are most likely to be heard and their interpretation of reality is more likely to be accepted"* (Williamson, 2006). Therefore the notion of 'voice' in terms of language and power are introduced – the powerful are more likely to speak and be acknowledged (*ibid.*); the interviewer must allow the interviewee to convey their opinions and to be understood.

Both Bourdieu and Foucault purport that power between the interviewer and interviewee is affected by the interviewer's 'habitus', i.e. the way a person thinks, sits, speaks (Alex and Hammarstrom, 2008). The narration shifts during an interview depending on the available power positions (*ibid.*). What is narrated and how it is interpreted depends on the age, education, social class, gender and ethnicity of the interviewer and interviewee (*ibid.*).

1.10.2 Physical survey

The basic building survey was performed in accordance with a standard survey guide, and the same routine was undertaken on each property providing circumstances enabled the researcher to do so. Where elements were concealed or inaccessible, documentary evidence was sought to confirm building information. Where this was not available, the information was sought from the owner-occupier, but a note made that such information was reported rather than observed.

1.10.3 Participants

The limitation of non-response error and the risk in the inability to trace/contact potential participants (Bryman, 2008) was mitigated as much as possible by making contact with potential participants through trusted groups (i.e. community groups and organisations) and through neighbours (snowball sampling). Snowball sampling is useful where there is no existing list to located participants of the desired population (Morgan, 2008). As with much qualitative research, the risk of refusal or inability to participate will continue to exist (Bryman, 2008). However, by performing the data collection on each property in one visit, the aim was that the participants' time commitment would be kept to a minimum, thus attempting to reduce the risk of refusal due to time limitations or inconvenience. Further to this, there was a risk of refusal or inability to participate or supply the required data (Bryman, 2008).

1.11 BENEFICIARIES

This study demonstrates originality through the development of a new model for EER motivation. Although there has already been extensive research performed on the possible technical savings which could be made in the existing housing stock, and on the role of behaviour, EER uptake is still low. By focusing on the 'motivation gap', the intention is that the findings from this research will inform government, organisations and further research to encourage better uptake of EER.

The model developed by this study could be used by central and local government - policy makers in particular - to inform policy and incentives to encourage greater

uptake of EER amongst owner-occupiers. In order for greater uptake to occur, an understanding of how and why owner-occupiers are motivated is needed. Future research could investigate the applicability of the model to other localities in order to identify how motivation could differ between cities and towns and their different divisions of society, and between countries.

1.12 THESIS ORGANISATION

The organisation of the thesis is outlined in Table 1.1 in relation to the research objectives and research questions. These are presented alongside the chapters in which they are delivered.

The thesis comprises of eleven chapters. Chapter one provides a detailed context for the study. It includes the research aim and objectives, and the key research questions. The research methodology used to address the key research questions is outlined. The principal delimitations and the study limitations are also outlined within this chapter.

Chapter two presents the literature review on motivation theory and its application to EER. Chapter three provides a literature review on the incentives and barriers for EER. The initial development of a conceptual model is given in Chapter four followed by a detailed research methodology in Chapter five. The study takes a mixed methods approach with emphasis on the qualitative methods. The chapter incorporates a justification of the approach taken. It also outlines and justifies the data collection and analytical methods to be used.

Chapters six to eight provides the analysis of the empirical data, and Chapter nine presents a discussion of the findings. The study validation is given in Chapter ten, before conclusions are drawn in Chapter eleven.

1.13 SUMMARY

This first chapter has outlined the context in which the research is situated and the justification for this study. The importance of energy efficiency performance of the housing stock is a national and international issue. The effect of climate change is not confined to ecosystems but has real implications for the built environment and the human population. A significant amount of research has highlighted the importance of adapting the built environment to not only mitigate further global warming, but also cope with our changing climate. Housing has been highlighted as a key component of such adaptation, but occupants have been slow to act, despite the implementation of various initiatives.

TABLE 1.1 Overview of the research objectives and questions in relation to the thesis structure

OBJECTIVE		CHAPTER(S)
1	To explore motivation theory and its application to domestic EER.	2
2	To acquire insight into the motivation for owner-occupied domestic EER through an extensive literature review of home improvements, energy efficiency, drivers for pro-environmental behaviour, home decision-making and motivation theory in the built environment.	2 - 3
3	To create a new model of motivations for owner-occupied domestic EER based on the literature review.	4
4	To develop and deploy a suitable methodology for primary data collection on owner-occupier motivation for EER.	5
5	To analyse and appraise the relationship between owner-occupiers' motivation for EER and the motivation themes in relation to the conceptual model.	6 - 9
6	To validate the findings of motivations for domestic EER, confirming whether the results reflect reality.	10
7	To draw conclusions about the motivation of owner-occupiers and develop recommendations for policy and professional practice, and for future research.	11

RESEARCH QUESTIONS		
1	Why do owner-occupiers perform domestic EERs?	9
2	What are the principal motivations for EER in the owner-occupied housing stock?	9
3	What are the drivers influencing owner-occupiers' motivations for EER?	9
4	To what extent do owner-occupiers' values influence their motivation for EER?	9
5	Which motivational theory or hybrid of theories 'best fits' domestic EER?	9

The precursor to action is motivation, which is defined as the energiser and director of action. Therefore, to better understand how to facilitate improvements in the owner-occupied housing stock, an understanding of owner-occupier motivation is essential. A model representing the factors affecting owner-occupier motivation in relation to EER which could be adapted to different contexts would be of use to policy-makers, a range of industry professionals, academics and potentially to homeowners themselves, to encourage better EER uptake and design incentives, which would hold greater appeal to owner-occupiers.

The research aim and objectives for this study are designed to facilitate the development of a model which can be tested, refined and validated. The research methodology to meet the key research questions was also outlined, as were the delimitations of the study.

The following chapter provides a comprehensive literature review.

CHAPTER TWO: A REVIEW OF MOTIVATION THEORY

2.1 INTRODUCTION

Chapter two presents a critical review of the existing literature on motivation including motivational theory and its application to EER in the owner-occupied housing stock. It contributes to the first, second and third research objectives which look to explore motivation theory, its application to EER, acquire insight into owner-occupier motivation for EER and develop a new model of owner-occupier EER. This chapter contributes to this through a review of the existing literature and applicable motivation theories.

2.2 MOTIVATION CONCEPTS

Motivation is concerned with activities reflecting the drive to attain specific goals (Heckhausen and Heckhausen, 2008). Rather than the action itself, motivation is the intention and willingness to act (Grothmann and Reusswig, 2006). Therefore, motivation is the precursor to action (Proverbs and Lamond, 2008). Owner-occupiers must first be motivated to perform an EER before undertaking an actual refurbishment.

The term 'motivation' has been used in both everyday language and in academic literature (Turner, 2006). Its Latin root means 'to move' (Eccles and Wigfield, 2002). It has been defined in a number of ways and put simply, it is the concept of "*why people do what they do*" (*ibid.*). It is an internal process which energises and drives the direction and intensity of people's effort (Kirk *et al.*, 2008; Reeve, 2005; Pittman and Heller, 1987). It is vital that the motivations behind owner-occupiers' actions be understood if energy efficiency measures are to be adopted (Christie *et al.*, 2011). This is of even greater importance where the government is attempting to encourage more substantial works, such as EER. Despite over three-quarters of owner-occupiers stating they would consider installing energy efficiency measures (DCLG, 2011a), people still do not take action (EST, 2010a), and the owner-occupied stock still requires greater action to improve its energy efficiency and reduce its carbon

emissions. For people to act, motivation is critical (Christie *et al.*, 2011; Peters *et al.*, 2010).

A number of motivation theories have been developed over the past century, although these have typically "*been based on rather divergent and often extreme images and assumptions about the nature of humans*" (Ford, 1992, p.8). Some of these theories have assumed humans to be biologically driven 'robots', whose actions are dictated by 'animal instincts', whereas others have assumed a logical man, portrayed as 'scientists'. There is an element of 'truth' in each perspective and consequently recent motivation theories have been based on a combination of such images (*ibid.*).

Existing theories, concepts and models most pertinent to the subject area are now discussed and their relevance to energy efficient refurbishment outlined.

2.2.1 Maslow's Hierarchy of Needs and Desires

Maslow's Hierarchy (Maslow, 1954) is based on the concept that individuals are motivated first by their physiological needs, i.e. shelter, food and water. Once the physiological needs are satisfied the individual will then desire safety, social engagement (i.e. interaction, belongingness and love), personal esteem and, finally, self-actualisation. In construction, Maslow's Hierarchy has been applied to worker motivation and productivity (e.g. Mansfield and Odeh, 1991) although "*few jobs contain all of these [hierarchy] characteristics*" (Price, 1992, p.185). In relation to housing, not only does a home "*satisfy the needs associated with daily living*" (Sirgy *et al.*, 2005, p.331), such as the basic physiological and safety needs, but it is also a platform for social engagement, personal esteem and self-actualisation (Figure 2.1).

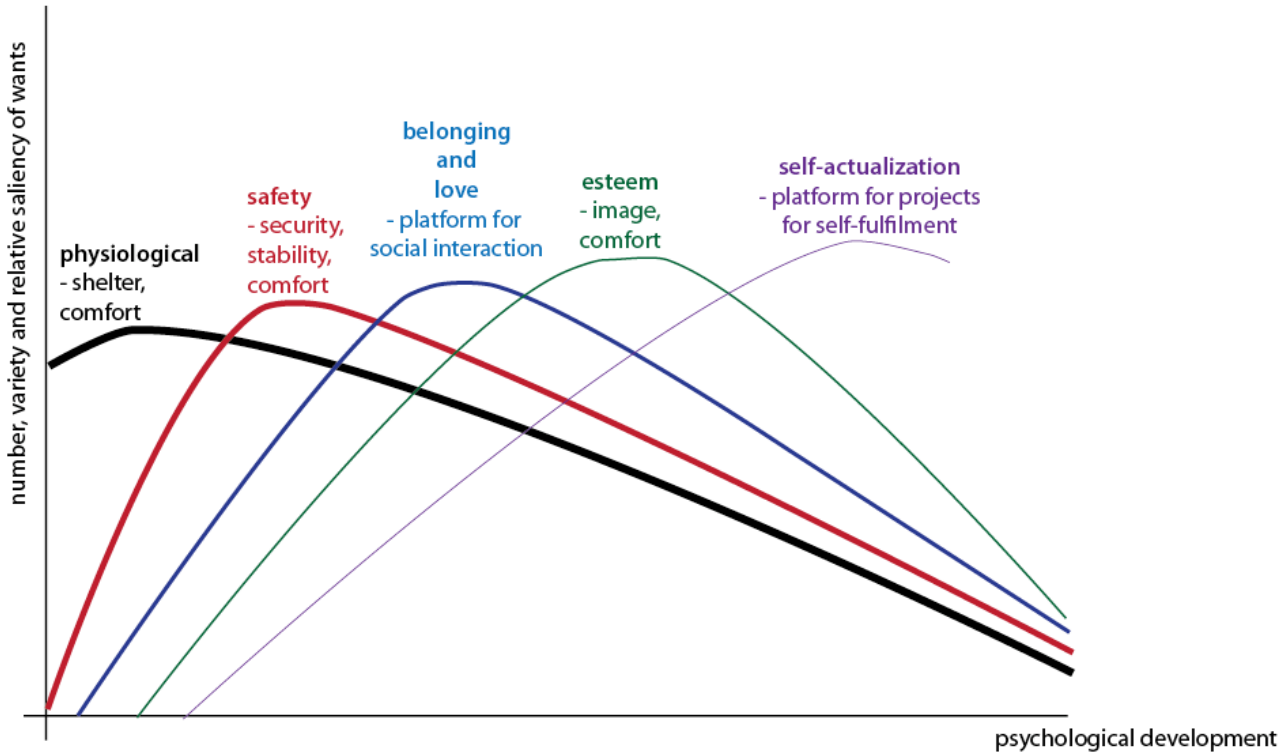

FIGURE 2.1 Maslow's Hierarchy and how it relates to the 'home'

Adapted from Nicol *et al.* (2009); and Aune (2007); Handy (1983).

Under models such as Maslow's Hierarchy, there is the assumption that where individuals have satisfied their personal needs, they "*are more likely to act ecologically because they have more resources (time, money, energy) to care about bigger, less personal social and pro-environmental issues*" (Kollmuss and Agyeman, 2002, p.244). This implies that those individuals and/or societies that are positioned towards the bottom of the Hierarchy (e.g. less affluent, those with safety issues) will be less concerned about the environment (*ibid.*). This may not reflect the reality: on an international scale, poorer counties have been found to rank environmental problems lower than other issues, but in terms of severity of the issue, affluent and poor countries have both ranked environmental issues highly (Diekmann and Franzen, 1999). This suggests that people will not act without being motivated to do so, regardless of whether or not they recognise the severity of the issue.

Some research has demonstrated that higher income groups consider comfort to be more important than saving energy (Pellegrini-Masini *et al.*, 2010). This is consistent with Maslow's Hierarchy where saving energy could be considered to be 'ethical behaviour' by higher income groups, whereas comfort satisfies individuals' lower needs (*ibid.*). However, an argument could be made against this in that a comfortable shelter could be construed as a basic physiological need and, therefore, is likely to be a motivation shared across all income groups.

The notion of 'home' can be loosely translated into three different, non-exclusive types – home as a haven; home as a project; and a home as an arena for activities (Aune, 2007). However, the role of the 'home' extends beyond this to fulfill the need for shelter, safety, a platform for social interaction, and portrays an image of the occupants. This is broadly consistent with the different levels of Maslow's hierarchy.

The model has also been used in relation to pro-environmental behaviour. In this context it is assumed that individuals are more likely to act pro-environmentally where they have already satisfied their basic personal needs and have the time, energy and money resources to act altruistically (Kollmuss and Agyeman, 2002). So, individuals who have met and continue to meet their basic needs will act pro-environmentally to satisfy the criteria of social engagement (i.e. through social norms), personal esteem (self-satisfaction and -congruity) and/or self-actualisation. However, this does not mean that those in lower income groups care less about the environment (Diekmann and Franzen, 1999); rather, the motivation to satisfy other priorities are stronger. Therefore, for individuals to be motivated to undertake pro-environmental behaviours, such as installing energy efficiency measures or undertaking an EER for altruistic reasons, the individual's personal needs must be met first (McMakin *et al.*, 2002).

2.2.2 Vroom's Expectancy Theory

Although more applicable to organisational motivation and productivity (Mansfield and Odeh, 1991), Vroom's Expectancy Theory (Vroom, 1964) has previously been

used in relation to housing (Tan, 2008) and also has some relevance to EER. Under this theory, an individual's motivation is dependent on three factors – their perception of their capability to perform a particular job; the reward associated with the accomplishment of that job; and the value they place on the reward. In terms of EER, this could be translated into whether owner-occupiers perceive themselves as capable of commissioning and/or delivering an EER; whether they perceive and/or desire the potential outcomes (i.e. increased comfort, lower energy bills, lower carbon emissions, an 'environmentally conscious' image); and whether these outcomes take precedence over other priorities.

2.2.3 Festinger's Cognitive Dissonance Theory

According to Festinger's theory (Festinger, 1957), people are motivated to avoid holding internally inconsistent beliefs, attitudes and values. Internal inconsistencies result in discomfort, and individuals will take action to reduce this discomfort (Jackson, 2005). In the context of housing, owner-occupiers may be motivated to make decisions to ensure their home reflects their actual, ideal and social (i.e. public) self-image (Sirgy *et al.*, 2005) and improve the consistency with their beliefs, attitudes and values.

Prospect theory was developed from Festinger's theory (Zundel and Stieβ, 2011). Both theories assume that individuals underestimate potential gains and overestimate potential losses.

Cognitive Dissonance Theory and Prospect Theory introduce some useful concepts. The actual, ideal and social image in relation to the beliefs, attitudes and values of not only the individual but of wider society become important. For example, if an individual's 'ideal self' would lead an 'eco' lifestyle but in reality they do not, they are more likely to take action in order to lead a more ecological lifestyle. Wichardt, (2012) uses the example of a health-conscious smoker which will result in mental distress because it threatens the person's overall perception of 'self'. However, if the individual perceives the risk of performing those particular actions as high and/or that

the potential gains are not favourable, the individual will not be motivated to act. Consequently, perception and expectation in relation to the self, rewards and risks are concepts which are applicable to EER.

2.2.4 Expected-Value Theory

Expected-Value Theory (Fishbein and Ajzen, 1975) is a broad category encompassing Rational Choice Theory, the Theory of Reasoned Action and the Theory of Planned Behaviour. It is based on the notion that action can be motivated by the expectations of the outcomes and the value attached to the outcomes. It parallels Vroom's Theory in this respect.

The underlying assumption of Expected-Value Theory is that of 'self-interest'. Consequently, such theories do not generally include normative aspects about why individuals act in favour of something where they do not directly care about it. However, to explain normative influences the concept of 'subjective norms' have been incorporated in adjusted theories in this category such as the Theory of Reasoned Action (Jackson, 2005; Sideridis *et al.*, 1998; Fishbein and Ajzen, 1977) and the Theory of Planned Behaviour (Jackson, 2005; Ajzen, 1988). Under the Theory of Reasoned Action, individuals are not controlled by unconscious motives but are considered to be essentially rational, making logical use of any available information (Kollmuss and Agyeman, 2002). As with Vroom's Theory, the Theory of Planned Behaviour suggests that individuals will only act if and when they feel competent about performing the desirable behaviour. This, however, raises doubts in its application to individuals who, in the absence of complete information, are the first to act (i.e. 'pioneers'). 'Pioneers' have already been seen in the context of EER, particularly through 'green open door' events.

Expected-Value Theory, as with Vroom's Theory, is useful in that, according to this theory, individuals will be motivated to act where they feel capable of undertaking a particular action and where the expected outcome is more desirable than the status

quo. Under this theory, in the context of EER, those who do not feel capable of undertaking (performing or commissioning) a refurbishment and do not sufficiently see a personal benefit of such a refurbishment are unlikely to be motivated to act.

Through this, the role of emotion becomes evident. Emotion can be viewed as a method of evaluation, used to assess the potential action against personal goals and an individual's capabilities. It is thought that the integration of emotion with expected-value models would be useful for predicting whether or not individuals will undertake environmental actions (Carrus *et al.*, 2008).

2.2.5 Self-Discrepancy Theory

The Self-Discrepancy Theory (Higgins, 1987) suggests that individuals will be motivated to act in response to feelings resulting from the perceived gap between their actual and ideal selves. Self-Discrepancy Theory, as with Cognitive-Dissonance Theory, postulates that individuals feel uncomfortable if large discrepancies exist between their actual and ideal self, and that they will subsequently act to reduce this discrepancy (Jackson, 2005). So, where individuals perceive themselves as, or would ideally be, pro-environmental, they are more likely to undertake an EER than those who do not and do not aspire to be pro-environmental.

'Self-identity' (actual, ideal and social) affects an individual's intention to act in a certain way. Where individuals perceive themselves to be 'green consumers', they are more likely than other individuals to be motivated to purchase and consume organic food (Sparks and Shepherd, 1992 *in* Jackson, 2005). If an individual's ideal self is not 'environmentally conscious', they are less likely to be motivated to undertake an EER for environmental reasons in comparison with those whose ideal selves *are* 'environmentally conscious'. This theory highlights the importance of the 'self' and 'self-identity'.

2.2.6 Prospect Theory

Prospect theory is "*currently the most popular theory of decision under risk*" (Abdellaoui *et al.*, 2007, p.1659). This theory was developed by Khaneman and Tversky (1979) as an alternative to expected utility theory to describe decision making (DEFRA, 2013). The theory assumes that people will assign probabilities with weightings relative to a reference point, and that these will be different for potential losses in comparison with potential gains (*ibid.*). More commonly applied in the realm of economics, business and trading, it has even been applied to subject areas such as international conflict (e.g. Levy, 1996). The concept of loss aversion incorporated by prospect theory has relevance in the realm of EER in the owner-occupied housing stock, where a home is a valued asset, EER potentially incorporates multiple and complicated decisions, and can require significant economic investment.

2.2.7 Excluded Motivation Theories

Those motivation theories which could be broadly applicable to some aspect of EER but were excluded include Actualisation theory, Field theory, Control theories, Reactance theory, Self-worth theories, and Self-determination theory. The reasons for excluding these theories varied depending on the theory, however, it was broadly a reflection of the degree of applicability for EER motivation in the context of owner-occupied housing, and whether any relevant concepts were broadly more applicable through other motivation theories. Table 2.1 outlines the justification for excluding these theories.

2.2.8 Summary of Main Motivation Theories

Individually, the motivation theories described above are not wholly applicable to the 'home'. However, each introduces useful concepts which can be applied to EER in owner-occupied housing. These are summarised in Table 2.2.

There is potential for overlap between the concepts. For example, where an 'individual values the outcome' this may reflect their 'different needs and priorities'.

The principal aspects taken from the five theories include the concepts of 'self', social norms, and outcome expectations and loss aversion.

TABLE 2.1 Outline of excluded motivation theories and justification for exclusion

THEORY	BRIEF DESCIPTION	JUSTIFICATION FOR EXCLUSION
Actualization theory	Considers personal growth and the 'self' in relation to motives.	Not sufficient to explain EER motivation purely due to personal growth and the 'self', the latter which is incorporated into other theories under study in this thesis.
Control theories	An individual should expect to succeed depending on the extent to which they feel in control of their successes and failures	This is a concept which features in some of the motivation theories considered in this thesis but as an independent theory appeared to provide insufficient consideration to the wider aspects of EER.
Field theory	Considered 'a bridge' between Drive theory and Expectancy-value theory.	The concepts useful in relation to EER are more applicable to EER in Expectancy-value theory.
Reactance theory	People will react when their personal freedom and control is threatened focusing on 'high-amplitutde' emotional and behavioural responses (anger, aggression, defiance).	Not only does it appear insufficiently applicable to EER motivation and the home, but 'high-amplitude' emotions and behaviour are not detected in relation to home EER, although emotional responses do feature but this is better incorporated in the theories under study in this thesis.
Self-worth theories	Multiple theories based on the notion that people will act to maintain a sense of personal worth, particularly when facing	Narrow focus which is not sufficiently applicable to EER. Self evaluations are incorporated into other theories

	competition, failure and negative social feedback.	under study in this thesis.
Self-determination theory	Combined personal agency beliefs with the need to maintain personal competence.	Useful in relation to personal agency beliefs, but the motivation to act to maintain personal competence is superficial in relation to EER motivation, and other concepts such as locus of control are incorporated into other theories under study.
Source: Ford (1992); Eccles and Wigfield (2002)		

2.3 LIKELY MOTIVATED ACTORS

Over three quarters of owner-occupiers would consider improving the energy efficiency performance of their homes (DCLG, 2011a). This, however, varies significantly between household income and age, with higher income groups and middle-aged groups more willing to consider energy works (*ibid.*). Owner-occupiers on lower incomes (< £12,000) have been reported to be less likely to consider energy efficiency improvements (58%) in comparison those

TABLE 2.2 Summary of motivation theories vs. concepts.

MOTIVATION THEORY	CONCEPT								
	Meet different needs and priorities	Individual feels capable	Individual values the outcome	Reduce inconsistencies in beliefs, attitudes and values	Reduce gaps between actual, ideal and social images	Overestimate potential losses, underestimate potential gains, loss aversion	Self-interest	Self, self-image and self-identity	Social norms
Maslow's Hierarchy	✓		✓						✓
Vroom's Theory		✓	✓						
Festinger's Theory				✓	✓	✓			✓
Expected-Value Theory		✓	✓				✓		
Self-Discrepancy Theory					✓			✓	✓
Prospect Theory						✓			

earning more than £44,000 (86%). Those aged 35 – 54 years old and 55 – 64 years old were more likely to consider undertaking energy efficiency improvements (75% and 78% respectively), in comparison with 18 – 34 year olds (67%) and over 65 year olds (58%) (*ibid.*).

Research has indicated that households most likely to want an 'eco-refurbishment' are typically from the upper income brackets (Peters *et al.*, 2010; EST, 2007; DCLG, 2009b). Owner-occupiers in the upper 60% income distribution are 75% likely to undertake significant home improvements works (DCLG, 2009b). However, affluence will not necessarily result in greater levels of ecological behaviour (Gyberg and Palm, 2009; Kollmuss and Agyeman, 2002). In addition, where people act it can affect the likelihood of taking further action (Gilligan *et al.*, 2010).

Those planning to undertake a refurbishment project are more likely to undertake energy efficiency works (EST, 2010a). The group most likely to undertake home improvements are those with growing families (*ibid.*; DCLG, 2009b), whereas households most likely to undertake at least one energy efficiency measure are two-adult households, middle-class households and those in semi-detached or detached properties (Caird *et al.*, 2008).

Engaging in 'pro-environmental' behaviour such as undertaking an EER for altruistic reasons is not a new concept and has received significant attention in research (De Young, 2000). Altruism has been previously defined as "*a motivational state aimed at increasing others' wellbeing or a tendency to maximise others' benefits with little or null interest in gains for oneself*" (Tapia-Fonllem *et al.*, 2013, p.713). Previous research has suggested that individuals can be positioned along a 'value continuum' ranging from 'ego-centric' to 'altruistic' (Bichard and Kazmierczak, 2009; Schwartz, 1992; Schwartz and Blinsky, 1987). When complimented with a continuum ranging from 'conservative' to 'open to change', research has shown that those who are classed as both altruistic and open to change were most likely to participate in pro-

environmental behaviour (Barr, 2003). Although potentially difficult to accept that EER would be undertaken purely on the basis on 'selflessness' or out of the concern of others, altruism may still play a role. In the context of curbside recycling, it has been found that an individual's environmental values had very minimal affect on recycling behaviour; rather situational factors (such as house size, local waste knowledge, access to curbside recycling schemes), and psychological factors (such as awareness, social acceptance) had a greater affect (*ibid.*).

It might, however, still be possible to promote pro-environmental behaviour amongst those individuals classed as ego-centred (reflecting 'self-interest' *not* 'selfishness' – De Young, 2000). Rather than being considered as only seeking their own happiness and not having concern for others external to us, ego-centric individuals' happiness depends on what happens to the things they value (De Young, 2000). Although this does not tell us whether or not individuals will perform EER for altruistic or ego-centric reasons, it does imply that individuals can be successfully motivated to achieve similar outcomes, but this will depend on the way we frame the options, tailoring to an individual's position on this continuum. This may, for example, be by appealing to the altruistic individual through the preservation of the environment or to the more ego-centric individual through an EER resulting in a more comfortable internal environment or reduced energy bills. The individual must value expected outcome for them to be successfully motivated to act, thus broadly supporting Maslow's Hierarchy, Vroom's Theory and Expected-Value Theory.

The idea of the 'ego-centric' individual has, however, been widely challenged (Martinsson *et al.*, 2011). Rather than the concept of 'ego-centred', it is individuals' values and beliefs in relation to moral norms and/or obligations which are important as motivators (*ibid.*). It is these 'moral norms' which are key for motivating pro-environmental action (Stern, 2000). Where individuals believe that the threat of environmental degradation threatens what the individuals value they are more likely to feel a sense of responsibility to act (Martinsson *et al.*, 2011). They are subsequently more likely to behave in a pro-environmental way.

Owner-occupiers' commitment to 'ambitious renovation' could be higher if their preferences are taken into consideration (van Oel *et al.*, 2009). Personal preferences tend to be influenced by individuals' values and therefore this affects the decisions made by householders in relation to improving and renovating their homes.

The literature lists numerous factors as influencing refurbishment 'decision-making', and therefore potentially has a role in the motivation for EER. These are listed in Table 2.3.

TABLE 2.3 Factors affecting decision-making in the home

FACTOR TYPE		
SOCIO-DEMOGRAPHIC	**ECONOMIC AND SOCIAL**	**PHYSICAL**
Income	Comfort benefits	Type and construction period
Age	Refurbishment costs	Dwelling location
Ethnicity	Relative energy prices	Neighbourhood
Ownership status	Potential energy savings	Housing market
Number of household members	Value-added	Housing alternatives
Number of children under 6 years old	Economic conditions	Previous, recent and planned works
Education level		Available options
Length of residence		
Lifestyle		
Anticipated occupant mobility		

Adapted from: DCLG (2011a); Braun (2010); DCLG (2009b); Grosche and Vance (2009); Baker and Kaul (2002)

2.4 SUMMARY

This chapter has outlined the principal motivation theories which could be sufficiently applied to owner-occupier homes. It has discussed each theory and its potential application to EER, highlighting the key concepts of each theory. Some overlaps between theories have been identified. The theories include Maslow's Hierarchy, Vroom's Expectancy Theory, Festinger's Cognitive Dissonance Theory, and Self-Discrepancy Theory.

The most likely actors were also discussed based on the existing literature. These include those in the upper income brackets, those with growing families, two-adult households, middle-class households and those in semi-detached and detached properties. Although 'altruistic' individuals have previously been suggested as more likely to undertake pro-environmental actions than others, individuals' environmental values have been found to have minimal affect on recycling behaviour and less likely to affect environmental actions involving large capital investment. Motivation for 'ambitious refurbishment' is more likely to be sustained where an individual's preferences are taken into consideration.

The following chapter discusses motivation concepts and their application to EER.

CHAPTER THREE: REVIEW OF INCENTIVES AND BARRIERS TO EER

3.1 INTRODUCTION

Chapter three provides a review of the existing literature on the incentives and barriers to EER in owner-occupied housing. This contributes to the second objective by looking to identify the drivers and barriers for EER. It also contributes to the first and second key research questions.

3.2 EXISTING HOUSING AND ENERGY EFFICIENCY

To meet national and international carbon reduction targets, as well as contributing to the continued habitability of our homes in a changing climate (Arup, 2008), the efficiency of the housing stock must be addressed.

As discussed in Chapter one, there are 26 million homes in the UK, of which around 68% are owner-occupied (DCLG, 2010) and currently contribute to 27% of the UK's total carbon emissions (Affinity Sutton, 2011; Peacock *et al.*, 2010; HM Government, 2006). Not only will the owner-occupiers potentially directly benefit from taking action to improve the energy efficiency of their homes, but this section of the housing stock also has the greatest potential for carbon reductions (Arup, 2008). It is this segment which has the greatest potential for carbon reductions (Arup, 2008) and potentially directly benefit the greatest from taking action. Despite having the greatest potential, the uptake of even the most cost-effective energy efficiency measures is low (Energy Saving Trust, EST, 2010a). To better understand this low uptake, a review of the incentives and barriers to EER is needed.

Between 70% and 90% of the existing housing stock in 2050 has already been built (Boardman, 2007; Lowe, 2007; Wright, 2008), and it is vital that these homes continue to be habitable in the face of a changing climate (Arup, 2008). Through its improved performance, the existing housing stock is seen as a key contributor to the UK's national and international carbon targets (Summerfield *et al*, 2010; DCLG,

2006; Johnston *et al.*, 2005). Despite the necessity of improvements in its performance, the heterogeneity of the housing stock in terms of construction type, age, condition, energy performance and tenure makes wide-scale intervention difficult.

3.2.1 Demolition

Mass demolition as an alternative to refurbishment can be viewed as attractive and neat in comparison (Plimmer *et al.*, 2008). It is one route advocated by the Environmental Change Institute (Boardman *et al.*, 2005) in *40% House*. However, it is legally complicated, economically expensive (Power, 2008), potentially socially destructive (Power, 2008) and environmentally detrimental (Power, 2008). Mass demolition also does not sufficiently take into account the accumulated embodied energy within existing housing (Power, 2008). However well they are built, new properties will contribute significantly to embodied energy (Power, 2008; Building and Social Housing Foundation, BSHF, 2008).

In contrast, refurbishment can result in better quality properties which are more thermally efficient (Yates, 2006), more socially acceptable (Power, 2008), and are less expensive with a lower environmental impact (*ibid.*). Additionally, the stability of the community can be further enhanced (Sustainable Development Commission, 2006).

3.2.2 Energy Efficiency

The energy efficiency performance of housing in the UK is measured on a scale of 1 – 100 using the Standard Assessment Procedure (SAP). Owner-occupied housing has an average SAP rating of 52.8 (DCLG, 2009a) in comparison with 62.4 in social housing and 78.5 in modern housing in England (DCLG, 2009a). An improvement in the performance of the existing housing stock would not only contribute to national reduction targets such as the 2008 Climate Change Act, but it would also maintain the habitability of homes (Grosche and Vance, 2009), improve the health of occupants

(Kavgic *et al.*, 2010; Gyberg and Palm, 2009; Wright, 2008), mitigate further increases in fuel poverty as the price of fuel to heat and power our homes continues to increase in the long term, and prevent global warming from rising more than 2°C (van de Wetering and Wyatt, 2010). However, at the current uptake rate of 'cost effective' energy efficiency measures, reduction targets are unlikely to be achieved (Davies and Osmani, 2011). Yet research has shown that, to achieve reduction targets, there is a need to go beyond 'cost effective' measures (WWF, 2008; Peacock *et al.*, 2007; Natarajan and Levermore, 2007; Johnston *et al.*, 2005) and exceed standard levels of refurbishment (Killip, 2006).

Despite the advantages of improving home energy efficiency for owner-occupiers, the government, and the environment, the uptake of EERs in owner-occupied dwellings has been slow. This is in spite of rising fuel prices, information campaigns and numerous exemplars through the 'green home' open days throughout the country.

3.2.3 Technical Models

Technical models based on calculations of estimated energy and/or carbon savings from installed measures (WWF, 2008; Peacock *et al.*, 2007; Natarajan and Levermore, 2007; Johnston *et al.*, 2005) have suggested the need for the adoption of an 'all measures' approach to ensure national and international targets are achieved, as opposed to 'business as usual' or 'cost effective measures' approaches. Estimations of possible energy savings through domestic refurbishment have ranged from 37% (Johnston *et al.*, 2005) to over 80% (WWF, 2008; Yates, 2006; Johnston *et al.*, 2005).

Government incentives – which are typically based on economic models to motivate owner-occupiers – have generally encouraged a more piecemeal, basic (cost-effective) measures approach (e.g. draughtproofing, low energy light bulbs, cavity wall insulation, loft insulation). However, where only the basic measures are installed such as those outlined in the 2008 English Housing Survey (DCLG, 2010) (listed below), just a 26% reduction in energy efficiency performance is estimated by DCLG

(2010). Consequently, the achievability of carbon emission reduction targets is questionable.

Potential improvement measures based on Energy Performance Certificate Recommendations (Table 3.1):

TABLE 3.1 Measures recommended under Energy Performance Certificate

LOW COST MEASURES (LESS THAN £500)
Loft insulation
Cavity wall insulation
Hot water cylinder insulation
HIGH COST MEASURES (OVER £500)
Upgrade central heating controls
Installation of energy efficient condensing boiler
More efficient, modern, fan-assisted storage heaters
Replacement warm-air unit
Manual biomass boiler or wood pellet stove
DCLG (2010)

3.2.4 Behaviour

Modelled studies are useful in estimating the potential savings possible, but either exclude occupant behaviour or assume 'standard occupancy'. However, in reality

occupant behaviour can vary considerably. Socolow's 1978 study on domestic energy consumption demonstrated that energy consumption can differ by a factor of two between identical properties (Schweiker and Masanori, 2010; Rosa *et al.,* 1988). This has been reaffirmed by more recent studies such as Chandiwala and Gupta (2010) which found occupant behaviour to be central to domestic energy consumption.

According to Stern (2000) there are four factors required for 'environmentally significant' behaviour to occur:

Attitudinal – norms, beliefs and values.

Contextual – interpersonal influences such as persuasion, community expectations, regulation and legal requirements, economic incentives and costs, availability of appropriate technology, and other contextual features such as the price of fuel, interest rates, interest groups, amongst others.

Personal capability – the knowledge and skills required for action, time availability for action, availability of resources including money to perform works.

Habit or routine – behavioural change frequently requires breaking established habits or routines, and this is recognised as key in environmentally significant behaviour.

This refers to 'environmental behaviour' rather than directly to refurbishment or the installation of energy efficiency measures, but it still has some role, particularly in terms of the first four factors – attitudinal, contextual (e.g. incentives and costs) and personal capacity (e.g. knowledge, availability of resources). The influence these factors have depends on the type of 'environmentally significant' behaviour; Stern (2000, p.417) suggests that 'expensive' behaviours "s*uch as reinsulating homes are likely to be strongly influenced by monetary factors*", included under both contextual and personal capability.

The installation of energy efficiency measures must be coupled with behavioural change for effective energy and carbon emission reduction, and to avoid the 'rebound effect'. A study by Wetherell and Hawkes (2011) found that, in a group of Bristol properties participating in the Pay-As-You-Save pilot programme, predicted energy bill savings following the refurbishment of the properties to be lower than many of them were in reality. The predictions were made through SAP which, like some modelled studies, assumes standard occupancy rather than reflecting reality. The predicted lower savings were also attributed to the rebound effect (based on the Khazzoom-Brookes postulate and Jevons Theory) where improvements in energy efficiency are likely to result in an increase in domestic energy consumption, and therefore an increase in the respective carbon emissions (*ibid.*).

3.2.5 Incentives

There are multiple drivers for improving housing energy efficiency (Davies and Osmani, 2011; Plimmer *et al.*, 2008) ranging from international policy, e.g. the European Union's (EU) Energy Performance of Buildings Directive (EPBD) (recast); UK policy and regulations, e.g. the Climate Change Act 2008 and the Building Regulations (Part L); to the motivations of individuals. International and national policy and legislation will, to some extent, affect local and individual drivers for EER.

To date, the government has typically focused on increasing information and awareness, and on economic incentives. This approach has been criticised for being principally based on economic models, traditionally excluding the role of values, an essential component for people to take action (Whitmarsh, 2009; Aune, 2007; Linden *et al.*, 2006). As stated by Aune (2007), "*[m]arket-based energy policy instruments focus on costs and competition as a solution for market breaks and assume the existence of a rational consumer, but this is a limited view of technological appropriation*" (p.5460).

3.2.5.1 Economic Incentives

In the context of domestic energy consumption, economic incentives have been the most successful in encouraging 'pro-environmental behaviour' and dissemination the least effective (Stokols, 1978). Although economic incentives are considered to be a good method of motivating people to act without a 'pro-environmental' attitude or concern for the environment (Kollmuss and Ageyman, 2002) it is potentially the least cost effective method, with increased likelihood for 'free ridership' whereby people who would have installed the measures in the absence of economic incentives benefit from such incentives (Grosche and Vance, 2009).

Although there is some evidence suggesting that people prioritise economic factors in decision-making in relation to the installation of energy efficiency measures (Nair *et al.*, 2010b; Bichard and Kazmierczak, 2009), a combination of measures has also been shown to be more effective (Gilligan *et al.*, 2010; Bichard and Kazmierczak, 2009). However, Christie *et al.* (2011) state, although there have been a number of programmes encouraging the adoption of energy efficient technology through monetary incentives, the uptake of the technology has been low. "*This suggests that the reasons behind this lack of adoption are far more complex than a simple economic impediment or information barrier*" (Christie *et al.*, 2011, p.452).

3.2.5.2 Penalties

The European Union have made provisions under the recast Energy Performance of Buildings Directive for member states to implement economic penalties and increase public awareness to encourage action under those national schemes which fall under the Directive (European Council for an Energy Efficient Economy, 2010). The UK's national programme is the Energy Performance Certificate (EPC), a compulsory scheme for domestic and commercial premises.

Domestic EPCs must be provided at the point of sale or when a property is leased. This provides a current energy rating for the property and a rating to reflect the

improvement potential. The EPC is accompanied by a recommendation report containing potential measures which could be implemented to improve the energy rating. This increases energy performance awareness amongst owners, occupants and homebuyers, potentially paving the way for market-driven demand for better energy performing buildings (Royal Institution of Chartered Surveyors, RICS, 2010). However, a study by Watts *et al.* (2011) shows that 45% of the homebuyers participating in the research had not and were not planning on retrofitting any measures as a result of the EPC, although some participants indicated that they had undertaken works regardless of the EPC.

The EPBD states that penalties for the infringement of national schemes must be effective, proportionate and dissuasive. In England, Northern Ireland and Wales this has translated into a £200 fine for not providing a domestic EPC, and £500 in Scotland. However, although such a tool may encourage some improvements to be undertaken by the vendors, landlord and/or homebuyer, it appears to promote the installation of smaller measures rather than EER, resulting in just a 26% improvement in energy efficiency where all recommended measures are installed (DGLG, 2010).

3.2.5.3 Subsidies and Payments

At a national level, economic incentives have previously been provided through subsidies for loft and cavity wall insulation, and economic rewards through schemes such as the Feed-in Tariff for low carbon or renewable electricity microgeneration. Subsidised loft and cavity wall insulation were provided through the Warm Front until early 2013 before the Green Deal was launched.

The Green Deal was a government programme under which the energy efficiency performance of a home can be assessed and improved using a low interest loan. It evolved from the Pay-As-You-Save pilot scheme which provided grants to households for energy efficiency installations. The main difference between the two is that PAYS was a grant rather than a loan. Under the Green Deal, the upfront cost of

energy efficiency improvement measure(s) is provided by private lenders through a loan (Booth and Choudhary, 2013) attached to the property rather than the individual. Repayments are then made through the savings made on the energy bills (*ibid.*).

The principle of the Green Deal is to remove upfront cost and reduce the hassle incurred by the owner. It encourages energy efficiency works, which go beyond the low cost measures, based on advice from an accredited advisor. The loan is attached to the property rather than the individual for up to 25 years and the repayments must meet the 'Golden Rule'; that is, the savings must exceed the loan repayments. There have, however, been criticisms of the Green Deal including:

- The interest rate which ranges from seven to nine percent (Low Carbon Hub, 2013; Department for Energy and Climate Change, DECCa, 2012a). Other sources of funding, including Nationwide Building Society offer lower interest rates (Nationwide, 2013);
- The unknown potential for the loan to affect any future mortgages secured against the property (Dowson *et al.,* 2012);
- Future changes to the household structure affecting the Golden Rule (i.e. the loan is calculated based on the Golden Rule for a four-person household. The property is sold to a two-person household and the repayments remain consistent with the original repayments thereby potentially exceeding the Golden Rule);
- The ability to accurately predict the energy savings from refurbishment packages without a full understanding of the building performance and occupant behavioural patterns, including the effects of the rebound effect (Booth and Choudhary, 2013; Dowson *et al.*, 2012), where energy efficiency improvements can result in increased domestic energy consumption (Wetherell and Hawkes, 2011);

- The Golden Rule could restrict the amount of carbon savings which are possible from a whole house refurbishment (Dowson *et al.*, 2012).

At the start of the present study, therefore, it was unknown whether the Green Deal will serve as an incentive, a disincentive or have no affect on whether owner-occupiers improve the energy efficiency of their homes.

3.2.5.4 Information

Another commonly used tool is information. There is an assumption that, for people to act, clear, comprehensive and complete information is needed because this increases the likelihood that people will act in an environmentally responsible way (Stokols, 1978). Economists have traditionally assumed that people act when they are provided with full information on costs and potential savings (Stern, 1986). Improvements in awareness have been attempted through the provision of information through organisations such as the Energy Saving Trust, local campaigns and the media.

Information-based tools "*have long been popular – and usually ineffective – policy approaches*" (Stern, 2011, p.307) in the context of behavioural change. The ineffectiveness of information is also recognised by Bichard and Kazmierczak (2009) who state "*fact-based informational campaigns aiming at changing people's behaviour have not been effective*" (p.iii). However, Stern (2011) states there has been some success from information campaigns, including encouraging increased uptake of technology, where psychological knowledge and the framing of the information is incorporated (*ibid*).

Economists have also assumed people behave in a perfectly rational way, which is now known not to be the case (Aune, 2007). In a study by Christie *et al*. (2011), homeowners demonstrating 'disconnected behaviour' were shown to be aware of their decisions (i.e. whether or not to adopt energy efficiency technology), thus challenging

the assumption that incomplete information can cause or contribute to 'disconnected' or irrational behaviour. Further, homeowners do not always consider "*whether they could make expenditure decisions that would make good financial sense in terms of enhancing the value of the property*" (Munro and Leather, 1999, p.519). Rather, in their study, Munro and Leather's respondents appear to have performed improvement works to create a 'home', to provide comfort, and predominantly "*driven by perceived necessity*" (p.518), broadly supporting the findings of Aune (2007).

As a tool for encouraging action, information has been described as 'elitist' (Gyberg and Palm, 2009). It requires individuals to sufficiently understand and interpret the information provided. Further, individuals may choose to accept or reject this information depending on whether it confirms or conflicts with information from friends and associates (Stern, 1986). They may also reject or ignore the information if it runs counter to personal values, beliefs, or societal and/or personal norms (Gram-Hanssen *et al.*, 2007). Once formed, even an inaccurate hypothesis will lead the person "*only to process…information that was consistent with it…* [with the] *reduced…likelihood of replacing it with a more accurate view*" (Pittman and Heller, 1987, p.470). However, Pittman and Heller (1987) also state there are "*limits on self-confirmatory and self-fulfilling processes*" and that other research has "*found no evidence that subjects used self-confirming information-gathering strategies…subjects prefer accuracy over simply confirmatory information*" (p.472).

Barr (2003) highlights three principal flaws in the assumption that increased environmental awareness through information dissemination will lead to action (i.e. behaviour):

> (1) "…*behaviour is contingent upon at least three alternative sets of factors: personal situation, psychological perceptions and personality characteristics, and finally environmental values*" (p.238);

(2) based on "…*alternative behaviours, even within the same behavioural realm…have divergent antecedents*" (*ibid*); and

(3) in relation to policy implementation, awareness campaigns "*take little account of the demographic trends in environmental behaviour*" (*ibid*).

As stated by Bichard and Kazmierczak (2009) "[e]ducation campaigns fail because they ignore the motivations for behaviour. People engage in behaviours for reasons…and simply knowing *what* to do is not a reason to take action" (p.26 – emphasis in original).

Despite such criticisms, information has been found to have a potentially "*dampening effect on the negative influence of cost*" (Grosche and Vance, 2009, p.144); that is, access to information increased the likelihood of undertaking energy efficiency works, despite the potentially large capital investment required.

Despite this, these incentives are also potentially integral components for homeowners' decision to undertake sustainable refurbishments. Indeed, Henryson *et al.* (2000) suggest in both the context of changing household energy behaviour and encouraging the investment in energy efficiency measures, information is important. However, to be most effective, information needs to be tailored to specific target audiences (Aune, 2007; Henryson *et al.*, 2000). Information should be specific, vivid, personalised and from a credible source (Gilligan *et al.*, 2010; Stern, 1986). Further, it is essential that information be correct, complete and easily accessible (Gilligan *et al.*, 2010; Henryson *et al.*, 2000).

Although important, the role of information and public awareness is based on 1970s rationalist models which assumed that education could stimulate 'pro-environmental behaviour' (Kollmuss and Ageyman, 2002). However, "*in most cases, increases in knowledge and awareness did not lead to pro-environmental behaviour*" (*ibid*, p.241). This is supported by Yohanis (2012), and Barr (2003) states the "*assumption that*

basic knowledge dissemination will have more than a minor indirect affect on behaviour is naïve" (p.237).

Perhaps knowledge does not necessarily lead to pro-environmental behaviour, at least in part, because awareness alone does not produce action, particularly "*in the absence of relevant information about possible solutions*" (Proverbs and Lamond, 2008, p.5) and that awareness does not necessarily lead to motivation, a prerequisite for action.

3.2.5.5 Values

Owner-occupiers' commitment to 'ambitious renovation' could be higher if their preferences are taken into consideration (van Oel *et al.*, 2009). Personal preferences tend to be influenced by individuals' values and therefore these will affect the decision made by householders' in relation to improving and renovating their homes, and particular works selected. Further, according to Whitmarsh (2009) domestic energy use is linked to "*social identity, status and norms*" and, therefore, changing energy behaviour cannot be done through information and economic measures alone (p.14). Values are also likely to be central to the decisions made to install energy efficiency measures.

According to Kollmuss and Agyeman (2002) values shape "*much of our intrinsic motivation*" (p.251). The use of values form a potentially significant part of motivating owner-occupiers to improve the energy efficiency of their homes through 'sustainable' refurbishments (*ibid.*). Values and attitudes are considered to be important in shaping pro-environmental behaviour (*ibid*); potentially the decisions made in relation to whether or not home improvements or refurbishments are undertaken; the improvement measures selected; as well as how our homes are used, which also affects the energy efficiency of a home. Savings do not only rely on the physical efficiency of the housing stock but also on the way occupants use their home (Janda, 2011; Wetherell and Hawke, 2011; Chandiwala and Gupta, 2010). This is also related to how owner-occupiers perceive and refurbish their home.

Those with a 'pro-environmental' attitude recognise the link between behaviour and the negative impact on the built and natural environment. Although the Energy Saving Trust (EST) has reported a rise in pro-environmental attitudes in the UK, a pro-environmental attitude does not guarantee pro-environmental action; this is known as the value-action gap (Kollmuss and Agyeman, 2002). Despite this, the EST has also reported a rise in 'pro-environmental' actions, such as the installation of insulation and energy saving light bulbs, switching off appliances when not in use, and increased levels of walking in preference to using the car (EST, 2008). Stokols (1978) suggests that "*most individuals (even those concerned about environmental quality) have expressed a general unwillingness to maintain reduced levels of resource conservation on a permanent basis*" (p.265). Furthermore, if people already consider themselves to be energy efficient it is almost impossible to save more energy or to behave differently (Henryson *et al.*, 2000).

3.2.5 Barriers

In spite of the clear advantages of improved performance at an international, national, local and individual level, there are numerous barriers to a wide-scale improvement in the energy efficiency performance of the existing housing stock. The Energy Saving Trust (2010) states "*many people like the idea of improving energy efficiency in their homes, they don't take action by installing energy-efficiency measures*" (p.7). Barriers to action to improve owner-occupied housing include:

- Information (particularly reliable, honest, trustworthy sources which take values/'demographic trends' into consideration)
- Knowledge and awareness
- Cost (affordability, capital priority, lack of resources, lack of upfront capital, unconvincing cost-benefit ratio),
- Hassle involved in improving a home
- Lack of feedback

- Inappropriate products available
- Lack of experience
- Too few best practice exemplars
- Trust (including trust of institutions, contractors, information sources and community)
- Other priorities (such as the costs associated with children)
- Social (including internal barriers such as attitude; locus of control or self efficacy; cultural or social norms)
- Motivation

(Dowson *et al.*, 2012; Watts *et al.*, 2011; Whitmarsh *et al.*, 2011; EST, 2010; Gyberg and Palm, 2009; Housing Forum, 2009; Meijer *et al.*, 2009; Stewart *et al.*, 2005; Barr, 2003; Henryson *et al.*, 2000; Munro and Leather, 1999)

Further, people live in differing circumstances "and their abilities to choose [between the available measures and technologies] vary according to income, knowledge, geographical conditions, energy solutions available, and moral" (Gyberg and Palm, 2009, p.2809). Barriers are, therefore, context-based, and as Stern (2011) states:

> "*The barriers to household behavioral change can vary with the behavior and household. An obvious example is the initial cost of energy-efficient household equipment. The importance of this barrier depends on the initial cost of the equipment, household income, and the availability of financing or policies that lower the cost barrier. Depending on the type of behavior, barriers may relate to household income, size, and life cycle stage; geographical relationships between home and travel destinations; home ownership status; decision-relevant knowledge; and cognitive, affective, and personality factors*"
>
> (p.308)

3.2.5.1 Cost

As a barrier to home improvements and refurbishments (e.g. Stewart *et al.*, 2005), to the installation of energy efficiency measures and sustainable refurbishment (e.g. Meijer *et al.*, 2009; Housing Forum, 2009), and to reducing domestic energy consumption (including behavioural intervention) (e.g. Whitmarsh, 2009), cost is cited extensively in the literature. The term 'cost' is used interchangeably and/or to mean a variety of things; cost in terms of affordability, capital priority, lack of upfront capital, unconvincing cost-benefit ratio (usually in the context of rental properties), and a lack of resources such as time constraints. There may be underlying reasons for a lack of resources (Kollmuss and Ageyman, 2002).

As stated above, Christie *et al.*, (2011) found that even in the presence of monetary incentives, the uptake of energy efficiency measures was low. Christie *et al.* (2011) also found that even where there is "*no upfront cost, interest-free repayments and immediate benefits (therefore removing the sense of an immediate sacrifice…), these homeowners [- those which wanted to be paid to acquire technology which would save them money -] still believed they have some reason to justify not paying the full price*" (p.455).

While the Green Deal meets the need to provide owner-occupiers with a means by which no upfront cost is incurred for the energy efficiency improvements, it is not interest-free, nor does it provide a means by which to pay for a more extensive home refurbishment (Dowson *et al.*, 2012). In contrast, the Feed-in-Tariff and the Renewable Heat Incentive do not remove the upfront cost of low-carbon technology, but it provides an economic return based on the amount of electricity or heat generated (Cherrington *et al.,* 2013; Muhammad-Sukki *et al.*, 2013).

3.2.5.1 Other Barriers

Stephenson et al. (2010) states that, according to the UK's Stern Review, a report produced by an economist, "the barriers to 'rational' behaviour and motivation fall

into three main groups: (i) financial and 'hidden' costs and benefits; (ii) multiple objectives, conflicting signals or information, and other market failures; and (iii) behavioural and motivational factors" (p.6121). However, it is recognised that Stern's analysis does not appear to include consideration of manufacturers, sellers, installers, policy makers, financiers and so on (ibid.). Similarly, Blake (1999) suggests there are three principal barriers to action:

- Internal barriers of a person, e.g. attitude and temperament, to which 'motivation' could be added;

- Whether people feel they can influence a situation (i.e. locus of control), should take responsibility, and trust institutions;

- Social and institutional barriers.

There are some similarities between these and those contained within the Stern Review. However, unlike the Stern Review, Blake's barriers appear to include consideration of internal barriers beyond behaviour and motivation, and of institutional barriers.

According to a study by Christie *et al.* (2011), a comparison of homeowners exhibiting 'disconnected behaviour' with a reference group showed there was no significant difference in the measured psychological, demographic, or contextual factors. However, social comparisons (i.e. comparison of oneself to others) were found to have an important influence on decisions.

Some of the barriers listed above are being addressed through information and economic initiatives (i.e. cost, knowledge and awareness). Others, such as best practice exemplars, are being addressed through 'open door' events and other

demonstration projects across the country. Experience of the industry will continue to grow, particularly with the introduction of the Government's wide-scale refurbishment programme, the Green Deal. However, other barriers such as social and motivation barriers still need to be addressed.

3.3 SUMMARY

This chapter has outlined the principal incentives and barriers to improve the energy efficiency of the owner-occupied existing housing stock. Refurbishment is a way of improving the energy efficiency performance of the existing housing stock, but its heterogeneity and the proportion which is owner-occupied makes significant improvements challenging. Unlike demolition which can be environmentally, socially and economically detrimental, refurbishment provides an opportunity to provide a means by which better quality, more thermally efficient properties are produced, which are more socially acceptable, less costly to produce, have a lower environmental impact and enhance the local community.

Technical studies have suggested the feasibility of achieving a high level of energy reduction is dependent upon installing 'all measures'. In reality, to date the government has encouraged a more piecemeal, low-cost measures approach. It is currently unclear whether the introduction of the Green Deal will result in the installation of higher cost measures. However, the improvement works are funded, they should be coupled with behavioural change to reduce the potential for the Khazzoom-Brookes postulate (i.e. the rebound effect) to diminish the possibility of reducing the energy savings resulting from the installed measures.

The principal incentives for owner-occupiers include economic and information. However, these are likely to be affected by the values held by owner-occupiers.

Barriers are well documented by the literature. There is an apparent crossover between incentives and barriers – cost, information, and knowledge and awareness. In

addition to these, hassle, lack of feedback, available products, lack of experience, few exemplars, trust, other priorities, social factors and motivation are all cited in the literature as likely inhibitors. Some of these barriers are currently being addressed through information and economic incentives, whereas others such as best practice exemplars are being addressed through the increasing number of 'green door' events and other demonstration projects nationally. Despite the introduction of the Green Deal, the Renewable Heat Incentive and the Feed-in-Tariff to help with the cost barriers, other barriers such as the social and motivation aspects are yet to be adequately addressed. Further, there does not currently appear to be an incentive strong enough to induce mass refurbishment to extensively improve the energy efficiency of the existing owner-occupied housing stock.

The following chapter provides a discussion of the principal conceptual components incorporated in existing motivation theories which appear to be relevant to EER in existing owner-occupied housing. It also provides the development of an initial conceptual model for owner-occupier motivations for EER based on the existing literature.

CHAPTER FOUR: THE DEVELOPMENT OF THE CONCEPTUAL MODEL OF MOTIVATION IN THE CONTEXT OF EER

4.1 INTRODUCTION

There are a number of conceptual components incorporated within the existing motivation theories described which appear to be of relevance to owner-occupier EER motivation. This chapter commences with an overview of the barriers and incentives to EER before discussing components such as intrinsic and extrinsic motivation, internal factors, the 'self', social norms, outcome expectations, and loss aversion. It also discusses how these concepts contribute to the development of the conceptual model. 'Internal factors' will provide a greater focus on 'intrinsic motivation' in relation to home improvements and EER.

4.2 INTRINSIC AND EXTRINSIC MOTIVATION

Motivation can be divided into 'intrinsic' and 'extrinsic'. The former results from an interaction between an individual, internal needs, desires, preferences, with their context (Pittman and Heller, 1987). The latter is external, usually in the form of coercion or financial incentive (Dolan *et al.*, 2010). Intrinsic motivation is sometimes considered as more altruistic; it is based on the idea that the reward for completing a particular activity is self-satisfaction or self-worth (Dolan *et al.*, 2010; Dörnyei, 2001).

These two categories are not necessarily complimentary, and tensions can arise between extrinsic motivation such as 'contingent rewards' and intrinsic motivation such as the desire to perform a task for its own sake (Bénabou and Tirole, 2003, p.490). With environmentally responsible behaviour, the principal focus has been on utilising incentives and/or disincentives, where environmentally responsible behaviour can be motivated through the manipulation of a reward or punishment (Pelletier *et al.*, 2008; De Young, 2000).

Where an individual engages in an activity to gain a tangible reward (i.e. extrinsic motivation), research has shown that their intrinsic motivation decreases in future

tasks (Bichard and Kazmierczak, 2009; Bénabou and Tirole, 2003; Pittman and Heller, 1987), and can even become a deterrent for engaging in future tasks (Gowdy, 2008). A tension, therefore, lies between initiating motivation and sustaining motivation. However, economic incentives have been most successful in encouraging 'pro-environmental behaviour' (Stokols, 1978) and can potentially play an important role in motivating action amongst owner-occupiers, but could reduce intrinsic motivation. Therefore, monetary incentives could be counterproductive (Dolan *et al.*, 2010). However, where extrinsic motivation (such as a monetary incentive) is removed, the desired behaviour returns to the baseline behaviour (Pelletier *et al.*, 2008). So, if an extrinsic reward for EER is removed, undertaking such a refurbishment becomes improbable (Parnell and Popoviv Larsen, 2005).

Not all extrinsic rewards will decrease intrinsic motivation. Verbal rewards such as praise have been found to increase intrinsic motivation (Pittman and Heller, 1987). In terms of EER, verbal rewards or praise could be in the form of positive social recognition such as open door events. To initiate and sustain owner-occupier motivation, both intrinsic and extrinsic motivation will be required. Although both are required, intrinsic and extrinsic motivation must not be in conflict. These will both affect owner-occupier motivation to undertake EER and are therefore featured in the conceptual model.

4.2.1 Internal Factors

Intrinsic or 'internal' factors affect our motivation to perform particular actions and make certain choices, including decisions relating to the home. These are represented at the centre of the conceptual model presented later in this chapter. Individuals' attitudes, values and beliefs are recognised as affecting homeowner choices (Nair *et al.*, 2010a) and whether they act 'pro-environmentally' or not (Kollmuss and Agyeman, 2002; Stern, 1986). However, a pro-environmental attitude does not necessarily lead to pro-environmental action such as reduced energy use (Nair *et al.*, 2010a). An individual's beliefs will also affect their perception of comfort and health (Stern, 1986).

The 'self' is a concept cited in the literature as having links with the concept of the 'home' (Aune, 2007), a 'home' reflecting the actual, ideal and social self-identity (Sirgy *et al.*, 2005). The role of the 'self' in motivation theory has already been noted, and it appears to play a key role in connection with EER. The home provides shelter and security; it contributes to our self and public image; it provides a platform for activities and social interaction (Aune, 2007; Munro and Leather, 1999). Owner-occupier decisions in relation to a home are likely to be affected by these factors, as well as by individual tastes (Aune, 2007; Aikivuori, 1996), and other priorities (Aune, 2007; Munro and Leather; Stewart *et al.*, 2005).

An individual's locus of control and their sense of responsibility will potentially affect their decision to act (Kollmuss and Agyeman, 2002; Stern, 1986), where the locus of control is an individual's perception of their ability to bring about changes through their own actions (Kollmuss and Agyeman, 2002). The decision to act in relation to home improvement will also be affected by the trust in institutions and organisations (Christie *et al.*, 2011; Martinsson *et al.*, 2011), builders (Stewart *et al.*, 2005; Munro and Leather, 1999), and the local community (Martinsson *et al.*, 2011).

An individual's decision to initiate, alter or terminate an action will be affected by their "*goals, values, capabilities, emotions and bodily states*" as well as the context in which the individual functions (Ford, 1992, p.45). These will also affect what priority the action and goal will be given (Ford, 1992). This highlights the role of emotions in motivation. Anticipated emotions can be significant drivers for the motivation to undertake action (Carrus *et al.*, 2008). Information can be used to influence emotions through the provision of potentially relevant problems and opportunities. Emotions are discussed in Section 4.3.

4.2.1.1 The Self

As a concept, 'self' is considered in social science to be an important factor in people's motivation to act in a particular way or not. It is incorporated in the

conceptual model as one of the internal factors affecting owner-occupiers' motivation to undertake EER. Self-identity is the label individuals assign to themselves. It is influenced by personal motivations (i.e. self-esteem, self-enhancement, self-understanding) and by social motivations (i.e. the demands and expectations of others, variety of roles we fulfill) (Whitmarsh and O'Neil, 2010). People's 'self-identity' will have an impact on motivation because this affects their intention to behave in a particular way. If individuals perceive themselves as environmentally concerned it is plausible they are more likely to recycle (Jackson, 2005) or purchase 'green' products (Jackson, 2005; Fellows and Jobber, 2000) than those who do not.

Two principal functions of 'self identity' are (1) to distinguish oneself from other individuals and (2) "*to conform to the values, beliefs and behaviours of the social groups to which one belongs*" (Whitmarsh and O'Neil, 2010, p.306). The social group to which a person adheres, and the associated lifestyle, affects whether the particular self-identity is considered positive or not (Parnell and Popvic Larsen, 2005). Social class may affect EER, which is likely to require large capital investment. Such 'economically fundamental decisions' may still have "*deep-rooted class-power structure*" (Gram-Hanssen and Bech-Danielsen, 2004, p.23). This will potentially influence an individual's self-perception in relation to their social class, the accepted social norms and the decisions they make to conform.

Where an individual perceives there is a gap between their actual and ideal self, motivation theory suggests that this causes the individual to experience discomfort. According to motivation theory, the individual will subsequently act to reduce this discomfort by reducing any inconsistencies between the actual and ideal self.

4.2.1.2 Social Norms

'Social influence' is considered to be a more subtle technique for motivating individuals, creating the desire to conform, comply and draw comparisons with others or with social norms (Pelletier *et al.*, 2008). At the social level, motivation is affected

by individuals' perceptions of social norms and the social support for such behaviour (Seacat and Northrup. 2010). Social norms can be considered both as an internal and an external factor – external as being what is considered as acceptable in society, internal because it is dependent on an individual's perceptions of social norms. It is, therefore, included in the conceptual model as part of the 'internal factors', although it could also be included under external factors.

Social norms have been shown as having a role in motivating pro-environmental behaviour, such as curbside recycling (Barr, 2003), in the context of energy behaviour (Martinsson *et al.*, 2011), and the appropriation of energy efficient technology (Christie *et al.*, 2011). They also contribute to an individual's perception of risk, regret avoidance and loss aversion (*ibid.*), the anxieties regarding the unknown and negative effects which may arise from EER (Zundel and Stieβ, 2011).

For social norms to have an influence on action, however, they must be readily visible (e.g. curbside recycling) and individuals must have an awareness of the pressure to conform (Bichard and Kazmierczak, 2009; Barr, 2003). EER is potentially less visible and, therefore, the role of social norms may be diminished.

4.2.1.3 Outcome Expectations and Loss Aversion

The outcome expectations of individuals and the desirability of these outcomes play an important role in motivation, as outlined by various motivation theories. People have been shown to favour the status quo (Christie *et al.*, 2011), overestimating potential losses and underestimating any potential gains. Action will be taken when the expected outcome compliments what the individual values (Tan, 2008). Therefore, owner-occupiers are more likely to undertake an EER where the outcomes compliment their values, and therefore they attach a higher value to the outcomes of the refurbishment.

Changes are evaluated against a reference point (Gowdy *et al.*, 2008). This reference point tends to be an individual's current situation, i.e. the status quo. For people to engage in an activity where a potential loss is perceived, research has shown that, to accept a 50-50 gamble, the potential gain needs to be double that of the potential loss (*ibid.*). Loss aversion can, to some extent, be manipulated through the 'framing effect'; that is, depending on how the choice is presented, the frame reference may change (*ibid.*). So, if an outcome such as EER is presented as a gain, and action would avoid losses such as energy bill spikes or discomfort, individuals will be better motivated to perform an EER. Outcome expectations and loss aversion have both been incorporated into the conceptual model.

The concepts discussed here can be generally divided into internal and external motivations. Internal motivations such as the 'self' have been included in the conceptual model as these have been highlighted under some existing motivation theories as potentially important concepts. Some internal motivations such as the 'self' can be directly influenced by other internal factors as well as external factors (e.g. social norms). 'Social norms', a concept which can double as an internal and external motivation, is another concept considered by existing theory as having a role in motivation. Finally, individuals' perceptions of outcome expectations and loss aversion are also portrayed by existing theory as having an influence on individuals' motivation.

4.3 EMOTIONS

Emotions are classed as a motivational process, and whether an individual takes action or not can be influenced by positive and negative emotions. Emotions form an evaluation method against which individuals can not only decide whether or not to initiate or terminate particular actions, but also to measure their progress towards their personal goals (Ford, 1992).

Owner-occupiers with a positive emotion towards an activity are more likely to undertake that activity. However, if there is a positive emotion towards a particular action (e.g. EER) but a negative emotion exists (e.g. a lack of trust concerning the professional advice, individuals doubt their capabilities, or strong loss aversion), the negative emotion is likely to override the positive emotion, and consequently the individual is unlikely to be motivated to act (Ford, 1992). Research has also suggested that ecological action is not only prompted by positive emotions but also by negative emotions such as guilt or fear (Carrus *et al.*, 2008). Although "*emotions are not necessarily irrational…they can and do lead to decisions that may be difficult to predict using a traditional decision-making model*" (Levy *et al.*, 2008, p.286).

Emotion does not only have a role in the decision to initiate action (Carrus *et al.*, 2008), but has a role in the decision to terminate the action. Early termination of an activity can result where an individual perceives the personal goal as unattainable or unrealistic, where less imperative goals are given greater priority due to more compelling emotions (i.e. they make the individual feel good), or where there is a lack of resources (time, energy, money) (Ford, 1992). Personal goals and the emotions associated with these goals will influence the owner-occupier's priorities, but they also have links to social praise (i.e. from friends, family, neighbours, and so on), to social norms (i.e. conforming to the particular social group an individual considered themselves a part of), and to self-image (*ibid.*).

4.4 MOTIVATIONS THEMES IN EER

As summarised in Table 4.1, there are three principal reasons identified by the literature as to why individuals perform works to their homes. The motivation for performing energy efficiency works is not solely to save money, but can also be for environmental and comfort reasons (DCLG, 2011a). Saving *energy* is not necessarily the principal motivation for home refurbishment (Aune, 2007).

The motivation themes presented in Table 4.1 can be generally linked to existing motivation theory - people are motivated for different reasons depending on whether

or not higher priority needs and desires have been satisfied and whether they value the outcome (e.g. improved comfort). The motivation themes are dependent on the owner-occupiers' beliefs, attitudes and values, as well as their priorities at any given time, their sense of responsibility, their locus of control, their perception of 'self' and their perception of the role of the 'home'. For example, does the individual desire to be portrayed as trendy, 'eco' or technological, and so on? Do they prioritise comfort above energy savings or the environment?

4.5 ECONOMIC MOTIVATION

Economic factors are cited by the literature as a barrier to action (i.e. the cost of the works, availability of funding) (Housing Forum, 2009) and as a motivation to action. The principal motivation across all income groups for performing energy efficiency works in the home is to make monetary savings on energy bills (DCLG, 2011a; Bichard and Kamierczak, 2009) This is an external factor, and it considered to be an important aspect for undertaking standard renovations (Grosche and Vance, 2009), 'sustainable refurbishment' (Housing Forum, 2010), and in the general adoption of energy efficiency measures (Nair *et al.*, 2010a; Nair *et al.*, 2010b). The economic factor will also affect the social 'motivation theme' through the 'motivation factors' of loss aversion and outcome expectations (Table 4.1).

Individuals tend to prioritise energy bill reduction over environmental benefits (Nair *et al.*, 2010b). Household income can also affect the principal motivation for performing EER – as energy prices continue to rise, it is the lower income owner-occupiers which "*have stronger incentives to save energy than households with higher incomes*" (Martinson *et al.*, 2011, p.5185).

TABLE 4.1 Motivation themes and drivers listed by the literature

MOTIVATION THEME	MOTIVATION DRIVERS (SUB-THEME)	REFERENCES
Economic	- Cost of energy bills - Potential savings - Available incentives - Cost of works - Availability of capital (funding, savings) - Household income - Value added to property	DCLG, 2011a; Martinson *et al.*, 2011; Zundel and Stieβ, 2011; Nair *et al.*, 2010a; Nair *et al.*, 2010b; Bichard and Kamierczak, 2009.
Social	- Comfort - Role of home - Social norms - Self - Sense of responsibility - Locus of control - Loss aversion - Expectations	DCLG, 2011a; Zundel and Stieβ, 2011; Pellegrini Masini *et al.*, 2010; Grosche and Vance, 2009; Aune, 2007; Anker-Nilssen, 2003.
Environmental	- Carbon footprint - Environmental impact - Resilience against climate change	DCLG, 2011a; Zundel and Stieβ, 2011; Nair *et al.*, 2010b.

4.6 SOCIAL MOTIVATION

Social motivation incorporates a number of external and internal motivation factors, albeit predominantly focusing on the latter. These are primarily based on individuals' beliefs, values and attitudes, but can also be influenced by economic motivation factors and by other external motivation factors such as government policies.

Comfort in the home is an important internal factor (Aune, 2007; Munro and Leather, 1999), and it is cited by the existing literature as a principal motivation for performing works in the home (DCLG, 2011a; Pellegrini Masini *et al.*, 2010; Aune, 2007; Anker-Nilssen, 2003). Home improvements are performed to create a 'home', to provide comfort, and because of a perceived necessity (Munro and Leather, 1999). The concept of 'comfort' is shaped by the owner-occupier's values and beliefs (Stern, 1986), and is culturally dependent, which has implications for habits and technological preferences (Stephenson *et al.*, 2010; Aune, 2007). Consequently, the decisions about how to improve home energy efficiency will be dependent on both the personal preferences and on cultural background.

People are principally motivated by increased levels of comfort and for economic reasons (i.e. to save money) (Aune, 2007). In the DCLG (2011a) report, this was true across all income levels. However, the frequency of environmental motivation increased with income, and comfort as a principal reason increased as income decreased. Comfort motivation has also been found to have greater importance over monetary savings in higher income households (Pellegrini Masini *et al.*, 2010; Anker-Nilssen, 2003), appearing to support Maslow's Hierarchy (Pellegrini Masini *et al.*, 2010).

4.7 ENVIRONMENTAL MOTIVATION

Motivation theories and some studies have suggested that those groups who are in a more financially secure situation and/or have met their basic needs (e.g. higher income groups) are more likely to be environmentally concerned, suggesting that owner-occupiers from higher income groups are more likely to undertake EER than those from lower income groups. However, other studies have shown higher income groups to be less environmentally concerned (Anker Nilssen, 2003), which potentially runs counter to Maslow's theory.

Individuals deemed as environmentally concerned or 'altruistic' are more likely to have the propensity to act in relation to energy efficiency (Martinsson *et al.*, 2011).

Despite this, 'environmental motivation' tends to be assigned a lower priority of the three 'motivation themes' (Nair *et al.*, 2010b), becoming ineffective where large costs or significant barriers exist (Pellegrini Masini *et al.*, 2010). Therefore, the environmental benefits of performing EER may be an advantageous byproduct rather than a principal motivation to act.

In contrast, in terms of improvements in home energy efficiency performance, the DCLG (2011a) report indicates that of the three 'motivation themes', environmental reasons for undertaking works was the second most given response across all income groups, while monetary reasons was the first most given. Environmental reasons were only given a lower priority to comfort by those over 65 years old, when the data was disaggregated by age.

The monetary, social and environmental 'motivation themes' are likely to have an affect on whether owner-occupiers can be successfully motivated to take action, and can provide a guide for framing motivation campaigns. So, by taking into account what is most likely to motivate a particular target group of owner-occupiers to take action, campaigns can place emphasis on monetary, comfort, environmental themes or a combination of these (Zundel and Stieβ, 2011). Emphasis may change as individuals' priorities change over time. 'Priorities' have therefore been incorporated into the conceptual model. The fluidity of the internal and external motivation factors has also been reflected as much as possible in this model.

4.8 INITIAL CONCEPTUAL MODEL

Two models are presented here to demonstrate the development of the conceptual model. Figures 4.1 and 4.2 have been developed from existing motivation theories and concepts. The first model (Figure 4.1) demonstrates the diversity of all the variables involved in EER. This was developed from the extant literature, incorporating studies on motivation, house maintenance, refurbishment, technology adoption, and domestic energy consumption. These have highlighted multiple variables, which have been subsequently placed in groups. These groups are

contained within a context (demonstrated by the dashed line) and are interrelated as demonstrated by the red arrows. Each group also reflects whether the individual needs to be willing, able or both for action to be facilitated. A circle was chosen rather than a linear or similar model as there is no definitive 'start' or 'end' point or group of variables.

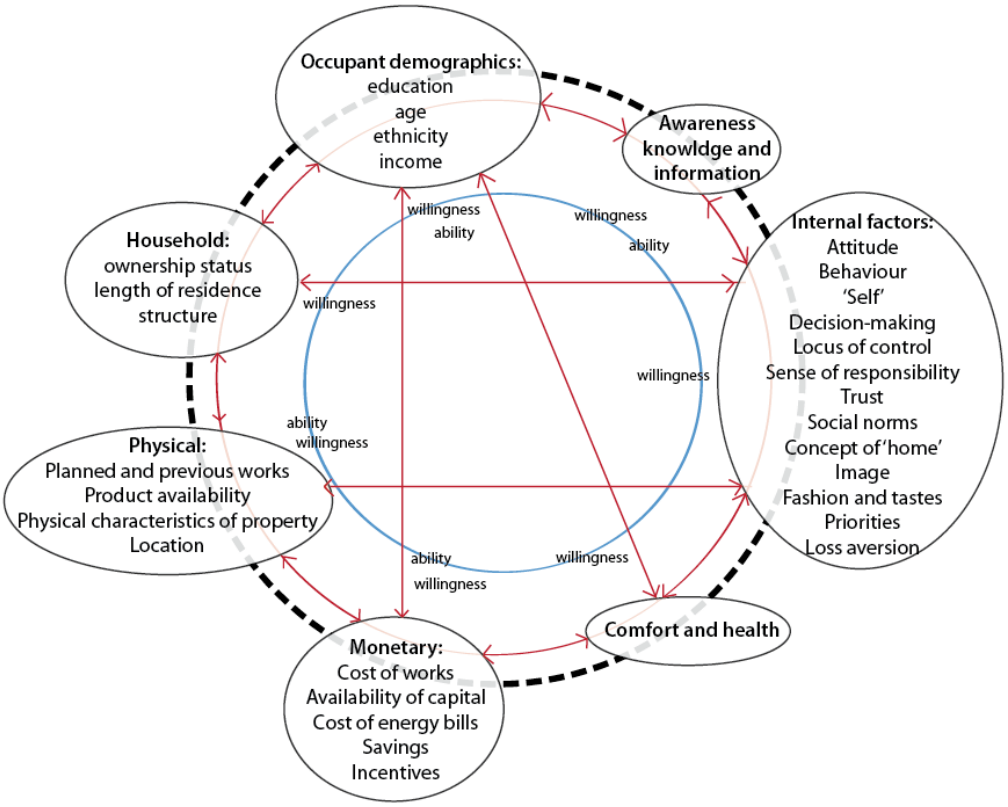

FIGURE 4.1: Groupings and interrelationships of the factors in the motivation for EER.

From this, the main conceptual model (Figure 4.2) was developed based on the 'internal factors' group. This also was circular as, again, there is no definitive 'start' or 'end' point, and to represent the fluidity of motivation for EER. Existing motivation models tend to either be simplistic or overly complicated, typically not demonstrating the relationship of motivation with the overriding context, even though the context has been deemed to be important.

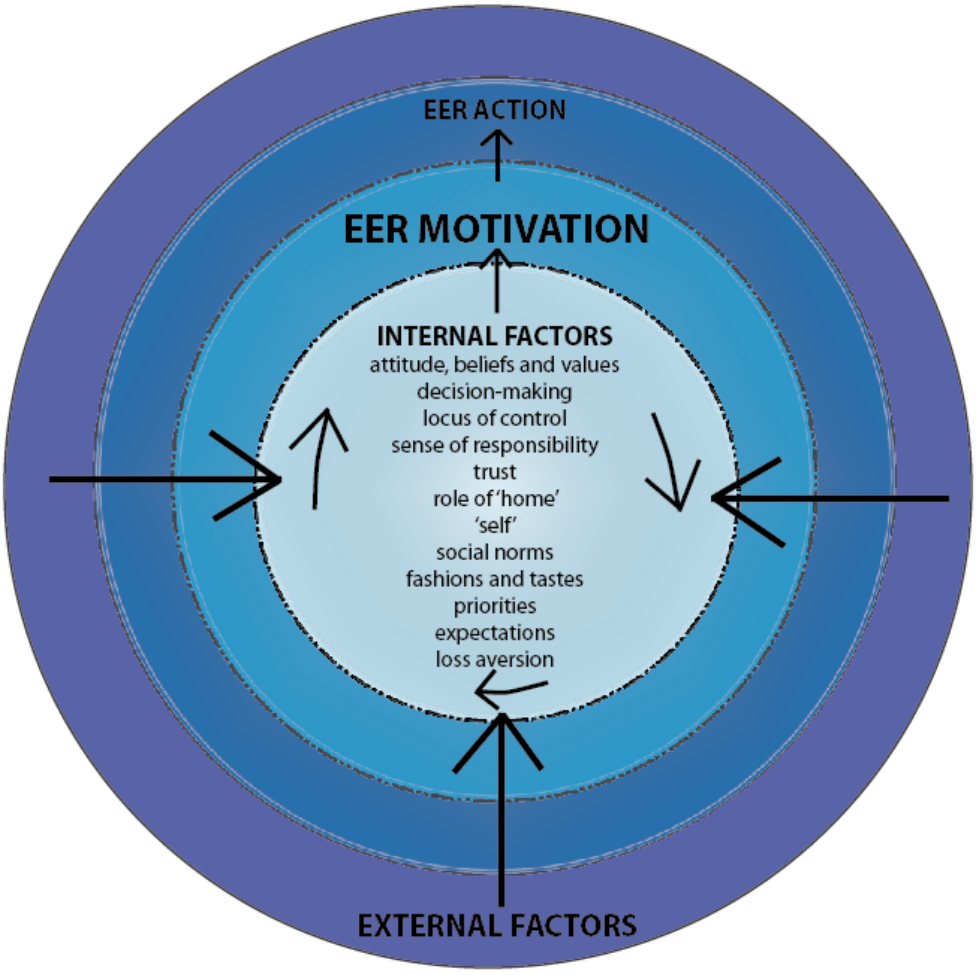

FIGURE 4.2 A conceptual model of the internal and external factors affecting owner-occupier motivation for EER

Unlike models such as Maslow's Hierarchy and Vroom's Expectancy Theory (Tan, 2008; Sirgy *et al.*, 2005; Price, 1992), which tend to have a limited number of variables, Figure 4.2 attempts to combine a wider range of variables and avoid the over-simplicity of some preceding motivation models: Figure 4.1 attempts to avoid over-complicating a complex subject. Unlike other models, Figures 4.1 and 4.2 do not suggest a final destination, and Figure 4.2 in particular indicates an ongoing process, where the context and internal factors potentially change over time.

Despite the broadness of the model, Figure 4.2 not only demonstrates the multiple variables which may affect owner-occupier motivation for EER. It also demonstrates the interrelationship of these variables. It can be built on further and provides flexibility to be applied to specific contexts, and advantages in the heterogeneous owner-occupied housing stock.

To increase owner-occupier EER motivation, internal factors and how they are affected by external factors (the context) need to be taken into consideration. The socio-economic profile will differ between areas, for example, but this may not only affect internal factors such as attitudes, social norms, priorities and the role of 'home', but it will also affect external factors such as access to funding for refurbishment works. Restrictions may apply to areas with historic buildings, and local programmes may support the installation of particular measures over others. This will, therefore, affect whether an owner-occupier can be motivated or not, the type of action they take and, to some extent, how they prioritise their internal factors.

Where the external incentives and/or campaigns for promoting increased uptake of EER solely focus on external factors, there is a risk of being less effective than if the incentives and campaigns are not congruent with individuals' internal factors. Incentives and/or campaigns need to appeal to and go some way towards satisfying owner-occupiers' internal factors. The desirable outcomes must be presented clearly, whether the outcomes are based on economic, social or environmental themes. Owner-occupiers are more likely to favour the status quo unless the owner-occupier's internal factors are satisfied and the desirable outcome of action is clear.

It is worth noting that both low- and high-income groups have higher priorities and constraints on their income than performing works to their homes (Munro and Leather, 1999). 'Other priorities' are recognised as a barrier to undertaking home improvements (Whitmarsh *et al.*, 2011; Stewart *et al.*, 2005; Munro and Leather,

1999;) and indicates the potential for complex and differing motivations for undertaking home improvements or refurbishments.

The conceptual model for owner-occupier EER motivation needs to be dynamic because neither motivation nor the home are 'start-end' processes; rather they change over time, as the needs, desires and internal factors of the owner-occupiers change. Both internal and external factors change over time and between locations, social groups and individuals. The conceptual model must be flexible enough to take account of this dynamic process.

4.9 DEVELOPMENT OF THE CONCEPTUAL MODEL FOR EER IN OWNER-OCCUPIED HOUSING

Figure 4.2 has been developed based on the literature review, incorporating internal and external factors, demonstrating how these interrelate, and how they affect motivation for, and the performance of, EER. Internal factors, energy efficiency motivation and EER action will all be affected by external factors (i.e. the context).

Internal factors are in the centre of the model (Figure 4.2). These and their propriety are specific to each individual, and interrelate and change over time. This is reflected by the arrows circling the internal factors in Figure 4.2. The internal factors not only affect the motivation to undertake EER but also influence the form that action takes. This is indicated in Figure 4.2 by the arrows flowing from the internal factors to EER motivation and action.

Internal factors are affected by other internal factors as well as external factors such as current incentives, penalties, social norms, the housing market, the condition of the property, the cost of the works, regulations, amongst others. External factors change more quickly than internal factors, but can affect internal factors, motivation and action. Figure 4.2 reflects this through large arrows moving from the 'external factors' layer, inwardly through the other layers.

Where an individual perceives the principal role of the 'home' as providing a comfortable environment, a rise in the cost of fuel and the affect on the individual's energy bills (an external factor) will threaten this comfortable environment through the impact on the affordability of heat. Therefore, this individual is more likely to act to maintain or improve the comfort of their home because they value the expected outcome of taking action. Also by taking action, they avoid negative emotions which could result from inaction such as discomfort and dissatisfaction.

The Feed-in Tariff made the act of installing electricity-generating technology, e.g. photovoltaic panels, more desirable by providing a reward (i.e. an income) for energy generation. This has resulted in an increase in the number of installations of this technology since the introduction of the scheme (Ofgem, 2012). By increasing the desirability of the expected outcome (i.e. an income for the generated electricity in addition to the desirability of greater fuel security and 'environmentally friendly' image) through external coercion, the perception of loss (technological and social risk) is over-shadowed by the potential outcome, and the likelihood of action is increased.

There has already been some acknowledgement in the literature of external factors such as the barriers to greater uptake (Energy Saving Trust, 2010; Housing Forum, 2009). However, limited work has been done to incorporate internal factors in relation to EER motivation, despite internal factors being a main component in motivation theory.

Existing motivation models appear to only partially apply to owner-occupier motivation for EER. Concepts featured in existing theories such as the 'self', social norms, outcome expectations and loss aversion are applicable to owner-occupier motivation for EER. However, existing models do not entirely explain EER motivation, and tend to place greater emphasis on a 'start-end' process, which is not necessarily suitable for the dynamic process in which both the external (context) and

internal factors change over time. Subsequently, motivation for EER will also change over time.

4.9.1 Internal Factors – The Model

The internal factors incorporated in the conceptual model have been elicited from the extant literature. An individual's attitudes, beliefs and values – which will dictate where the individual will be placed on an altruistic-egocentric continuum – appears to be the foundation for a number of other internal factors such as decision-making, sense of responsibility, the role of 'home', the 'self', social norms, fashions and tastes, outcome expectations and loss aversion (Stephenson *et al.*, 2010; Aune, 2007; Sirgy *et al.*, 2005; Kollmuss and Agyeman, 2002; Munro and Leather, 1999). Many of these are also guided by the individual's emotions. We can thus begin to see the interrelated nature of the internal factors.

The locus of control of an individual and their self-efficacy may also be affected by their attitudes, beliefs and values. Locus of control reflects whether or not a person feels capable to make changes through their own efforts. To be motivated to perform an EER, an owner-occupier should hold a positive locus of control to facilitate future action, particularly for environmental reasons. Self-efficacy refers to an individual's belief in their own abilities, and is possibly more significant for EER motivation than locus of control. It is, however, intertwined with a locus of control.

Central to motivation for EER is decision-making. This results in the adoption of action, the rejection of action in favour of alternative scenarios, or the maintenance of the status quo. How decisions are made in relation to the home is dependent on how owner-occupiers perceive the role of the 'home' (i.e. is it a platform for activities, social interactions, a haven, and so on?), their priorities, their perception of 'self' (including actual, ideal and social image), social norms (i.e. what they perceive as acceptable by the social group to which they belong or aspire to belong), and fashions and tastes at the time.

The sense of responsibility an individual has to undertake EER (i.e. to reduce their environmental impact) can also reflect the principal motivation for action (i.e. environmental motivation theme). Individuals with a weaker sense of responsibility would be better motivated through the economic or social motivation themes.

The trust owner-occupiers have towards government, institutions, contractors and community has been recognised as a factor which can affect whether or not individuals take action in relation to their home. Individuals with a lower sense of trust are less likely to be motivated to act than those with a higher level of trust. This is an important aspect in the context of the home, which is usually perceived as safe and secure. Consequently, individuals with lower trust levels may be better engaged through a social motivation theme, such as retaining comfort, safety and security of their home (including improved fuel security).

The expected outcomes of an EER, whether it be a more comfortable home, savings on energy bills, or other outcome, are perceived as desirable or not may motivate individuals to take action. Where the owner-occupier does not attach a high value to the outcomes, they are unlikely to be motivated to act, and are more likely to favour the status quo. The status quo is typically favoured, individuals being loss adverse (e.g. economic risk, social risk) and shown to overestimate losses and underestimate gains. The desirability of the outcome must, therefore, outweigh the perceived losses and risks.

4.9.2 External Factors – The Model

External factors have been the focus of many studies in home energy efficiency improvements (DCLG, 2011a; DCLG, 2009b; Grosche and Vance, 2009; Housing Forum, 2009; Meijer *et al*., 2009; Barr, 2003; Baker and Kaul, 2002). Although external factors are not the main focus of this research, they still form an important aspect in the forming of EER motivations. External factors relate to the context in which an owner-occupier is situated and are reflected more broadly in Figure 4.1. These include the physical characteristics of the property, product availability, cost of

the works, and available grants and financing mechanisms. There is, however, inevitable overlap with internal factors, due to aspects of knowledge and awareness, and practical capabilities of the owner-occupier (e.g. ability to perform 'do-it-yourself' projects) (Fawcett and Killip, 2014; Peng, 2013) which are associated with both internal and external factors.

4.10 IMPLICATIONS

The conceptual model (Figure 4.2) could be useful in a number of applications. Broadly, it could be used to shape national and local policy. It could be used as a model to guide the implementation of an incentive scheme which is sympathetic to different contexts. It would also aid understanding of the principal factors which can stimulate and sustain motivation for engaging owner-occupiers in EER and to encourage action going beyond the level of action facilitated by the Green Deal. Although it is unlikely to directly affect EER uptake, the implementation of this model at a policy level potentially will.

Information campaigns could, in addition, be guided by the model (Figure 4.2), particularly at a local level, providing greater consistency in terms of internal and external factors, and a better understanding of motivations for EER and how to best encourage this amongst owner-occupiers. The identification of the principal motivations and the strengths of these motivations within a locality will enable local policy makers and professionals to better target owner-occupiers more effectively by focusing on the most influential motivations for owner-occupiers in their specific areas within their information campaigns.

Professionals are less likely to use the model directly, but its use at research, policy and local levels might enable improved understanding of EER in owner-occupied housing within industry indirectly. This improved understanding could facilitate the ability of advisors and other professionals to better assess owner-occupier motivations

for undertaking EER, and thus help to sustain the motivations of their clients and to provide better services.

4.11 SUMMARY

Owner-occupier motivation is multifaceted and complex. Motivation is the precursor to EER (i.e. action) and to encourage greater uptake of EER a better understanding of this motivation is required.

Existing motivation models and concepts, which have typically been derived from a psychology or sociology perspective, give some indication of potential motivations. However, these have yet to be specifically applied to EER. Existing theories suggest that people are driven by a combination of needs and desires, their expectations and perceptions of outcomes, their perception of risk, their perception of actual and ideal 'self', and by social norms. Although this is useful in providing some insight into owner-occupier motivations for EER, existing models are not sufficiently applicable to provide adequate understanding.

The conceptual model (Figure 4.2) has been developed from the existing literature and from existing models to indirectly facilitate greater uptake of EER through improved understanding, particularly at policy level. This multi-disciplinary, dynamic model incorporates concepts from existing theories, but unlike many theories, the model relates the factors to the context. Motivation will be influenced by a wide number of interrelated internal and external factors, as demonstrated by the model. There has been an attempt to demonstrate the relationship between the multiple factors which affect EER in relation to specific contexts.

Owner-occupiers are likely to perform EER works for three principal reasons – energy bill savings, to increasing comfort and to reduce environmental impact. Whether individuals have a more 'egocentric' or 'altruistic' attitude affects the strength of these principal motivations. This should be taken into consideration when

deciding on the most appropriate approach to adopt to motivate owner-occupiers to undertake EER, particularly in government policy. Future government programmes could use the model to inform policy, information campaigns and incentives, increasing motivation levels and, in doing so, stimulate greater uptake of EER. Professionals and organisations could use the model to provide more effective information and services, and encourage greater action amongst owner-occupiers.

The following chapter presents the research methodology for the study.

CHAPTER FIVE: RESEARCH METHODOLOGY

5.1 INTRODUCTION

This chapter outlines the research methodology used to investigate the research questions. First, the underlying philosophical assumptions are discussed. Second, the research design - including research methods, data collection and analysis techniques - is described. Finally, a chapter summary is given. A critical realist stance is taken, complimented by the use of multiple case study research, to go beyond what is directly observable and to investigate the real domain of reality and, therefore, the underlying mechanisms of the motivations for EER in the owner-occupied housing stock. Figure 5.1 outlines the principal methodology phases, incorporating the methods used.

5.2 PHILOSOPICAL ASSUMPTIONS

Creswell (2003) describes a methodology as a "*strategy or plan of action that links methods to outcomes*", affecting the choice of methods and their use (p.5). Research methodologies are guided by the philosophical assumptions of the researcher. These assumptions relate to the nature of reality (the ontology) and to the extent to which this reality can be known (the epistemology). Philosophical assumptions, epistemologies, ontologies and methodologies have been grouped into research paradigms (Creswell, 2007; Creswell, 2003).

A research paradigm orientates thinking and research. It is the set of beliefs about the research topic, how it fits together, how we enquire about it and how we interpret the research findings (Wisker, 2001). It is a set of basic beliefs, 'metaphysics' or worldview. This basic belief system guides the researcher "*not only in the choices of methods but in ontologically and epistemologically fundamental ways*" (Guba and Lincoln, 1994, p.105). For the researcher, their worldview defines the nature of the world, "*the individual's place in it, and the range of possible relationships to that world and its parts*" (Guba and Lincoln, 1994, p.107).

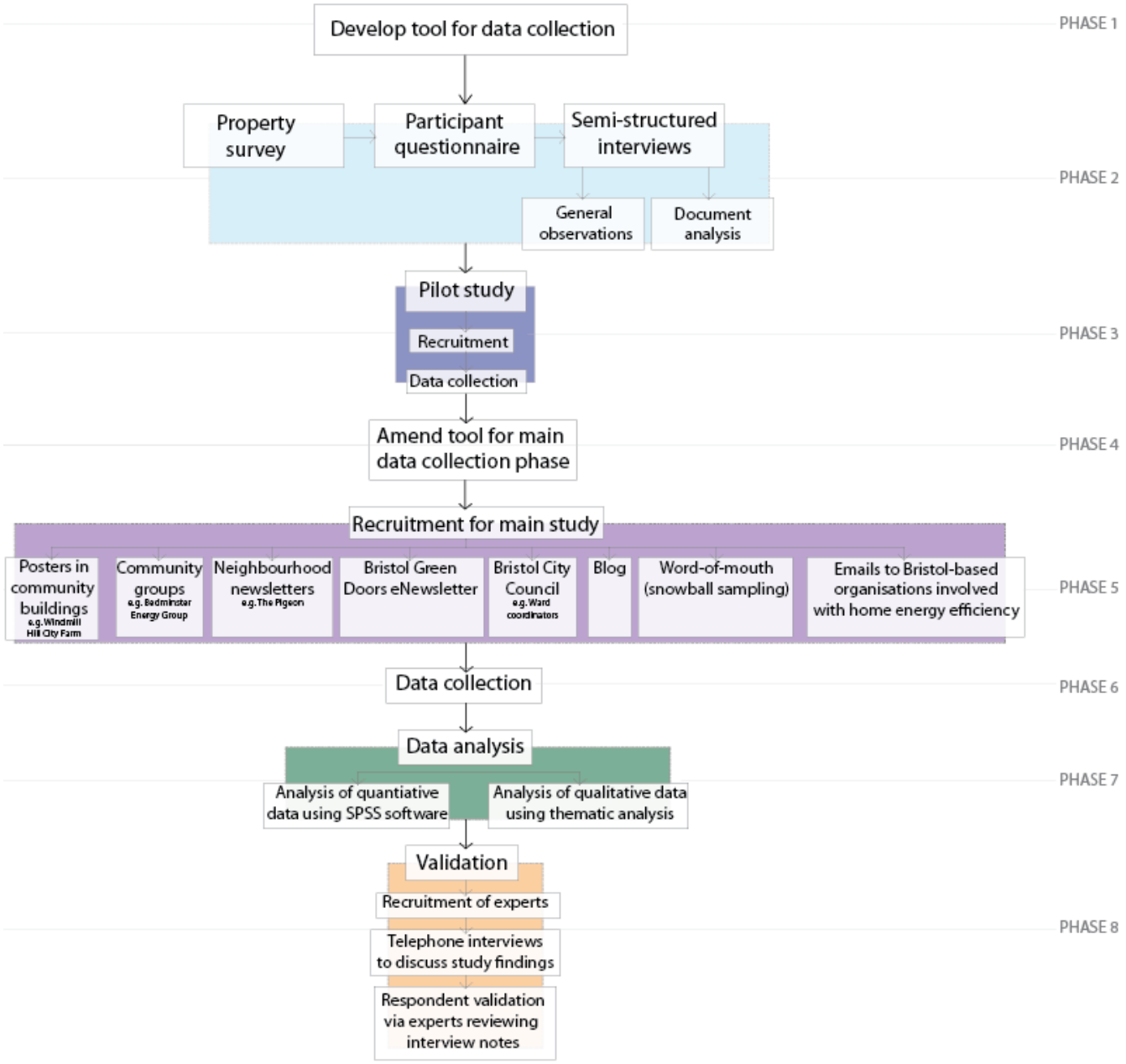

FIGURE 5.1 Principal methodology phases incorporating methods used in this study

Paradigms are currently viewed as lying along a continuum, with positivism at one end and constructivism at the other (Hunter and Kelly, 2008; Guba and Lincoln,

1994). Rather than perceiving paradigms as either quantitative or qualitative, they can be viewed as being positioned along a quantitative-qualitative continuum (Creswell, 2003). "*Although the main thrust of positivism is quantitative, there have been cases of qualitative positivism*" (Alvesson and Sköldberg, 2009, p.15). Unlike positivism, "*social constructivism is mainly qualitative*" although there have been examples of quantitative constructivist research (*ibid*.). In contrast, critical realism does not tend to favour either type of study.

Positivism became and remained popular during the first half of the twentieth century (Alvesson and Sköldberg, 2009). This epistemological stance advocates the use of natural science methods of investigation. Positivists assume existence of an objective, apprehendable reality (Guba and Lincoln, 1994). Based on quantitative data, positivism followed:

observable truths - phenomena and knowledge confirmed by the senses (Bryman, 2008);

law-like statements from which the manifestation of events are deducible (Paley, 2008);

deductive approach whereby theory generates hypotheses which can be tested to assess the explanations of laws (Bryman, 2008);

inductive strategy where knowledge is produced through the gathering of facts, which provide the basis for the law-like statements (Bryman, 2008);

generalisability, which is concerned with external validity of the research.

This attempts to generalise the findings beyond the context within which the study was undertaken, i.e. to demonstrate that the findings will apply to those actors or situations these findings are meant to represent (Bryman, 2008; Donmoyer, 2008);

verification - the process of checking aspects of the research process and/or the findings to confirm their accuracy and demonstrate rigor (Ballinger, 2008), distinguishing between meaningful and meaningless statements (Paley, 2008). Verification was rejected by some philosophers such as Karl Popper in favour of falsification (Guba and Lincoln, 1994);

falsification whereby a scientific statement is tested to ascertain whether it is true or false – where an observation does not corroborate the statement, the statement is considered not to be valid and is thus revised or rejected (Flyvbjerg, 2001); and

value freedom where the belief is held that science should endeavour to make research free from values (May, 2001).

In constructivism all knowledge of reality is socially constructed (Alvesson and Sköldberg, 2009). The form and content of these realities depend on individuals or groups holding the 'constructions' (Guba and Lincoln, 1994). However, according to proponents of this paradigm knowledge should not extend far beyond these social constructions (Alvesson and Sköldberg, 2009), rather the role of research is to explore how such social constructions are formed. Findings are created as the investigation proceeds by the 'interactively linked' researcher and object (Guba and Lincoln, 1994). Under this paradigm the "*distinction between ontology and epistemology disappears*" (Guba and Lincoln, 1994, p.111). Constructivism has links to grounded theory, hermeneutics, critical theory and feminism (Alvesson and Sköldberg, 2009).

Unlike constructivism, under critical realism, epistemology and ontology should be kept separate to avoid confusing what exists with the knowledge or beliefs we have about it (Alvesson and Sköldberg, 2009). From a critical realist perspective, positivism and constructivism are 'superficial' (Alvesson and Sköldberg, 2009), focusing only on one domain of reality (i.e. that which is sensorily observable). Critical realists purport there is a world independent of humans (Blaikie, 2010; Alvesson and Sköldberg, 2009), and the underlying mechanisms and structures which produce phenomena in this world can be represented through theories (Alvesson and Sköldberg, 2009). The interest in underlying mechanisms distinguishes this paradigm from other traditions.

The critical realist paradigm has been used to frame this research. Owner-occupiers may not be fully aware of the reasons and meanings behind their motivations and actions, therefore the constructivist paradigm is rejected. Motivations, whether acted upon or not, may not be directly observable and thus the positivist paradigm is rejected. There needs to be a study which goes beyond the surface of owner-occupier EER for greater understanding of the motivations for such refurbishments. Critical realism is the most appropriate paradigm for this.

According to critical realism there are three domains of reality – the empirical, the actual and the real. The empirical reality is what can be observed; the actual concerns what comes about independent from the researcher; and the real domain incorporates underlying mechanisms which produce phenomena. Critical realism is principally concerned with the study of the 'real domain' and how it is linked to the empirical and actual domains (Alvesson and Sköldberg, 2009). In the investigation of owner-occupier motivations for EER, there is a need to explore underlying mechanisms (i.e. the 'real domain') because motivation is not necessarily exhibited in the empirical domain and therefore may not be directly (or sensorily) observable. It is more likely to exist in the 'real domain', where it is a driving force for the empirical and actual domains.

Unlike science, which is a product of social conditions, the mechanisms science identifies operate "*independently of their discovery*" (Bhaskar, 1998, *in:* Alvesson and Sköldberg, 2009, p.40). Critical realism focuses on the network of "*theoretical and observable elements characterising efforts going beyond the surface of social phenomena*" to discover the underlying structures and mechanisms (Alvesson and Sköldberg, 2009, p.40). However, according to the critical realism paradigm, truth cannot be absolute and it "*rejects the possibility of a theory-neutral observational language*" (Johnson and Duberley, 2000, p.154). Although reality is assumed to exist under critical realism, due to basic flawed human intellectual mechanisms and phenomena being intractable, reality can only be imperfectly understood (Guba and Lincoln, 1994).

Case study research is well-suited to the critical realist paradigm because it involves the study of a phenomenon within its real-life context, thus generating understanding of the phenomenon, the principle issues, related issues and its context. Therefore, rather than focusing on the empirical and actual domains, case study research seeks to investigate beyond what is directly observable.

Within the critical realist paradigm there is a recognition that people may not be entirely aware of the reasons and meanings behind their actions (Johnson and Duberley, 2000), thus rejecting the notion that the world is created by the minds of its observers. Despite this, in-depth interviews are commonly used in critical realist case study research (Easton, 2010) to get close to the meanings of interviewees' and their interpretations of their social world (Blakie, 2010; Denzing and Ryan, 2007).

A multiple case study, cross-sectional method was adopted. A case study investigates a phenomenon or regularity within its real-life context, researching "*an experimental theory or topic using set procedures*" (Proverbs and Gameson, 2008, p.99). It enables the incorporation of contextual multivariate conditions rather than isolated variables (Yin, 2003), and is particularly favourable when the phenomenon under investigation

"*is not readily distinguishable from its context*" (*ibid.*, p.4). A case study should, therefore, not only show in-depth understanding of the principal issues of the study but also a broad understanding of the related issues and context within a bounded framework (Proverbs and Gameson, 2008). As an intensive research method, it is considered to be consistent with critical realism (Easton, 2010).

As the principal method, the challenge with case study research is, however, the richness and wide range of variables. This richness means that multiple sources of evidence will be required rather than a single data collection method. Case study research tends to incorporate multiple sources of evidence (Proverbs and Gameson, 2008; Miller and Brewer, 2003; Yin, 2003). The emphasis is on triangulation of methods to better enable the researcher to evaluate different sources of information and test their concept, theory or model ('construct validity'). A more robust result is produced where there is a consensus between sources (Proverbs and Gameson, 2008).

The research also used a retroductive strategy. It adopted an iterative, ongoing process to enable the refinement of the model and mechanism throughout the research process.

5.3 RESEARCH DESIGN

The research design provides a framework for data collection and analysis (Bryman, 2010). This study was a cross-sectional comparative case study. A comparative design "*implies that we can understand social phenomena better when they are compared in relation to two or more meaningfully contrasting cases or situations*" (Bryman, 2010, p.58).

This research takes a largely qualitative approach. The owner-occupier interviews were the main source of data. The building survey as a quantitative method, was used as a means of categorising the case study properties. A short questionnaire to capture basic information on socio-demographics and basic activities were also used and

completed by the participant whilst the researcher performs the building survey. Where available, documentary evidence was used such as energy bills, Energy Performance Certificates, photographs, surveys, specifications, operation and maintenance manuals, and construction drawings. Documentary evidence was used where available, and was of particular use where measures are concealed (i.e. wall insulation) or not accessible.

5.3.1 Multiple Case Study

Bristol acted as the bounded framework for the study, therefore, although the study was multi-sited, the case study neighbourhoods and properties selected were all situated within Bristol. Bristol can be considered as an exceptional case overall due to its 'green credentials', and the 'core city' in England suffering from the least deprivation overall. It also exhibits some typical features of 'core cities'. Therefore, although the case is 'exceptional' it is likely to feature some attributes of a 'typical case'.

Bristol is a major UK city; it is the eighth largest city in the UK and the sixth largest in England. It incorporates a wide range of styles of domestic architecture and has around 4,500 listed buildings (BCC, 2012a) and 33 conservation areas (BCC, 2009). This enabled investigation into whether such aspects affect owner-occupier choices for EER.

Bristol's population has been estimated to grow at a faster rate than the national population and other large cities in the UK (BCC, 2011). Between 2000 and 2010, it had an annual growth rate of 1.06%, ranked eighth fastest growing UK city in 2012 (Centre for Cities, 2012**)**. The population is forecast to increase by 10 – 20% over the next ten years (BCC, 2011), increasing the demand for housing. Energy use and carbon emissions have traditionally increased as population and economy grow. Yet, with local, national and international carbon and energy reduction targets it is essential to mitigate this increase in energy use and carbon emissions, the existing

housing stock being a good candidate for contributing to energy and carbon reductions.

The City Council has implemented a Climate Change and Energy Security Framework, incorporating projects such as supporting private sector insulation initiatives and the identification of Green Deal opportunities (BCC, 2012b). Considered to be the UK's 'green capital', Bristol has the greatest number of environmental organisations outside London (Sustainable Bristol, Date Unknown). It has been awarded the title of European Green Capital for 2015 – the first UK city to hold this title. It was a finalist in the European Green Capital award in 2010, 2011 and 2014 (*ibid.*). The city has been working towards reducing its contributions "*to climate change since 2000*" through the development and deliverance of strategies and action plans (European Commission, 2012).

In 2010 the city held the largest 'Green Doors' open event in the UK (Bristol Green Doors, 2012), and is currently the largest 'Green Doors' event outside London. In September 2012 it was one of seven cities to secure additional funding towards the implementation of the Green Deal. It is also considered to be one of the UK's most sustainable cities, ranked consistently in the top five in Forum of the Future's Sustainable Cities Index between 2007 and 2010 (Ross and Underwood, 2010; Aeron-Thomas *et al.*, 2009; Cowley *et al.*, 2007). It has a cluster of activities and organisations such as Forum for the Future and the Centre for Sustainable Energy working towards improving the energy efficiency of the local and national housing stock.

In England, 98% of deprived areas are located in cities, where "deprivation refers to a general lack of resources and opportunities" (DCLG, 2011b, p.1) and the deprivation score reflects "the circumstances and lifestyle of the people living there" (ibid., p.2). The South West of England conforms to a similar pattern with the majority of

deprived areas located within the Bristol area (South West Observatory Core Unit, 2011).

Bristol incorporates areas of extreme wealth and areas of extreme deprivation, measured under the Index of Multiple Deprivation (IMD). The IMD is a government-produced index identifying deprivation levels throughout England. Deprivation is assessed for lower social output areas (LSOA) against a range of indicators including income; employment; health and disability; education, skills and training; housing and services; crime; and living environment. There are also two supplementary indicators which fall under 'income deprivation' for vulnerable groups – income deprivation affecting children and income deprivation affecting older people.

Under the IMD, Bristol has 252 Lower Layer Social Output Areas (LOSAs), 61 LSOAs within the most deprived 20% in England, and 32 within the most deprived 10% in England. Bristol also incorporates nine LSOAs within the most deprived 2% in England, one of which is within the most deprived 1% in England. The nine most deprived LSOAs form part of five different wards – Filwood, Lawrence Hill, Southmead, Whitchurch Park and Hartcliffe (South West Observatory Core Unit, 2011; DCLG, 2011b).

Of the total Bristol population, 13.9% live in the most deprived 10% areas of Bristol, 25.3% of the population inhabit the most deprived 20% areas (South West Observatory Core Unit and Homes and Communities Agency, 2011). It is ranked 93rd of 326 of English Local Authority Districts (where one is the most deprived), calculated by taking the average LSOA rank within the local authority district (Open Data Communities, 2012). However, in comparison with the other English 'Core Cities', Bristol has the lowest percentage of LOSAs classified in the most 25%, 10% and 5% most deprived in England (Birmingham City Council, 2011).

Although Bristol has attributes which might make it unique (and therefore an exemplar case), as with all cities and regions it comprises of wards categorised as having low, medium and high deprivation under the IMD. Therefore, findings could be representative of other cities and regions.

5.3.2 Case Selection

The case selection process must clearly state the particular reasons why a specific group of cases is needed (Yin, 2003). This purposive form of sampling is often used in case study research to identify participants who are most likely to contribute data which are relevant to the research questions and sufficiently detailed (Oliver, 2006). The process involves establishing the criteria against which cases are screened beforehand to assess whether these cases meet the study criteria. As explained above, the overarching case within which the case study neighbourhoods are bounded is Bristol. The units of measurement are the 'case properties'.

Table 5.1 outlines the criteria against which the potential case study neighbourhoods and properties were assessed. The purpose of producing such a table is to use purposive sampling to capture as many of the variables suggested by the literature as having an influence on individuals' decisions and motivations in relation to their home. It also aims to reduce the subjectivity of selecting cases, a potential bias and threat to the research validity (Oliver, 2006).

Case properties were selected on the basis of their deprivation relative to their LSOA. High, medium and low deprivation LSOAs were included in the sample population. These wards were Whitchurch Park (high deprivation), Henbury (medium to high deprivation), Knowle (medium deprivation), Windmill Hill (medium deprivation), Bedminster (medium deprivation), Southville (medium deprivation), Redland (medium to low deprivation), Clifton East (low deprivation), Henleaze. (low deprivation). Whitchurch Park incorporates three of the total SOA designated the

most deprivated 10% in England. The distribution of these properties is shown in Figure 5.2.

The wards incorporated a mixture of dense urban spaces and more sparsely populated areas as indicated in Figure 5.3. The sample also incorporated a range of different architectural styles, from Regency and Victorian to interwar properties. It also included one property in a Conservation Area (Clifton East). The sample properties included a range of construction dates, many of which were solid walled reflecting the high proportion of this construction type in Bristol, and the higher domestic property age in Bristol relative to the national average. For example, 60% of domestic properties in Bristol were constructed prior to 1944, in comparison with the England average of 49% (Opinion Research Service, 2012). Based on the multiple wards included, and because Bristol, like other UK cities, is composed of various family structures and socio-demographics (BCC, 2013), it was anticipated that these variations would be reflected in the sample.

The selected cases enabled the investigation of motivations and variables between case types, including investigation between different and similar cases. Although a specific ‘negative case’ was not incorporated, the use of properties with differing levels of EER were aimed to provide a form of negative case. Not only did the no or low-EER cases provide a more detailed comparison (i.e. whether the motivations of owner-occupiers in these case properties differed from those in EER properties), but also provided a strategy to avoid cases being selected on the basis that they supported the developing account (Schwandt, 2007).

TABLE 5.1 Case selection criteria cross-referenced to cases

CASE SELECTION CRITERIA		JUSTIFICATION
1	Different types of construction/architectural types (including conservation area/Listed properties).	The literature suggests that construction and architectural types affect people's decisions to act or not, and how they act. Including different construction/architectural types in the selection criteria will attempt to see whether and how this affects motivations of owner-occupiers.
2	Different location types - urban, suburban and rural.	The literature suggests that rural properties tend to be the least energy efficient. Including location type in the selection criteria will attempt to see whether and how this affects motivations of owner-occupiers.
3	Low, medium and high deprivation areas.	If the cost of works is a barrier to performing energy efficiency works as the literature suggests the level of area deprivation should be included in the selection criteria to see whether and how this affects motivations of owner-occupiers.
4	Households with different socio-demographics (age groups, income, professions, education levels, ethnicity).	The literature suggests different socio-demographic groups are more likely to perform works than others. Including different socio-demographic groups in the selection criteria attempted to identify the extent to which this affects motivations of owner-occupiers.
5	Different household structures (young families, professional couples, single parent, retired, amongst others).	The literature suggests that different household structures will be more likely to perform works to their homes than others. Including different household structures in the selection criteria will attempt to identify the extent to which this affects motivations of owner-occupiers.
6	Different length of residence	The literature suggests that the length of residence adversely affects whether owner-occupiers are likely to perform works. Including different lengths of residence in the selection criteria will attempt to identify the extent to which this affects motivations of owner-occupiers.

7	Different levels of EER.	Does motivation differ between owner-occupiers who perform no or minimal energy efficiency works and those who undertake whole house energy efficiency works? What makes those who have undertaken extensive energy efficiency works go further than the basic standards?

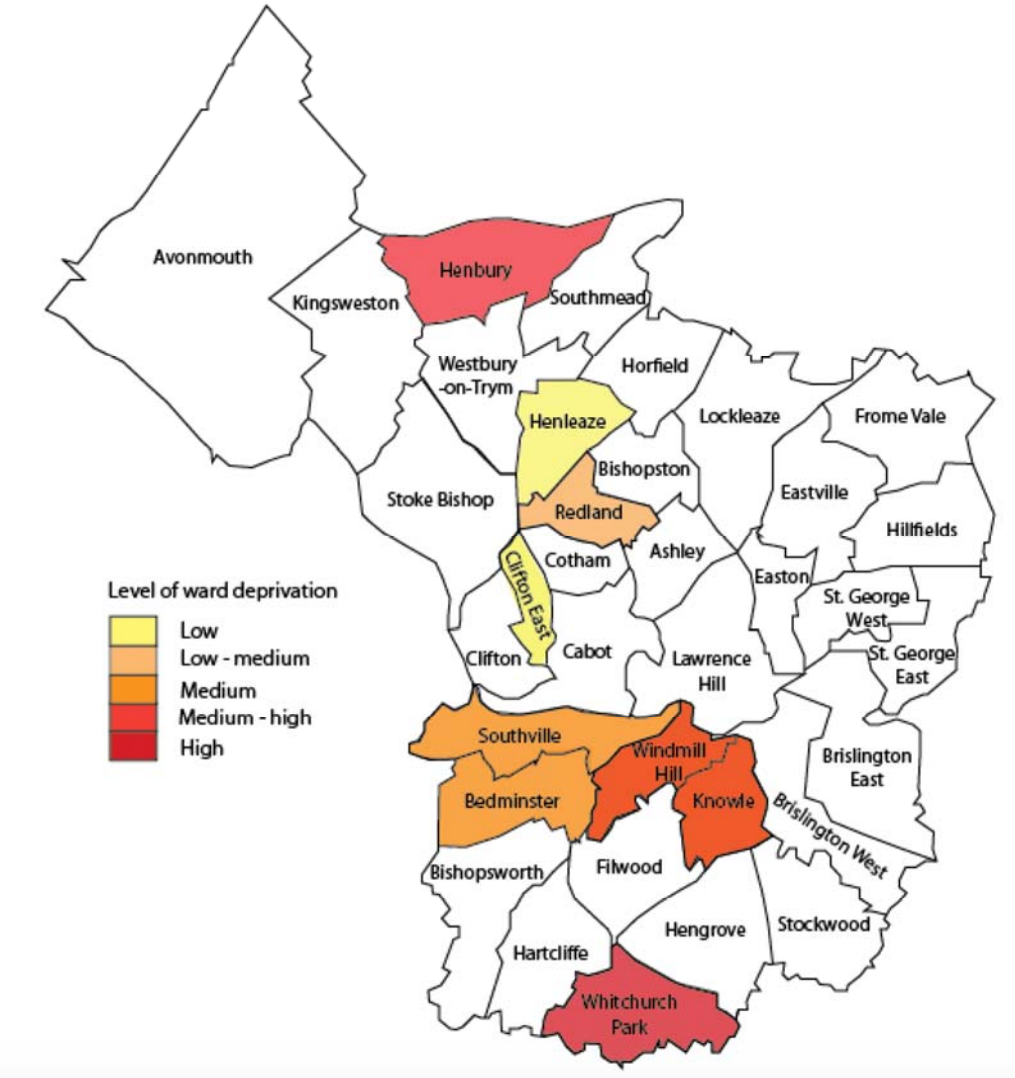

FIGURE 5.2 Study wards in relation to Bristol

Source: Author

(Adapted from Bristol City Council (BCC), 2008)

Contains Ordnance Survey data © Crown copyright and database right 2008

see license https://www.ordnancesurvey.co.uk/opendatadownload/products.html

FIGURE 5.3 The Bristol wards

Source: BCC (2008)

Contains Ordnance Survey data © Crown copyright and database right 2008

see license https://www.ordnancesurvey.co.uk/opendatadownload/products.html

Criteria one to six in Table 5.1 were developed based on the existing literature, which highlighted these factors as affecting whether owner-occupiers performed home improvement and refurbishment works. According to the literature, some of these, such as location and construction type, are potentially linked. The aim of Criteria seven is to investigate whether motivations vary between EER levels and therefore properties which had undergone differing levels of EER were required.

Figure 5.4 indicates that the number of properties considered 'non-decent' are predominantly located centrally. A home is deemed as 'non-decent' where it fails one of more of the Decent Homes Standard – be above the minimum standard for housing; be in a reasonable state of repair; have reasonably modern facilities; provide a reasonable degree of thermal comfort (Kaluarachchi and Jones, 2014; Opinion Research Service, 2012).

4.5 RESEARCH METHODS

Research methods are a set of procedures, tools and techniques used to generate and analyse data (Bryman, 2010). This is different from research methodology which refers both to the theory of acquiring knowledge and the task of considering, reflecting and justifying the most appropriate method to obtain data (Wellington *et al.*, 2005). That is, where the methods are the techniques for obtaining data to provide the base for knowledge, methodology relates to the theoretical approach to the research (*ibid.*). With regards to different research methods, critical realism is described as being reasonably 'tolerant' (Easton, 2010).

Broadly, there are two forms of research method – intensive and extensive (Easton, 2010). Whereas extensive research methods are typically (but not exclusively) concerned with large-scale and statistical analytical research, focusing on patterns and regularities, and has minimal explanatory capacity, intensive research incorporates the context, is concerned with causal explanation (*ibid.*) but is limited in terms of

statistical generalisability. The latter tends to use interviews and qualitative analysis (*ibid.*). This research method takes more of an intensive research approach.

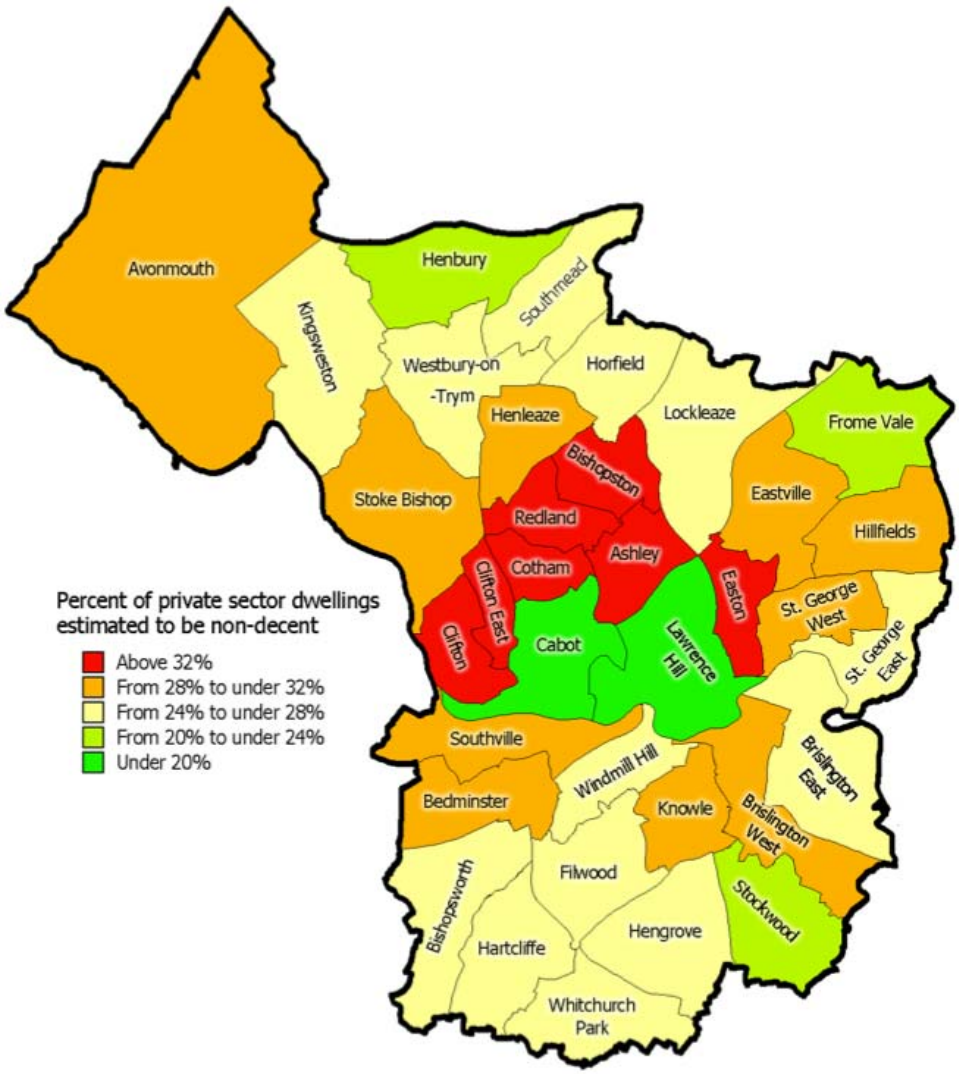

FIGURE 5.4 Rate of non-decent homes by ward

Source: Opinion Research Service, 2012

Table 5.2 outlines the research methods used to contribute to answering the research questions. In addition to the literature review, the interviews and physical surveys contributed to question one, incorporating aspects of the physical attributes of the buildings with the perspective of the owner-occupier. The interviews, physical survey

and documentary evidence complimented the literature review in investigating question two, which seeks to identify the principal motivations for EER, and question three which seeks to investigate the drivers influencing the motivations for EER. The interview also attempted to contribute to the investigation of questions four and five which ask the extent of values in the motivation for EER and which motivation theory or hybrid of theories 'best fits' EER.

TABLE 5.2 The research methods which contributed to answering the research questions

RESEARCH QUESTION		RESEARCH METHOD(S)		
		1	**2**	**3**
1	Why do owner-occupiers perform domestic EERs?	Interview	Building survey	
2	What are the principal motivations for EER in the owner-occupied housing stock?	Interview	Building survey	Documentary evidence
3	What are the drivers influencing owner-occupiers' motivations for EER?	Interview	Building survey	Documentary evidence
4	To what extent do owner-occupiers' values influence their motivation for EER	Interview		
5	Which motivational theory or hybrid of theories 'best fits' domestic EER?	Interview		

5.5.1 Interviews

The choice was to use in-depth semi-structured interviews with owner-occupiers to elicit deep, rich data which extends beyond the empirical and actual domains of reality, into the 'real domain' advocated under critical realism. Qualitative interviews are conversations which attempt to collect data, with the emphasis on the interviewer asking the questions and listening, and the interviewee responding to those questions (Corbetta, 2003; Warren, 2001). The in-depth interview is considered to be a technique which is able to get close to the interviewees' meanings and interpretations of their social world (Blakie, 2010; Denzin and Ryan, 2007), and is a technique frequently used in critical realist case study research (Easton, 2010) and in research

more generally (Fielding and Thomas, 2008). Although they have not been the most common method in motivation studies, they have been used in motivation research, particularly in the area of education (e.g. Dowson and McInerney, 2001).

Unlike existing data sets and surveys, the interview technique enables the opportunity for the researcher to clarify responses and to probe for further information (Dale Bloomberg and Volpe, 2008). One of the principal advantages of data collection through in-depth interviews is the potential to discover the perspective of the interviewee (May, 2001). The flexibility afforded through semi-structured interviews enables the interviewer to respond to the direction the interviewee takes the interview; that is, the interviewer can seek further clarification and elaboration from the interviewee, beyond the interviewees' initial answers. This form of interview therefore facilitates a dialogue between interviewee and interviewer (ibid.), in which the order and structure of questions can be varied, and additional questions can be included. However, semi-structured interviews also provide a structure to provide a platform for comparability between interviews (*ibid.*) by asking the same major questions in the same way in each interview (Fielding and Thomas, 2008).

There are well-documented limitations associated with using interviews as a data collection technique. Not only do interviews require researcher skill, but also the cooperation, articulation and perspectives can significantly differ between interviewees (Dale Bloomberg and Volpe, 2008). The use of semi-structured interviews can enable the interviewer to "*adapt the research instrument to the respondent's level of comprehension and articulacy*" (Fielding and Thomas, 2008, p.247). This uniqueness and the variation between interviews can make analysis difficult. To avoid difficulty, the themes in each case were identified before comparing these themes across the cases.

The accounts given by people in interviews may be inaccurate or, although the accounts may be genuine, there may be events or circumstances surrounding

interviewees' experiences which the interviewees are unaware (May, 2001). However, although data generated by interviews is not 'accurate' or 'distorted', it provides a way of analysing the way people perceive events and relationships, and the reasons for their perspectives (*ibid.*).

Further, rather than a neutral data collection technique, the data gathered from interviews are generated from an interaction between interviewer and interviewee, and the context in which the interview is held (Dezin and Lincoln, 2003; May, 2001). The data generated can be affected by the characteristics of the interviewer, such as gender, class and ethnicity (Denzin and Lincoln, 2003), and the interviewer's presence potentially causing a biased response (Creswell, 2003).

For a more complete understanding (May, 2001), to reduce the influence of the interviewer's presence on the interviewees' responses (Creswell, 2003), to temper the effect of the 'power' relationship on the dialogue, (Chrzanowska, 2002) and to observe interviewees in their own environment, interviews were performed in the interviewees' homes. This also had the advantage of the researcher being able to observe the immediate context and the interviewee in that context. It did, however, entail ethical considerations which are discussed in the section on ethics (Section 5.12). Further, to avoid the influence of the 'power' relationship, the researcher dressed in a 'smart casual outfit', which was neat, clean and inoffensive (Mauthner *et al.*, 2002). This also has the benefit of enabling practical clothing for a building inspection.

After securing consent from the participants to do so, interviews were recorded. Appendix A outlines the interview topics, questions and prompts, and which research questions they contributed to. These have been generated based on four principal topics guided by the literature review: attitudes, values and beliefs; motivations for installing EER measures; factors affecting original motivations; and factors affecting their decisions.

The interview topics guided the questions for those owner-occupiers who had undertaken EER and those who have not. It starts with a somewhat open question as a 'lead in' question regarding the participant's perception of their own motivation for EER. Overall, topic one (attitudes, values and beliefs) aims to investigate how the participant views the 'home', their connection to the environment, their social image and locus of control.

Topic two (the motivations for installing EER measures) forms the largest part of the interview. It aims to investigate the EER or energy efficiency measures which have been installed, motivations for EER and how this is affected by the perception of 'home'. It further considers the factors affecting the motivation to act, whether those who are non-EER households have previously considered EER, how long EER households might take to consider taking on such a project, the aims of an EER, and whether financial aid and other incentives would stimulate EER in non-EER households.

Topic three (the factors affecting original motivations) explored the factors affecting the decisions for undertaking (or rejecting) an EER. Finally, topic four (factors affecting their decisions) aims to identify the factors affecting the decisions which were made to undertake an EER or not, why certain measures were selected and whether these differ from those originally considered by the interviewee.

Interviews were transcribed verbatim, aiming to capture the language used by the participants. The interviews were fully transcribed rather than selected sections. The purpose of these approaches was to avoid missing meanings and themes. Although it is suggested that more selective transcripts are of greatest use, as the extraneous parts of a transcript will make the script difficult to read, this method was chosen as a means of the researcher developing greater knowledge of the data in order to better understand the themes and sub-themes during the thematic coding phase. Although

transcription cannot "*record all features of talk and interaction from recordings*" and are thus selective in some way (Davidson, 2009, p.38), observations were also noted during the interview process to mitigate bias at this stage.

Internal factors based on those internal factors in the conceptual model were presented to the participants on individual cards accompanied by a definition sheet. These were placed in order of strength as perceived by the participants relative to EER and EER motivation. An example of this is shown in Figure 5.5. The purpose of this was not only to avoid leading the participants but also as a comparison between the self-reported strength of internal factors against those elicited through the qualitative data.

5.5.2 Physical Survey

The decision was made to perform a basic building survey prior to the interview to identify key attributes of the building and the types of measures installed. First, it aimed to compliment the interview through providing the interviewer with greater understanding of the immediate context. It broadly provided a similar level of information across all the properties without needing to rely on the interviewees' knowledge, where the interviewees may or may not have a full understanding of construction, refurbishment and energy efficiency measures, thereby mitigating a potential weakness of the interviews. Second, the purpose of the physical survey enabled the categorisation of properties and comparison of motivations between categories. Third, the building survey identified the measures installed and assessed the EER level attained. This enabled exploration of energy efficiency measures and EER during the interview in terms of why specific measures were chosen above others (where other measures would have been technically feasible as assessed by the researcher), and why a particular level of refurbishment was reached as opposed to a lower or higher level. The use of a physical survey of the properties also required ethical considerations, which are discussed in Section 5.12.

FIGURE 5.5 Internal factors rearranged in order of strength for EER and EER motivation (Case 009)

The physical survey was carried out in accordance with the Royal Institution of Chartered Surveyors (RICS) Guidance Notes (2004) where applicable. The researcher followed "*a logical sequence of inspection*" when undertaking the surveys (RICS, 2004, p.14). As suggested by Hoxley (2002), surveys were undertaken starting externally where possible as to ease re-inspecting the exterior at a later date if anything were missed. Where possible, the internal inspection commenced with the roof space (*ibid.*). The RICS guidance notes were only partially applicable as there was no need to assess the needs of the clients, agree and obtain instructions from the clients, and comply with the agreed instructions. However, the researcher undertook an impartial, professional assessment of the property and its condition. In addition to this, the researcher undertook a preliminary desk study, covering information such as

Conservation Area and Listed Building status, relevant site information (*ibid.*), site history, and so on.

For the purpose of this physical survey, only basic equipment was used based on the equipment recommended in the RICS guidance notes (2004), including personal identification. It was assumed, and confirmed with participants prior to visiting, that the properties under investigation were not undergoing building works and, therefore, Personal Protection Equipment (PPE) was not required. A note was made of any reasons for the researcher not being able to physically access property or parts of.

Information of use to the study which may be available from the owner-occupier from the list given by RICS (2004) includes:

- Previous structural repairs, past/current insurance claims;
- Structural alternations/additions;
- Redecoration/renewal of finished;
- Age of property;
- Length of residence of current occupier;
- Listed or in Conservation area
- Availability of mains services

It should, however, be borne in mind that any information from the owner-occupier, unless confirmed through documentary evidence, may not have be entirely accurate.

5.5.3 Documentary Analysis

Where available, documentary evidence was used. This included documents such as energy bills, Energy Performance Certificates, photographs, surveys, specifications, operation and maintenance manuals, and construction drawings. An example of these

are provided in Figures 5.6 and 5.7. The purpose of including documentary evidence is to complement both the interviews and the building surveys. The documents should support or disprove what is said in the interviews and recorded in the physical survey, or where building measures/elements are concealed (e.g. cavity wall insulation) or not accessible.

This, as with the interviews and building surveys, entails ethical issues, particularly regarding confidentiality. This is discussed in the section on ethics, below.

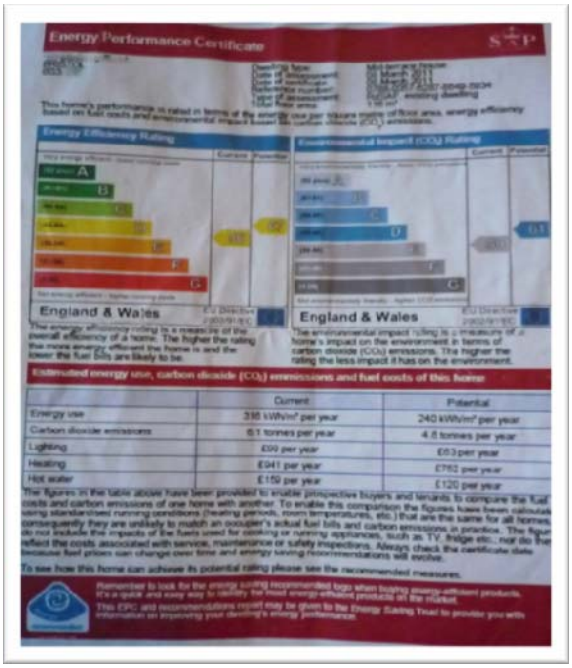

FIGURE 5.6 Example of documentary evidence – EPC (Case 002)


CAVITY INSULATION GUARANTEE AGENCY

25 Year Guarantee Certificate

The Guarantee

Period of Guarantee - 25 years from date of installation

Your Route to Total Satisfaction

Conditions

CIGA

CIGA House, 3 Vimy Court, Vimy Road, Leighton Buzzard, Beds. LU7 1FG

FIGURE 5.7 Example of documentary evidence – Cavity wall insulation guarantee (Case 012)

5.5.4 Interviewee Questionnaire

Whilst the building survey was being undertaken, interviewees were asked to complete a questionnaire to capture the information presented in Table 5.3.

TABLE 5.3 Interviewee questionnaire

INTERVIEWEE QUESTIONNAIRE TOPICS		
Age	Gender	Ethnicity
Education	Income	Family structure
Length of residence	Profession and profession of partner (where applicable)	Participation in groups/networks (e.g. local community groups, Green Doors events, 'green' or 'eco' groups or organisations.
Other environmental activities (e.g. recycling, growing own food, cycling to work)	Country of birth/country of residence for past 10 years	

5.6 DATA COLLECTION TECHNIQUES

There were a number of phases for data collection (Figure 5.1). Of these phases, phases three to six were primarily concerned with the data collection, including pilot study, recruitment and main phase data collection. This section will consider these four principal phases.

5.6.1 Question development, pilot study and question refinement

The key research questions (Section 1.6) were used as a framework to develop the participant interview questions. These were presented to demonstrate the relationship to the key research questions (Dale Bloomberg and Volpe, 2008). Feedback on the interview questions was sought from the study's supervisory team, and the questions amended where necessary. This was combined with a pilot study to reduce the risk of encountering errors arising from questions being poorly worded, or a poor interviewing approach.

A pilot study was undertaken in July 2013 to test the data collection techniques. This consisted of an owner-occupier in Hartcliffe (high deprivation ward) and an owner-occupier in Horfield (medium deprivation ward). Data collection was performed as intended during the main phase, including the use of consent forms and recording the interviews. Interviews were not transcribed, as the purpose of these pilot interviews was to inform the refinement of the data collection tools. Following the pilot study, the interview questions and physical survey framework were subsequently refined for clarity where the original questions posed difficulties for the pilot respondents (Fowler, Jr. and Mangione, 1990). This included further development of prompts as shown in Appendix B, and minor rewording of some of the interview questions. The physical survey (Appendix C) was amended to include 'water recycling'.

5.6.2 Main data collection

Fieldwork incorporated a basic physical survey of twenty-five case study properties, a participant questionnaire and an in-depth, semi-structured interview with the owner-occupier(s) lasting between 60 and 90 minutes. A copy of the interview questions is provided in Appendix A. Any other relevant materials discovered during the study, e.g. documents, were also incorporated into the data collection process.

Interview questions were based on four primary topics and these were divided into two distinct categories for EER and non-EER participants. The interview questions were cross-referenced with the key research questions (Section 1.6). Prompts were provided for each interview question in an attempt to standardise information provided by the researcher, and reduce potential bias. The interview questions were designed to build within a topic to avoid leading the participant. For example, under the topic 'factors affecting original motivation', a list of possible factors affecting motivation was only shown to the interviewee after they had been asked whether they could think of any factors affecting their motivation.

All participants were provided with an information sheet about the study (Appendix B) and required to complete a consent form. Participants were sent this in advance where possible to provide them with the opportunity to read the information and the opportunity to terminate their participation where they felt uncomfortable. Only one individual terminated their participation upon being sent the information. The data was coded for anonymity (e.g. Case 001, Case 002). These coded names were used in the main research documents, with the participants' identities and their coded names stored in a safe.

The physical survey of the building enabled categorisation of the case properties in terms of physical features, level of EER, type of energy efficiency measures, and so on. This also enabled further investigation of the first and third key research questions during the participant interview. A standard framework was created to enable the

same approach to be adopted for each physical survey. This framework is provided in Appendix C.

5.7 SAMPLING

Case properties were selected based on a number of criteria as outlined in Table 5.1. This incorporates the requirement to select properties within low to high deprivation wards which was done by referring to the IMD for Bristol. Purposive sampling was done to incorporate the first three selection criteria as much as possible. Where the information on the other criteria was available, as many of the selection criteria were used to guide the selection of case properties. Importantly, where possible at least two properties from the same area were included to investigate whether particular areas had an affect on EER motivation. Across the twenty-five case properties, there were examples of no or low EER to high level EER.

Properties were selected using a combination of purposive sampling and snowball sampling, which is a subset of purposive sampling. Interviewees were asked at the end of the interview whether they knew of other owner-occupiers in the area who had undertaken EER, who would be potential candidates for the study.

The researcher approached energy community groups (e.g. Bedminster Energy Group), organisations, particularly those working in home energy efficiency, and BCC (e.g. Ward coordinators/officers) regarding potential participants, but complying with the 1998 Data Protection Act. Flyers were also posted through front doors of properties in a variety of ward deprivation categories where these were observably undergoing works (e.g. solid wall insulation) or featured low carbon technology on the exterior of a property. Posters were displayed in community buildings (e.g. Windmill Hill City Farm), advertisements in ward newsletters (e.g. The Pigeon) and the Bristol Green Doors eNewsletter, and finally a blog was set-up outlining the study and asking for participants (Figure 5.8). The blog was also used to communicate a summary of the research findings. The variety of sources used provided a broad base

for recruitment. A nominal £10 voucher was provided to participants for donating their time to the study (i.e. an honorium). In research, vouchers vary in value from less than £5 (Prestage and Humphrey, 2014) to over £100 (Greenbaum, 1998). Housing studies (e.g. Wallace *et al.,* 2014) have been reported to reward participants with £20 vouchers. Based on this information, in the present study, a £10 voucher was provided to participants – a central point between the £5 and £20 outlined in the literature. Those participants who were recruited early were unaware of the voucher; this was only advertised for later recruitment drives with the study information.

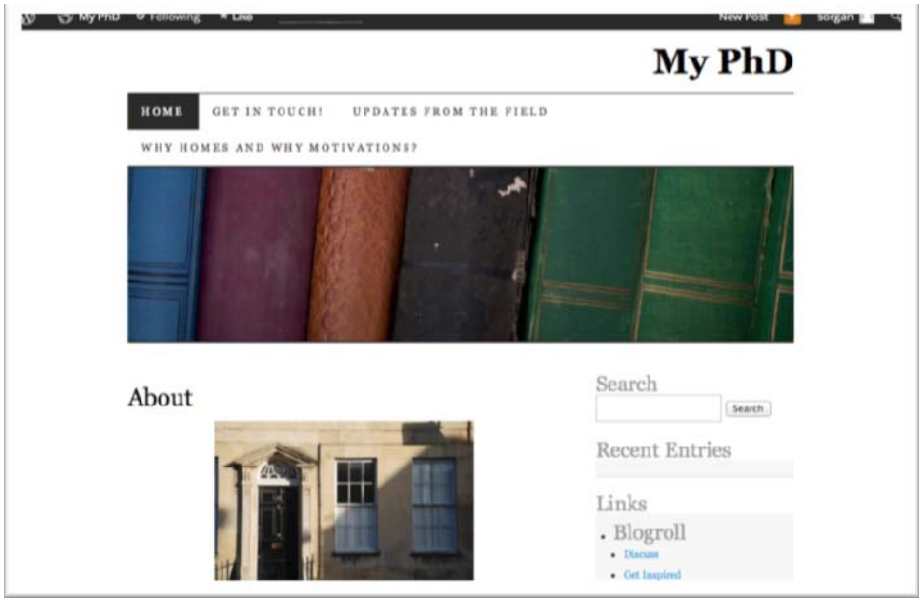

FIGURE 5.8 Research blog used for recruitment purposes and to communicate findings

The researcher made herself available in various wards on specific dates as outlined on the information flyers (Figure 5.9 and Appendix B) to answer any questions owner-occupiers might have. There were ethical implications of doing this, and precautions were taken as outlined in Section 5.12.

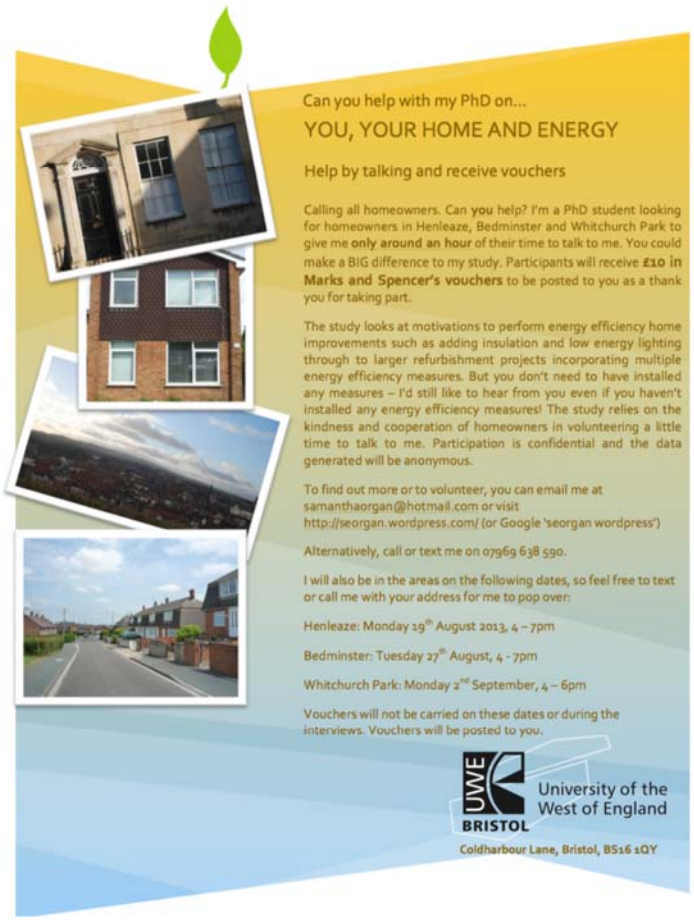

FIGURE 5.9 Recruitment flyer targeting the Bedminster, Henleaze and Whitchurch Park wards

5.7.1 Sampling - General

Some forms of non-random or non-probability sampling methods aim to achieve a level of representativeness without using random sampling methods (Davidson, 2006). Two non-probability sampling methods was used in the study - purposive sampling and snowball sampling.

The use of non-probability sampling can result in human judgement affecting the selection process, "*making some members of the population more likely to be selected than others*" (Bryman, 2008, p.169). Random sampling would have potentially eliminated this (*ibid.*), but would have also reduced the likelihood of the population having direct experience of EER.

A key limitation of this study concerned non-response error. Due to the type of interviewees required (i.e. owner-occupiers), there was a risk in an inability to trace and/or contact potential participants (Bryman, 2008). To mitigate this risk, a range of recruitment sources were targeted, including contact via trusted groups such as community groups and organisations, and through neighbours (snowball sampling). Further to this, there is a risk of refusal or inability to participate or supply the required data (*ibid.*). Although the option was provided to terminate participation at any time, this was reduced by providing volunteers with information about the study as early as possible, and to design the data collection so only a single visit was necessary, thus reducing the potential time burden on the participants.

5.7.2 Purposive Sampling

Due to the nature of the research in targeting owner-occupiers who have undertaken EER, purposive sampling was chosen as a sampling method. This sampling technique is common in case study research because it has the distinct advantage of enabling the selection of participants who are most likely to provide data that are relevant and sufficiently detailed to contribute to the research questions (Oliver, 2006). Purposive sampling was needed in the first instance to be able to select participants with first-hand experience of undertaking EER and for a diverse range of owner-occupiers to be included not only to avoid the influence of bias but also as a comparison between different selection criteria.

The main limitations of purposive sampling include the difficulty in applying or extending findings to other groups or situations (Given, 2008). However, to access owner-occupiers as a 'hidden population', i.e. one for which there is no list by which to trace them, particularly in relation to EER vs. non-EER households this was a necessary means by which to recruit members from this population to conduct exploratory research (*ibid.*).

Limitation concerns regarding purposive sampling relate to the quality of the data resulting from bias created by the selection process, thus limiting validity and the generalisation of the data (Morgan, 2008; Davidson, 2006; Atkinson and Flint, 2003). There was also potential for bias through the inclusion of individuals within certain social networks, but potentially excluding others who are external to those social networks and protective gatekeepers restricting access to the target population (Atkinson and Flint, 2003). The construction of the selection criteria and the use of a broad base for recruitment, and the additional use of snowball sampling were used to mitigate these potential limitations as much as possible.

5.7.2 Snowball Sampling

Snowball sampling was also used to access owner-occupiers for the study. Although not the main method of sampling, snowball sampling was particularly useful in gaining access to a number of the participants. This included neighbours of existing participants in some wards, and was particularly useful for gaining access to those who had already performed medium to high levels of EER.

Snowball sampling is a useful form of purposive sampling where no lists exist to locate participants of the population of interest (Morgan, 2008). It is classified as an 'ascending methodology', with research working upwards by locating those at ground level who are needed to "fill in the gaps in our knowledge on a variety of social contexts" (Atkinson and Flint, 2003).

The technique contradicts many of the assumptions which underpin more traditional sampling (Atkinson and Flint, 2003), but snowball sampling is considered to be a beneficial technique where the population under study is hidden or difficult to access. Classic snowball sampling typically involves the initial participant assisting in the recruitment of other participants (Morgan, 2008; Atkinson and Flint, 2003), thereby taking advantage of participants' social networks. However, this necessitates initial

participants knowing other participants "who share the characteristics that make them eligible for inclusion in the study" (Morgan, 2008).

Contact with populations which are potentially difficult to access is not the only advantage of this sampling technique. Other advantages are listed as: the development of trust because referrals are made by acquaintances, peers, family, friends; it is economical, efficient and effective; and can produce in-depth data relatively rapidly (Atkinson and Flint, 2003).

Snowball sampling is not only considered an alternative technique, but a complementary strategy for obtaining "more comprehensive data on a particular research question" (Atkinson and Flint, 2003). This was, therefore, used in conjunction with purposive sampling.

There are a number of limitations of snowball sampling, some of which are broadly similar to purposive sampling, including:

- the concern about the quality of the data;
- bias arising from selection limiting the validity and generalisations of the samples (Atkinson and Flint, 2003; Davidson, 2006; Morgan, 2008);
- bias pertaining to the inclusion of individuals within certain social networks, but potentially excluding those external to those social networks;
- access issues in terms of reticent or protective gatekeepers;
- can initially require some previous knowledge or contacts;
- the most popular, longer-term residents or those with a wider social network are more likely to be identified by initial participants. There is a general assumption that social networks comprise of individuals "*with relatively homogenous traits*" (Atkinson and Flint, 2003);

- there may be initial hostility and/or suspicion towards the researcher from the potential participants. The early establishment of trust is therefore important under this method of sampling.

Some of the issues such as inclusion issues were mitigated by including a diverse group of initial participants (Morgan, 2008), in accordance with the selection criteria. Where initial participants did not know their neighbours, or are unable or unwilling to pass on their neighbours' details, an information 'flyer' (Figure 5.9) was posted through neighbours' letterboxes in the neighbourhood where undertaking the interview with owner-occupiers who had undertaken an EER.

5.8 ANALYSIS

A holistic approach was taken in the analysis of the data (Creswell, 2007). This was done in two principal stages – the analysis of the qualitative data, the analysis of the quantitative, and then the cross-referencing between the two. First, the qualitative data was transcribed before the initial thematic analysis was done using the qualitative analysis software, NVivo. Property survey and questionnaire data was entered into the statistical software, SPSS to run descriptive and non-parametric analyses.

5.8.1 Qualitative Analysis

Analysis of the qualitative data by thematic analysis is where a search across and between the data sets occurs. The purpose of doing so is to uncover "*repeated patterns of meaning*" (Braun and Clarke, 2006, p.15). It is a form of analysis which is recognised as "*not wed to any pre-existing theoretical framework*" and amongst other theories has been used with critical realist work, acknowledging "*the ways individuals make meaning of their experience, and, in turn, the ways the broader social context impinges on those meanings*" (Braun and Clarke, 2006, p.9). NVivo is an effective tool for performing thematic analysis.

Coding through the use of nodes was performed. The aim of coding data is to enable the development of a detailed understanding of the phenomena under investigation (Lewins and Silver, 2007). Codes act as 'signposts' and although these can be generated in number of ways, in this study the coding was derived from the 'ideas or concepts' from the existing literature, and the conceptual framework developed from this literature (*ibid.*). The initial coding was added to or expanded where further 'themes or topics' were identified within the data set (*ibid.*).

Coding can be generated inductively, deductively or through a combination (Lewins and Silvers, 2007). The deductive approach tends to be explicit and can be selected when the researcher 'knows what to look for', guided by the conceptual model (Figure 4.2), the research questions, hypotheses, and so on (*ibid.*). The codes are generally formed prior to commencing fieldwork. The former approach is selected to prevent the influence of existing theories from overly affecting the data, and therefore a 'bottom-up' approach is taken, closely exploring the data and producing a large number of codes. However, inductive and deductive approaches are not 'mutually exclusive' (*ibid.*), and therefore a combination of the two can be beneficial. Both should be iterative and give 'close' consideration of the data (*ibid.*). The emphasis of thematic analysis is to work flexibly (Braun and Clarke, 2006) and, therefore, the thematic data sets were generated using a combined (inductive and deductive) approach. Initially nodes were created based on the motivation themes and the original conceptual model developed in Chapter four. The inductive approach was also used, resulting in the expansion of existing themes and the introduction of new themes where patterns were detected within the data pertinent to the study. Consistent with critical realism, 'latent' approach was used for theme identification, whereby the underlying ideas were identified "*as shaping or informing the sematic content of the data*" (Braun and Clarke, 2006, p.13).

The decision was made that there was limited benefit in analysing the frequency of certain words, and word linkages. Instead, the nodes produced in NVivo were manually processed. This had the additional benefit of being able to assess whether a

single comment made once was of greater significance than more frequently expressed elements. Coding enabled the identification of key issues within each case (i.e. analysis of themes) and the identification of common themes across and between cases (Creswell, 2007). The purpose of doing so was not to generalise beyond the cases, but to generate understanding of the complexities of the cases, and to transcend the cases (*ibid.*).

Themes highlighted during the thematic analysis were categorised by the quantitative data generated from the property survey and questionnaire. This facilitated comparisons to be drawn between motivations and property and socio-demographic characteristics, and between levels of EER. It also enabled the comparison of internal factors and pro-environmental behaviour in relation to EER. Chi-Squared tests were run to analyse the relationship between EER and a number of other variables including construction type (e.g. solid wall, cavity wall).

The justification for adopting the deductive approach as an initial approach to the coding of the qualitative data is two-fold: first, it was recognised that the research and the researcher are not free from theoretical or epistemological grounding, as implied with a purely inductive approach (Bruan and Clarke, 2006). Second, to ensure that the data generated was driven by the interest in the topic (*ibid.*). The use of an inductive approach as part of the coding strategy was to provide the potential for greater depth to be achieved in the analysis, and the opportunity to go beyond the themes identified by the extant literature.

5.8.2 Quantitative Analysis

Descriptive and non-parametric tests were undertaken on the quantitative data. The purpose of performing descriptive tests was to provide an overview of the characteristics of participants and properties in the study. This enabled some categorisation and comparisons of the data to be drawn.

The choice to use non-parametric tests was to reflect the nature of the study in that much of the information is ordinal and nominal, and the population could not be assumed to be normally distributed. These tests were performed to test a number of variables to identify whether an association between certain variables could be ascertained.

5.9 VALIDITY

In empirical case-based research, there are four principal tests which can be applied to assess research design quality – construct validity, internal validity, external validity and reliability (Yin, 2003). *Construct validity* refers to the triangulation of methods and a logical chain of evidence (Fielding and Warnes, 2009). The aim of triangulation is to avoid subjectivity occurring within the research and the data generated (Fielding and Warnes, 2009), and to produce a more robust result through a consensus between sources (Proverbs and Gameson, 2008).

Internal validity refers to the researcher inferring the incorrect conclusion from the data (Fielding and Warnes, 2009). Therefore, "rival explanations contained in opposing propositions and their associated literature will be considered and addressed" (ibid.). External validity refers to whether or not the research results are applicable beyond the case research. The choice to do a multiple case design and to produce a methodology which can be replicated aims to enable the application of this research outside those cases included within this research. The final test is reliability. This asks whether the same steps could be replicated and whether "the methods effectively measure what they are meant to measure?" (Fielding and Warnes, 2009).

To validate the research findings six elite telephone interviews were performed with experts in energy efficiency and EER. Further details are provided in Chapter ten.

5.10 GENERALISATION

This research presents a multiple case study and is therefore not statistically generalisable. The research can, however, be generalised to a general theory or to

concept (i.e. analytical generalisation) (Miller and Brewer, 2003). The methods used in this research can also be replicated and applied to different contexts.

5.11 LIMITATIONS

Other than those limitations already noted within the text, this study is only considering a sample of wards and properties within Bristol. As explained in Section 5.10, above, it is recognised that this study did not produce statistically generalisable findings. However, the purpose of this study is to produce in-depth findings within a context rather than wider but shallower results.

5.12 ETHICAL CONSIDERATIONS

The intention was that no sensitive information would be collected as part of the study. However, participants and their properties remained anonymous and each case was assigned a coded name at the beginning of the collection process (i.e. Case 001, Case 002). Elite interviewees, unless requested by the interviewee, were also be given a coded name to protect confidentiality. This was made clear to all participants prior to their engagement, and the option to opt out of anonymity was provided on the consent form (Appendix B). No participant opted out of anonymity. Guarantees of confidentiality were and will continue to be upheld (Blaikie, 2010).

Prior to any fieldwork being undertaken approval from the University Ethics Committee was obtained and amendments made in accordance with their recommendations. These were:

1. The information and consent forms (Appendix B) to be on University headed paper

2. The information and consent forms (Appendix B) to be separated rather than combined

3. The provision of an explanation for documentary evidence – this was inserted in the information paper (Appendix B).

4. An explanation of how the documents were to be collected and returned to the participant - this was inserted in the information paper (Appendix B).

5. The provision of a Health and Safety Assessment and clarification of the procedures for lone working to be sent to the Committee – provided and lone working in accordance with RICS guidelines

6. Change of wording from 'anonymous' to 'anonymised'.

5.12.1 Consent

Research involving human participants should, as far as possible and practicable, be based on the freely given consent of the participants (Social Research Association, SRA, 2003). The research in the present thesis involved voluntary participation and consequently participants were not given the impression that they were *required* to participate, and they were made aware of their right to refuse to participate at any stage or be able withdraw (SRA, 2003; Blaikie, 2010). This was outlined in the information supplied to the participants. Consent forms were written in an easily understood language.

Informed consent was sought from the participants through the use of consent forms (Blaikie, 2010). The consent form was accompanied by an information sheet. The consent form and information sheet informed participants of the study background; the study procedures including the collection, storage and use of the data; their rights in the study including their right to withdraw; and confidentiality. Forms and the study were explained to the participants prior to the collection of data (Stouthamer-Loeber and Bok van Kammen, 1995), and wherever possible they were sent to the participants in advance of the visit to give them time to read the information without being influenced by the researcher's presence. Participants were also given the option to read through and sign the form in the absence of the researcher at the start of the researcher's visit to avoid any feelings of coercion. Data collection only proceeded once the consent form had been signed by the participant.

The purpose of a consent form and the general role of ethics in this study is to follow ethical guidelines outlined in the literature. The SRA (2003) gives five key reasons for good ethical practice:

- Protect research participants;
- Ensure high quality research;
- Reassure funders;
- To maintain the reputation of research;
- To comply with legislation.

Good ethical practice extends beyond this to include the commitment to the rights of participants (including data protection), to the respect for participants, to knowledge, and to the protection of the researcher (Wiles *et al.*, 2006; British Sociological Association, BSA, 2002).

Participants were, as part of the consent process, given information about the study, their role and the limits to their participation. The access participants have to interview transcripts and field notes, and the power of the participant to alter any notes, expand on answers, or withdraw information was also clarified in the information provided to them (BSA, 2002).

According to the SRA (2003), the level of information provided to participants can be at two extremes – at one, the participant is overwhelmed with "*unwanted and incomprehensible details*" about the research; at the other, material facts are withheld or the participants are misled. In reality, an appropriate level of information would fall somewhere between these extremes (p.28). Further, the clarity and comprehensibility of this information is considered to be as important as information quantity (*ibid.*).

5.12.2 Confidentiality

As stated above, unless specifically requested, the identity of participants and their properties remained anonymous. The BSA (2002) highlights the importance of respecting the anonymity and privacy of participants, and the necessity to take measures to securely store data. Confidentiality and anonymity of participants were, and will continue to be upheld (Blaikie, 2010).

5.12.3 Vulnerability/Personal Safety

Due to the nature of the research, visiting participants in their homes was required. There are typically three principal aspects of research safety – physical harms, emotional harms and societal harms (Hughes, 2008), although in the context of this research the main aspect was that of physical harm. There were two principal issues – lone working of the researcher and the risk of being victimised during the data collection; and the vulnerability of the owner-occupier and risk of their being victimised.

To minimise the risk of being victimised in the home, both the researcher and the participant had the option of discontinuing the data collection at any time (Hughes, 2008). Where the researcher felt it necessary to terminate the data collection, this would have been done in the most courteous way possible. Good practice suggests the need for the researcher to position themselves so that it is easy to exit the property without the exit route being blocked. This was possible during the interview, but it was not possible during the physical survey, although it was still possible to be aware of the exit points (Hughes, 2008).

As the research involved lone working, the researcher did not only consider the health and safety aspects of site visits, but they also made a record of the appointment at home and/or the office, and told someone the expected return time (Hughes, 2008; RICS, 2004). The researcher arranged to make contact with a designated person at a specified time (*ibid.*). They also carried a personal alarm and a charged mobile phone

(RICS, 2008). Additional precautions included acquiring local knowledge of the research areas, planning the best routes to and from the research sites with telephone numbers of reputable taxi companies, carrying sufficient funds to cover travel and unexpected expenses but not substantial amounts, and not carrying expensive equipment where possible or wear expensive jewellery (Hughes, 2008).

The initial participants were contacted prior to the actual data collection to arrange a visit. If either the researcher or the participant was uncomfortable at this phase, there was the option of cancelling the visit and seeking an alternative participant. Only one individual terminated their participation upon receiving information, prior to a visit being arranged. Early contact also initiated the construction of a working relationship and trust between the researcher and participant.

5.12.4 Survey

As part of the explanation, it was emphasised that the physical survey was for researcher purposes and by no means a professional survey, and was not to be relied upon by participants as an analysis of the success of the energy efficiency measures or as a recommendation for installing measures. The physical survey could not provide advice. However, in accordance with the RICS professional standards, the researcher still acted "*with integrity and avoid conflicts of interest and avoid actions or situations inconsistent with their professional obligations*" (2012, p.12).

The risk of damaging property was lessened as the survey was non-destructive in nature, covering aspects which were either directly observable or where there was documentary evidence in support of elements of interest. The RICS (2011) include a variety of considerations regarding safety during site visits and travelling to site. Some factors are not applicable as the properties were not derelict and the properties were homes rather than construction sites. However, other aspects from RICS (2011) were observed, including:

- Whether the owner-occupier has house rules the research should observe;

- Risks from people or animals;
- Whether special access arrangements are required;
- The structural integrity of the building or its components, any sharp objects or hidden openings;
- Any deleterious materials such as asbestos;
- The presence of vermin or birds and any associated by-products.

Additionally, whether gender or the researcher's level of fitness has a bearing on any identified hazards was taken into consideration (*ibid.*).

5.13 SUMMARY

This chapter outlined the methodology and research design which was adopted for the study. A critical realist stance was be taken, using a retroductive research strategy. A multiple case study approach was used for the data collection based in Bristol.

Owner-occupied properties were physically surveyed to provide some basic information about the building including property features and the level of refurbishment undertaken, supported by documentary evidence. Interviews were performed with the owner-occupier to ascertain their motivations, values and beliefs, the factors affecting their motivations and decisions, and their expectations of the refurbishment. These interviews were supported by the physical survey. Basic information about the owner-occupiers was captured through a basic questionnaire.

The triangulation of methods and by following a logical chain of evidence contributed to construct validity. Internal validity was achieved through the consideration and, where possible, rejection of rival explanations. External validity was met by the use of a multiple case study rather than the single case and by following a method which can be replicated. The reliability of the findings was tested through elite interviews.

There were a number of ethical considerations. These pertained to the rights and the safety of both the researcher and the participant. The participant was informed of the purpose of the study, their role and the use of the data. Confidentiality and anonymity, unless otherwise requested, was given to participants and upheld throughout and after the study.

The following chapter presents the quantitative data analysis. This includes descriptive and non-parametric analyses.

CHAPTER SIX: QUANTITATIVE DATA ANALYSIS

6.1 INTRODUCTION

This chapter provides the findings and a discussion of the quantitative data obtained from the questionnaire and property survey. The following section provides a description of the socio-demographic profile of the participants and the case properties. This is followed by non-parametric analysis, discussion of the results and by a summary. Full tables and graphs are provided in Appendix F.

6.2 DESCRIPTIVE ANALYSIS

This section outlines the descriptive analysis of the quantitative data. Figure 6.1 provides an overview of the twenty-five case properties relative to their general physical characteristics, location and ward deprivation.

6.2.1 Socio-demographics

Gender and ages

The greatest proportion of participants were individual females (60%), followed by individual males (32%). The smallest group comprised of both male and female being present at the time of the data collection (8%). The greatest proportion of participants fell into the 61 – 70 years category (33.3%) followed by 36 – 45 years category (20.8%).

Education and income

Over half the participants had completed some form of postgraduate studies (54.2%). The proportion of participants with an undergraduate degree was equal to the number of participants who had completed a Masters degree (16.7%). A-levels/Scottish Highers were the minimum education level gained by participants (12.5%).

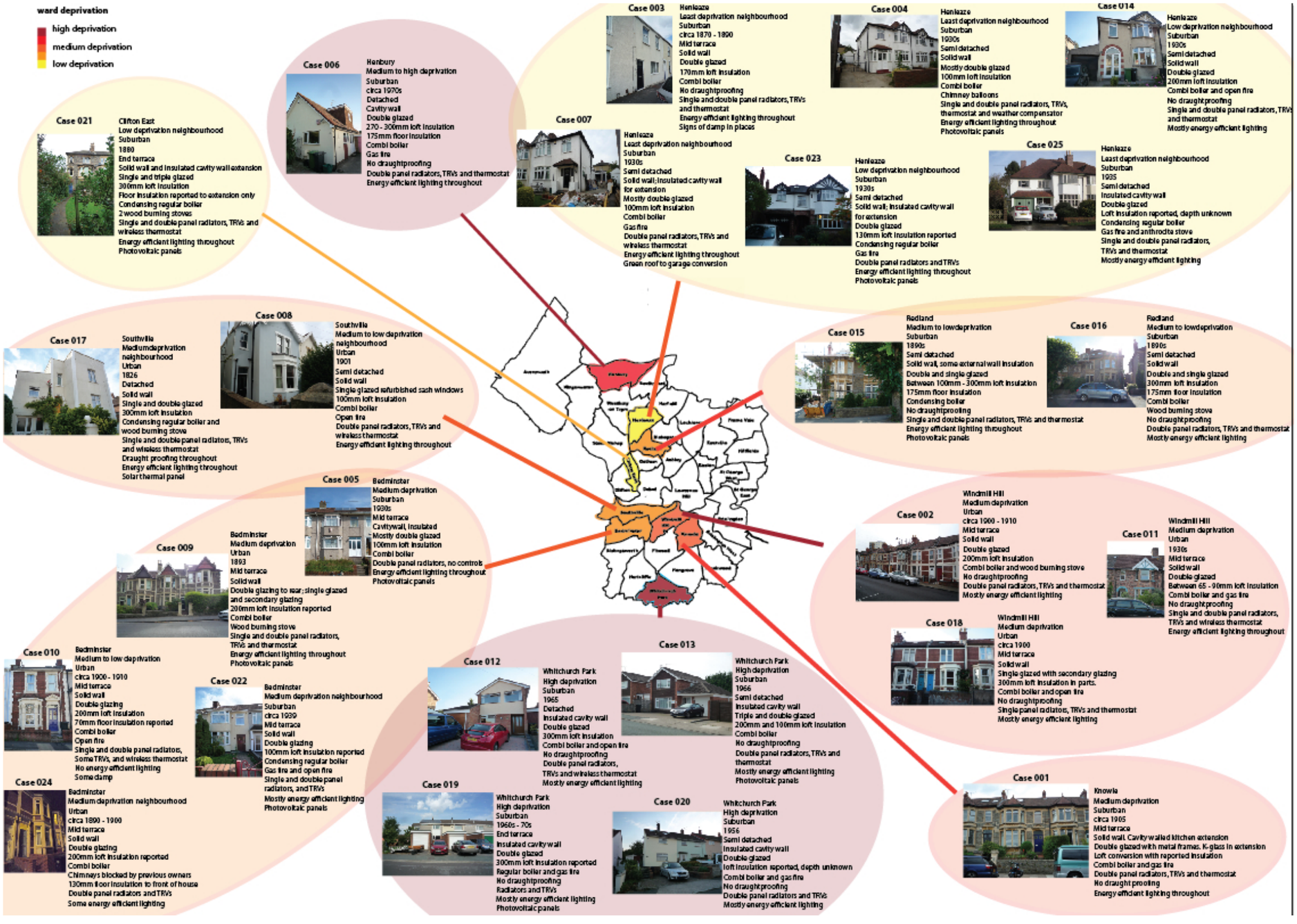

FIGURE 6.1 Case properties in relation to location and ward deprivation

All income levels were incorporated through the selection of study participants. A fifth of cases (20.8%) earned over £49,000. A third of participants (33.3%) earned between £30,000 and £39,000. Almost a third of participants earned less than £30,000.

Household structure and children

Participants predominantly lived with a partner (48%) compared with 24% who lived with both their partner and dependents. The proportion of participants who live on their own was equal to those who live with their dependents (12%).

In the sample population, participants were more likely to have two children (41.7%) or no children (37.5%). The ages of these children tended to be over 18 years old (41.7%), with the next most common child age being 1 – 2 years old (8.3%) for 'age of child 1' and 3 – 5 years old (12.5%) for 'age of child 2'.

Length of residence

A third of participants had lived in their home for over 20 years (29.2%). This is in comparison with those who had lived in their home for 4 – 8 years and 9 – 15 years (16.7%), and those who lived in their homes for 16 – 20 years (12%). In contrast, an equal number of participants lived in their home for less than 1 year, for 1 – 3 years and for 16 – 20 years (12.5%).

Profession and partner's profession

A quarter of participants were retired (25.9%). Higher or further education professions were the next most common job type given by participants (18.5%). This is in contrast to 14.8% of participants' partners listed as retired, followed by IT-, creative-, financial- and legal-based professions (all 7.4%).

Participation in groups

A higher proportion of participants were involved with local groups focusing on environmental issues (37.5%), compared with no involvement in groups (33.3%), groups focusing on community issues (12.5%), groups focusing on environmental and community issues (8.3%) and political groups (4.2%).

6.2.2 Environmental Activities

Almost all participants (95.8%) reported that they recycled. This could be interpreted as a result of the availability of the curbside recycling facilities in Bristol. In contrast to recycling, fewer participants were involved in growing their own food. In total, 16 participants (66.7%) reported growing their own. This included participants growing food in their garden and/or on allotments. Although Bristol is the UK's first 'cycling city;, fewer participants reported cycling to work (or similar, i.e. if retired) (54.2%) than growing their own (66.7%) or recycling (95.8%).

Participants tended to shop locally (95.8%). This is in comparison with 75% who reported that they shop Fairtrade and 66.5% who purchase organic food. This does not appear to be as a result of neighbourhood deprivation or income. Chi-squared tests to explore the relationship between: neighbourhood deprivation and buying Fairtrade (p = 0.489; n = 25); income and buying Fairtrade (p = 0.987; n = 25); neighbourhood deprivation and buying organic (p = 0.589; n = 25); and income and buying organic (p = 0.610; n = 25) are all more than 5%, indicating these relationships are not significant.

Over two-thirds of participants did not report additional environmental activities (70.8%). There does not appear to be a relationship between whether a participant engages in additional environmental activities and the level of EER (p = 0.294; n = 25).

6.2.3 Energy Saving Behaviour

A higher proportion of case properties turn down their thermostat to reduce their energy costs and/or environmental impact (79.2%). However, not all the case properties had a thermostat installed (16%). 79.2% of participants reported using the thermostatic radiator valves on their radiators.

Of the study participants, 87.5% reported turning their appliances off when not in use. However, fewer participants (66.7%) reported switching off appliances at the wall (socket) when the appliances are not in use. A greater number of participants (70.8%) reported washing laundry at 30° Celsius than turning off their appliances at the wall.

Similarly to 'other environmental actions' a greater proportion of participants (69.6%) did not report performing other forms of energy saving behaviours. There is a clear trend of behaviours reported as being undertaken amongst the participants. The greatest number of participants are involved in turning off their appliances when not in use; second most common behaviour is turning down their thermostat and adjusting the thermostatic radiator valves; third, participants washed their laundry at 30° Celsius; fourth, participants turned appliances off at the wall. Participants tended not to report involvement in additional energy saving behaviours.

6.3 PROPERTY ATTRIBUTES

The cases included a mixture of deprivation levels (Figure 6.2), including the neighbourhood with the lowest deprivation rating in Bristol (Golden Hill in Henleaze) and the highest deprivation rating in Bristol (Hareclive in Whitchurch Park). A higher proportion of cases included those in low and medium deprivation neighbourhoods - 36% of cases were in a medium deprivation neighbourhood, considered for the purposes of this study as a IMD score of between 20 to 35 based on the mean and median of the LSOA list for Bristol, and 28% of valid cases were in low deprivation neighbourhood.

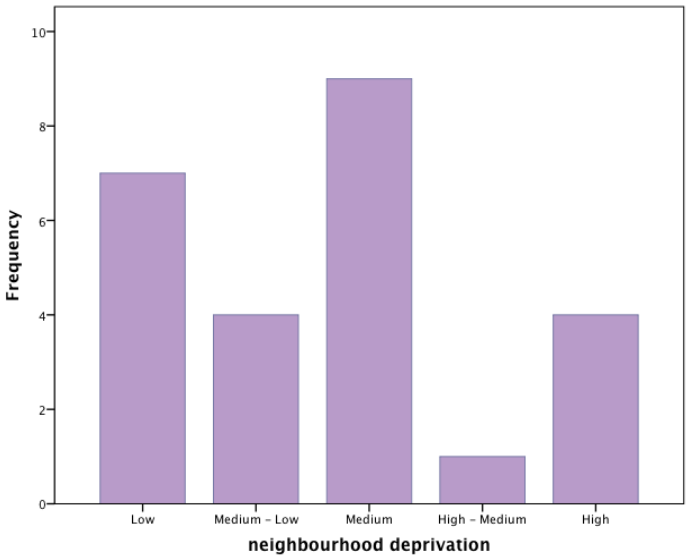

FIGURE 6.2 Types of neighbourhood deprivation level

Figures 6.2 and 6.3 summarise the attributes of the case properties. Over half (52%) of the properties were located in suburban areas. The greatest proportion of cases were built during the inter-war period (1920 – 1939) (32%) and pre-1919 (1850 – 1899, 20% and 1900 – 1919, 20%) (Figure 6.3). This would correlate with the high proportion of solid wall properties: cavity walls, although introduced pre-1900, did not become more widespread until the 1930s. However, a greater number of cavity walls were expected for the case properties constructed in the 1930s – four of seven 1930s properties were solid walled.

The predominant construction type for the cases in the research was solid walled (72%). This supports the predominant ages of the properties. Of all those properties within the sample, 20% of the cases were cavity wall, and 8% system build. Table 6.1 outlines the key physical attributes of the case properties in the sample.

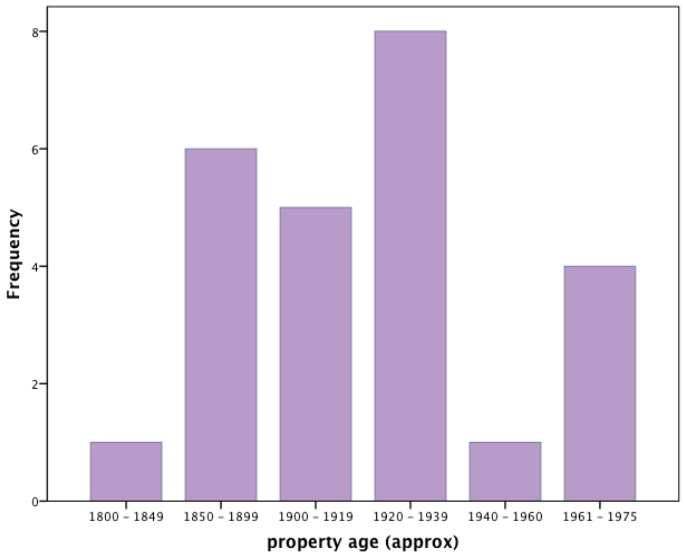

FIGURE 6.3 Distribution of property ages within sample

Figure 6.4 highlights some of the most common attributes from the case properties in the sample. Case 025 (Figure 6.4) is an example of a suburban, interwar, semi detached property with solid walls, double glazing and no wall insulation which predominated in the sample.

The most common building types were mid-terraced (40%) and semi-detached (40%). The greatest proportion of the case properties included no form of wall insulation (68%). This is interpreted as, at least in part, attributable to the high proportion of solid walls and the 'hard to treat' designation of solid walls. The higher level of cavity wall insulation (24%) (Table 6.2) in comparison with the cavity walls listed in the construction type (20%) is attributable to the cavity wall insulation being installed in all the cavity walls and the system build property (8%) within the sample.

TABLE 6.1a Key physical attributes of case properties in sample

	CASE PROPERTIES' ATTRIBUTES									
	Location	Property ages	Construction type	Curtilage	Glazing	Wall insulation	Roof insulation	Floor insulation	Draught-proofing	Energy efficient lightbulbs
Most common in sample	Suburban 52%	1920 - 1939 32%	Solid wall 72%	Mid terrace 40%	Double 64%	None 68%	100 - 200mm 52%	None 88%	Double/ multiple glazing only 44%	76 - 100% 80%
	Urban 32%	1850 - 1899 24%	Cavity wall 20%	Semi detached 40%	Part single, part double 24%	Cavity 24%	2-1 - 300mm 32%	Reported but unknown depth 4%	None 36%	25 - 50% 12%
	Urban-suburban 16%	1900 - 1919 20%	System build 8%	Detached 12%	Part double, part triple 4%	Part internal 4%	Reported but unknown depth 8%	Less than 100mm	All 16%	None 4%
		1961 - 1975 16%		End terrace 8%	Part single, part triple 4%	Part external 4%	Less than 100mm 4%	100 - 200mm 4%	Partial 4%	51 - 75% 4%
		1800 - 1849 4%								
Least common in sample		1940 - 1960 4%								

TABLE 6.1b Key physical attributes of case properties in sample

	CASE PROPERTIES' ATTRIBUTES									
	Energy efficient appliances	Primary heating system	Secondary heating system	Heating distribution system	Heating controls	Type of materials	Low carbon technology	Water recycling	Airtightness	Ventilation
Most common in sample	All 64%	Condensing combi 60%	Gas fire 32%	Double panel 52%	Thermostat and TRVs 80%	Conventional 92%	None 58.3%	None 48%	None 100%	None 48%
	None 16%	Condensing regular 16%	Open fireplaces 28%	Single and double panel 40%	TRVs 12%	Conventional and ecological 4%	Photovoltaics 33.3%	Water butt 44%		Bathroom and kitchen fan 28%
	Partial 12%	Combi 12%	None 20%	Single panel 4%	None 4%	Ecological 4%	Solar thermal 4.2%	Water butt and water recycling system 4%		Kitchen only 24%
	Most 4%	Regular 12%	Woodburning stove 20%	Unknown 4%	Termostat, TRVs and weather compensator 4%		Photovoltaics and solar thermal 4.2%	Manual recycling 4%		
	Unknown 4%									
Least common in sample										

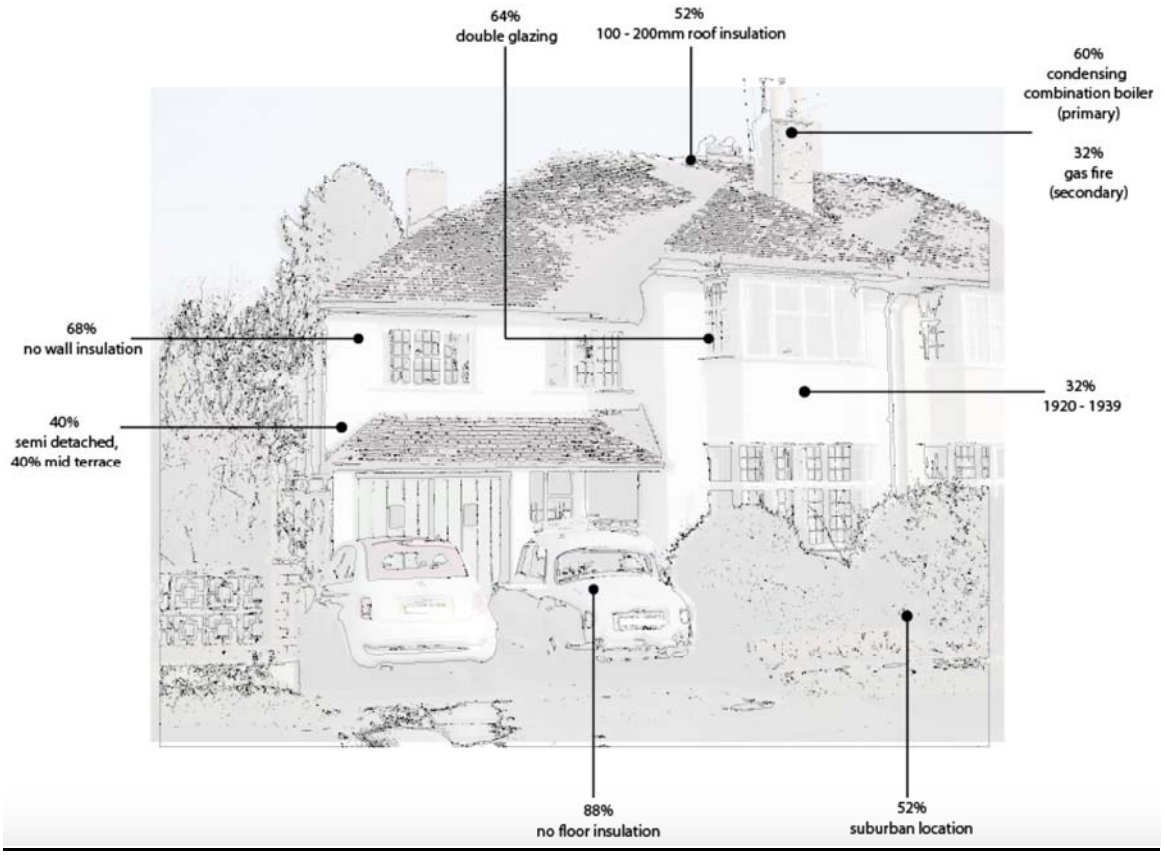

FIGURE 6.4: Sketch of Case 025, highlighting some of the most common property attributes in the sample.

TABLE 6.2 Types of neighbourhood deprivation level

wall insulation

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1 none	**17**	**63.0**	**68.0**	**68.0**
	2 cavity	**6**	**22.2**	**24.0**	**92.0**
	3 part internal	**1**	**3.7**	**4.0**	**96.0**
	6 part external	**1**	**3.7**	**4.0**	**100.0**
	Total	**25**	**92.6**	**100.0**	
Missing	System	**2**	**7.4**		
Total		**27**	**100.0**		

Only 12% of the case properties had any level of floor insulation. Unlike the wall and floor insulation, all the case properties included roof insulation. The greatest proportion of properties included 100 – 200mm of insulation (52%) and 201 – 300mm of insulation (32%). The thickness of insulation required for new builds depends on the K-value (thermal conductivity) of the insulation and resultant U-value. However, a minimum of 250mm insulation thickness is given by the Building Regulations as an acceptable level to achieve 0.18 W/m^2K (HM Government, 2010). Based on this, it is likely over 60% of the case properties would not achieve this Building Regulations minimum level.

The greatest proportion of case properties had full double glazing (64%) or a combination of single and double glazing (24%). A large proportion (44%) of properties incorporated draughtproofing through the multiple glazed units. However, 36% of case properties included no form of draughtproofing.

Condensing boilers were the most common type of boiler amongst the case properties (76%). Condensing boilers as required by Building Regulations are typically highly efficient due to using the latent heat contained within the exhaust gases. Condensing combination boilers made up the largest proportion of primary heating systems in the case properties (60%). However, combination boilers are not currently compatible with solar thermal technology which may restrict the future installation of such technology in these properties or add additional expense changing the primary heating system. There appears to be a relationship ($p = 0.005$; $n = 25$) between the primary heating system and low carbon technology.

The greatest proportion of properties used double panel radiators as the main heating distribution system (52%) followed by a combination of single and double panel radiators (40%).

Although the most common form of heating controls were a combination of thermostat and TRVs (80%) there were some case properties with no heating controls (4%) or just TRVs (12%). There was only one case which included a weather compensator (4%) and none of the properties had advanced zoning controls installed.

Most of the case properties had some form of secondary heating system (80%) (Figure 6.5). Gas fires were the most common form of secondary heating system amongst case properties (32%) followed closely by open fires (28%).

Most of the case properties included some form of energy efficient lighting (96%), with the largest proportion including 76 – 100% of light bulbs (80%).

The greatest proportion of case properties had all energy efficient appliances (64%). Although this is comparatively lower than the proportion of energy efficient

lighbulbs, one interpretation might be the ease and cost of replacing lightbulbs verses appliances, or the comparative frequency of replacing these elements.

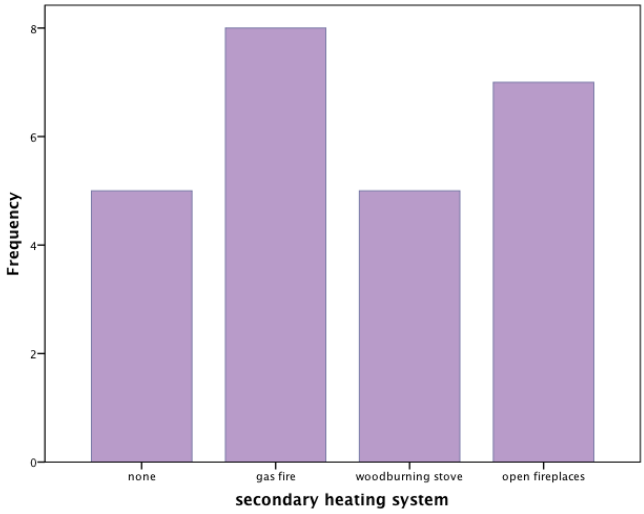

FIGURE 6.5 Types of secondary heating systems and their proportions in the sample.

More than half of the case properties had no form of low carbon technology (58.3%) (Figure 6.6). The most common form of low carbon technology installed in case properties were photovoltaic panels (33.3%). One interpretation of this popularity might be that this form of technology was, until December 2012, generating a favourable rate of return through the Feed-in-Tariff before the Government cut the unit rate. Only one case had solar thermal panels for hot water generation (4.2%) and another case had photovoltaic panels and solar thermal installed (4.2%).

The type of materials used to decorate and furnish the properties were typically conventional (92%), with only two properties reporting some inclusion of ecological materials (conventional and ecological materials, 4%; ecological materials, 4%).

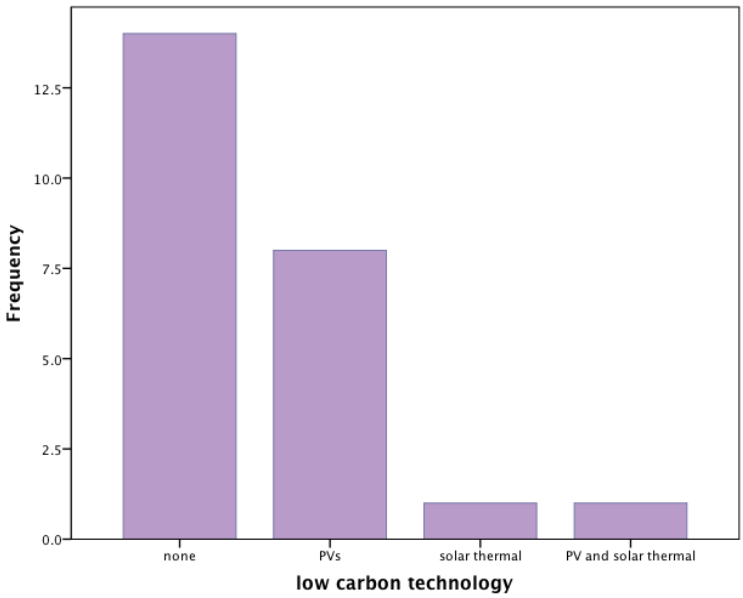

FIGURE 6.6 Types of low carbon technology and their proportions in the sample.

Airtightness of properties is considered separately to draughtproofing. None of the case properties included any form of airtightness works. A large proportion of the case properties included no form of mechanical ventilation (48%). This was followed by 28% of cases including mechanical fans in the kitchen and bathroom(s) and 24% in the kitchen only.

Small (40%) and medium (40%) gardens were most common within the sample, although this does not appear to have a statistical relationship with whether participants grow their own food (p = 0.226; n = 25). Although not recorded by the survey, some participants had professed to grow food on allotments.

Almost half of cases included no form of water recycling (48%), followed by the use of a water butt(s) (44%). One case (4%) included a water butt and a water recycling system, whereby a rainwater tank was submersed in the rear garden and the water used to flush the toilets in the house. One case reported performing manual water recycling.

EER levels

EER levels were not governed by strict guidelines requiring properties meet particular insulation levels or similar, rather the researcher considered all those energy efficiency components installed and gave each property an overall rating on a scale of 1 to 10, guided by general principles.

No property attained the highest two levels (nine and ten) of energy efficiency levels (Figure 6.7) since no properties included airtightness, no solid wall building included full solid wall insulation, and so on. Therefore no 'very high' category is included in Figure 6.7. However, there was a combination of low to high EER levels included in the cases selected.

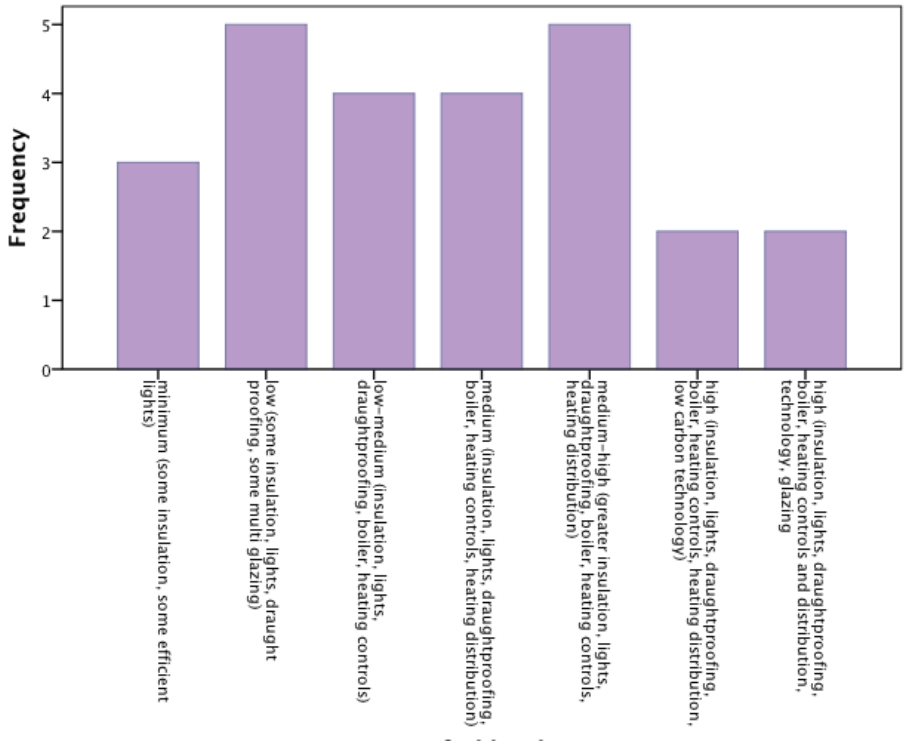

FIGURE 6.7 Proportion of EER levels in the sample.

The most common EER level amongst the case properties was level three (low) (20%) and level six (medium - high) (20%). This was followed by level four (low – medium) (16%) and level five (medium) (16%).

6.4 INTERNAL FACTORS

Clear trends in the participants' rankings of internal factors emerged from the descriptive analysis. In a number of cases such as *attitudes, beliefs and values* the rankings appeared to be clustered around particular areas (Figure 6.8). For example, 36% of the participants, ranked *attitudes, beliefs and values* as the most important factor in the decisions to improve the energy efficiency of their home, followed by rankings of 3rd (16%) and 4th (16%). This clustering of rankings along a scale was similarly the case for *locus of control*, *fashions and tastes, sense of responsibility, and social norms*. In contrast, the rankings of the other internal factors fell into two categories: general clustering around two principal points (e.g. *expectations of the outcomes, decision making*) (Figure 6.9) and a mostly mixed spread (e.g. *role of home, self*).

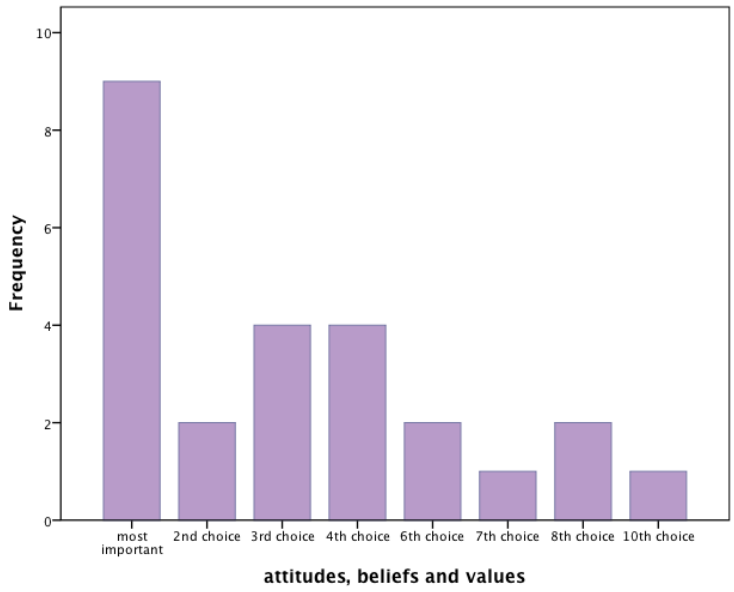

FIGURE 6.8 Internal factor rankings - *attitudes, beliefs and values*

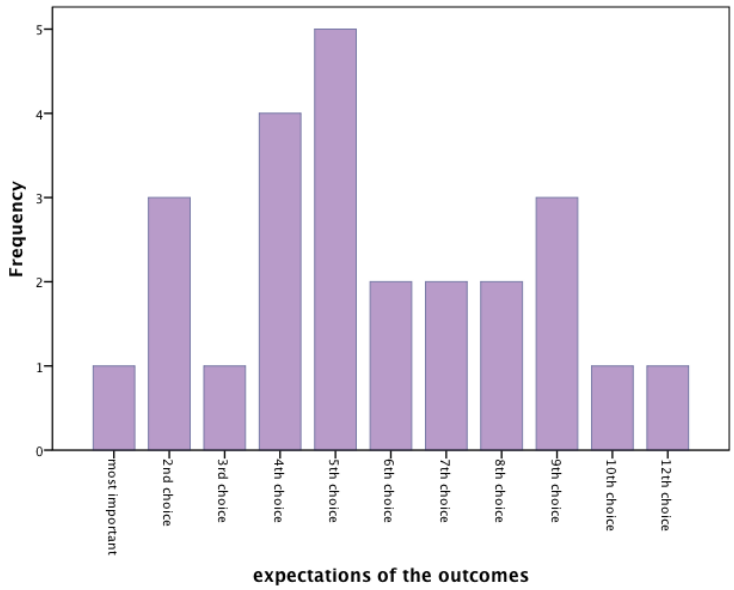

FIGURE 6.9 Internal factor rankings – *expectations of the outcomes*

Interestingly, there were a number of internal factors which were *not* ranked as having 'no importance', including *attitudes, beliefs and values*, *expectation of the outcomes* (Figure 6.9), *priorities, role of home, self,* and *sense of responsibility*. There were also a number of factors which were not ranked as 'most important', and a number which were not ranked in 12th place (weakest importance). Those internal factors without the 'most important' ranking were *social norms*, *self, loss aversion, locus of control* (Figure 6.10), *expectations of the outcomes,* and *decision making*. Those without a 12th ranking included *attitudes, beliefs and values, decision making, locus of control, priorities, role of home, self,* and *sense of responsibility*. This is interpreted as demonstrating that, although internal factors tend to differ between participants, there can be a general consensus amongst the participants regarding the ranking of internal factors. This consensus can be strong and clustered, or a weaker consensus demonstrated perhaps by a greater spread in results.

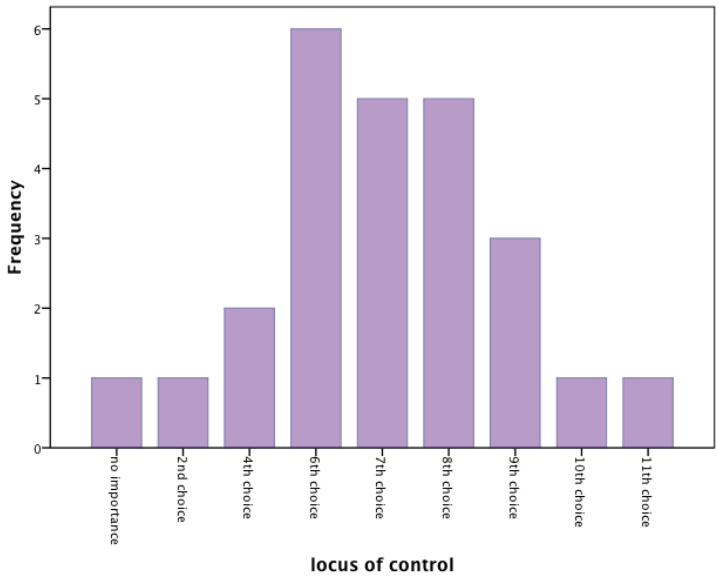

FIGURE 6.10 Internal factor rankings – *locus of control*

6.4.1 How It Translates

Table 6.3 highlights the top rankings for the internal factors. Those figures in bold show the higher of the group of values. Some internal factors such as attitudes, beliefs and values clearly have a large difference in ranking percentage between the top rankings, whereas others only have a 4% difference (i.e. priorities, sense of responsibility, self, locus of control). One interpretation of this might be that there are a number of internal factors which are likely to be core for all participants, whereas others may form more of a dynamic role, changing in ranking depending on other internal or contextual factors.

TABLE 6.3 Ranks for the internal factors based on the highest percentages of responses.

TOP RANKINGS	INTERNAL FACTORS	RANKING WITH THE HIGHEST PERCENTAGE
1	**Attitudes (36%);**	1
3	Attitudes (16%);	
4	Attitudes (16%);	
1	**Priorities (24%)**	1
2	Priorities (20%)	
3	Priorities (12%)	
2	Sense of responsibility (28%)	3
3	**Sense of responsibility (32%)**	
4	Sense of responsibility (20%)	
2	Expectations (12%);	5
4	Expectations (16%)	
5	**Expectations (20%)**	
3	Self (20%)	6
6	**Self (24%)**	
10	Self (20%)	
4	Loss aversion (16%);	9
6	Loss aversion (12%)	

8	Loss aversion (12%)	
9	**Loss aversion (24%)**	
4	Role of home (12%);	5
5	**Role of home (28%);**	
7	Role of home (16%);	
10	Role of home (12%);	
5	**Decision (24%);**	5
9	Decision (16%)	
10	Decision (12%);	
6	**Locus of control (24%);**	6
7	Locus of control (20%);	
8	Locus of control (20%);	
7	**Trust (28%)**	7
8	Trust (16%)	
12	Trust (16%)	
10	Social norms (16%)	11
11	**Social norms (28%)**	
12	Social norms (16%);	
11	Fashions (20%)	12
12	**Fashions (36%)**	
none	Fashions (12%)	

This translates into the following order of strong to weak influence (Figure 6.11):

FIGURE 6.11 Internal factor rankings – scale using rank with highest percentage of responses (mode)

It is worth noting that the top rankings of many internal factors in the table are clustered (e.g. *priorities* – 1, 2, 3; *fashions and trends* – 11, 12, none). However, there are a number of internal factors whose top rankings are spread (e.g. *self* – 3, 6, 10). This has be interpreted in two ways: that there are primary factors which have clear rankings for the participants, and secondary factors which are unclear and more dynamic in their rankings; and that there are factors which had different meanings or interpretations for each participant, despite the list of definitions provided to each participant. Based on this, then Figure 6.11 could be altered to clarify primary and secondary factors (Figure 6.12).

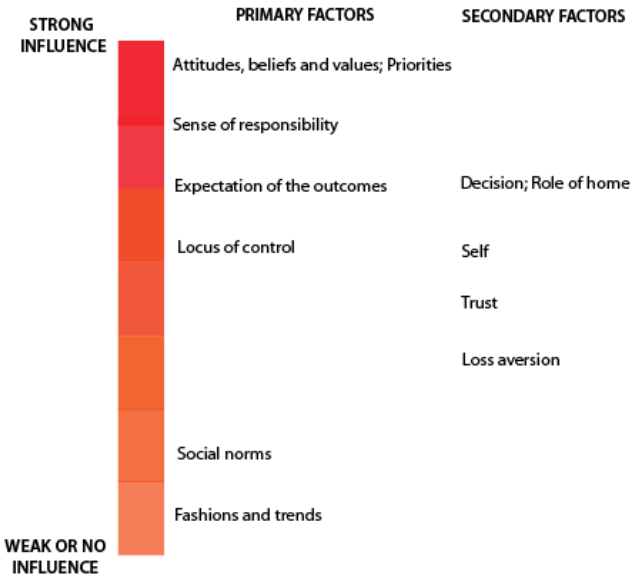

FIGURE 6.12 Internal factor rankings – scale showing primary and secondary factors

This ranking changes slightly again if the mean ranking is taken into account (Table 6.4). Based on the mean ranking, the order in which the internal factors can be ranked changes to include sense of responsibility being the most important internal factor with regard to the decisions the participants made to improve the energy efficiency of their homes. There appears to be groupings of factors based on the mean rank into five categories, indicated in Table 6.4 by the different colours.

This can be visually represented as shown in Figure 6.13. Based on the mean ranking the internal factors stay primarily in the same order as Figure 6.11 showing the order based on the rank with highest percentage of responses. The scale represented in Figure 6.13 is the scale adopted in this study.

TABLE 6.4 Internal factors ordered by mean ranking - grouped

INTERNAL FACTORS ORDERED BY MEAN - GROUPED					
FACTOR	**MODE**	**MEAN RANK**	**MINIMUM RANK**	**MAXIMUM RANK**	**RANGE**
Sense of responsibility	3	3.12	1	11	10
Attitudes, beliefs and values	1	3.44	1	10	9
Priorities	1	3.8	1	11	10
Expectations of outcomes	5	5.68	1	12	11
Role of home	5	5.68	1	10	9
Self	6	6.44	3	11	8
Decision making	5	6.76	2	10	10
Locus of control	6	7.28	2	11	11
Trust	7	7.28	1	12	12
Loss aversion	9	7.48	2	12	12
Social norms	11	9.76	2	12	12
Fashions and tastes	12	10.16	1	12	12

FIGURE 6.13 Internal factor rankings – based on the mean rankings

Strong influence

The interpretation of the internal factor ranking order was multifactorial. With regards to the factors ranked as having the strongest influence, first those participants who volunteered for the study had a good awareness of the current situation regarding the environment, albeit with varied perspectives. This awareness appeared to feed into their feelings of responsibility to reduce their impact on the climate. This was interpreted as participants feeling uncomfortable with their contribution to environmental degradation, whether that was their local, national or global environment. This would imply the relevance of Festinger's Cognitive Dissonance Theory and Expected-Value Theory.

Second, *sense of responsibility* was more commonly ranked as third to *attitudes, beliefs and values* and to *priorities*, implying the participants are less aware of the underlying role of *sense of responsibility* on their decisions regarding the energy efficiency of their home. Additionally, this *sense of responsibility* to a large extent is

likely to have been generated by participants' *attitudes, beliefs and values*, although this is also true for a number of other internal factors.

Priorities were generally ranked as having a strong influence regarding undertaking home energy efficiency works. This is interpreted as being strongly connected to availability of resources (time, money, and so on) to invest in energy efficiency projects and other contextual factors; that is, whether other, stronger demands such as the needs of children or unforeseen circumstances (e.g. redundancy, unexpected bills) were involved. *Priorities* were also considered to be strongly linked to *attitudes, beliefs and values*, something that was exhibited strongly by some of the participant interviews where home improvement works and/or aesthetics were given lower priorities over holidays or the installation of low carbon technology.

Strong to moderate influence

The internal factors interpreted as having a moderate influence on EER or works clearly had a role but had a greater mix of responses than those internal factors ranked as having a strong influence. However, the slightly lower ranking of *expectancy of the outcomes* may not exclude Vroom's Expectancy Theory from EER. Rather it can be interpreted in one of three ways: that participants do not fully understand what it means by 'expectations' despite a definition being provided; they believe it has a strong role but less so in relation to *sense of responsibility*, *attitudes, beliefs and values*, and *priorities*; or since some of the technology being used to improve the energy efficiency performance of the homes or being installed to help owner-occupiers be more self sufficient (e.g. low carbon technology) is comparatively new, with innovations happening on a relatively regular basis, making it difficult for owner-occupiers to be certain of the outcomes of installing such components in their homes. The latter two interpretations are thought to be most likely in this research.

The *role of home*, although ranked as a factor with a moderately strong influence it generally had a spread of ratings across the scale, although it was the most frequently

given answer (5) with a mean rank (5.68). This was equal to the mean ranking of *expectations*. An interpretation of this is that, the decision to 'create' a functional home to best suit the individual could be an expected outcome of more substantial works, but also that a home should be comfortable, efficient, welcoming and provide a platform for social interaction and individual space, technically functional, and aesthetically pleasing – all potential outcomes of undertaking any works.

Moderate to weak influence

Participants' assigned rank of the *self* was interpreted as having a moderate to weak influence (median = 6; mode = 6; mean = 6.44). There was a spread of rankings given for *self*, none providing the most or least importance. However, it ranked more highly than *social norms*. This is interpreted as the image of self not being wholly for the purpose of portraying an image to society in the context of the home and energy efficiency, rather it is for their own perceptions of their actual and ideal self. This reflects the concepts from the motivation theories of Festinger's Cognitive Dissonance Theory and Self-Discrepancy Theory.

Decision-making was defined as relating to the process of EER, acting in favour of alternative scenarios or maintaining the status quo. It appeared to be a difficult concept for participants to place and this could have skewed the findings in relation to the overall rankings. Although mainly clustered around the middle and end of the scale in terms of strength, including being assigned '*no importance*' by 8% of participants, this factor was shown to have a moderate influence on energy efficiency works and refurbishment (median = 6; mode = 5; mean = 6.76).

Weak influence

Despite the high ranking of *sense of responsibility*, the ranking of *locus of control* implies that, although participants felt strong responsibility to act, this is not reflected in their belief about whether or not they can change things through their actions. That is, *locus of control* only has a moderate to weak influence over their decisions to

improve the energy efficiency of their home regardless of the stronger influence of other apparently linked factors.

Trust was assigned as exerting a weak influence on participants' decisions to perform EER or energy efficiency works to the home. This was reflected by the median (7) mode (7) and mean (7.28) rankings.

Loss aversion in terms of participants favouring the status quo, overestimate potential losses and underestimate potential gains was ranked as having moderate to weak influence on energy efficiency works. This could be interpreted in one of three ways: first, that the participants who took part were more likely to be pioneers in the area of energy efficiency improvements and therefore are less likely to favour the status quo. This is, at least in part, discounted due to the range of different participants and the range of refurbishment levels, although their volunteering for participation in the study would suggest some interest in the subject area. Second, that in relation to energy efficiency home improvements and refurbishment, although *loss aversion* has a role, home works can be necessary to ensure the habitability of homes and to ensure that the value of the home is maintained. Third, the other internal factors act as strong enough motivators to overpower *loss aversion* in favour of action.

Weak or no influence

The weakest internal factors were *social norms* and *fashions and tastes*. This would imply that unlike visible pro-environmental actions, such as curbside recycling, *social norms* have less influence over EER. There is an argument that energy efficiency home improvements are not visible from outside the home and therefore the lack of visibility reduces the influence of *social norms*. This does not, however, wholly apply due to the installation of low carbon technologies such as photovoltaic panels and solar thermal panels. Further, *social norms* can also apply to the influence of friends and families (i.e. the participants' social circle). Another interpretation is that *social norms* have a stronger influence but one that participants are less aware of, or that,

when it comes to projects requiring more resources (e.g. time and capital), *social norms* has a weaker influence. *Fashions and tastes* were considered weakest based on the median (11) mode (12) and mean (10.16) ranks. This is interpreted as the other internal factors having greater significance in the context of EER, thought to be due to the level of resources (e.g. time, money, and so on) required.

6.5 NON-PARAMETRIC ANALYSIS

The choice to use Chi-Squared test was based on the suitability of the non-parametric tests and the type of data. Both the Mann-Whitney U Test and the Kruskal-Wallis Test were discounted based on the requirement for the data to include continuous (scale) variables – the data are predominantly categorical (nominal and ordinal).

The Chi-Squared analyses all provided that more than 80% of the cells were less than 5, indicating that the necessary assumptions for the standard asymptotic calculation of the level of significance had not been met. Therefore, the 'exact' test was used, which provided a means to produce more reliable results from this small data set (Mehta and Patel, 2011).

6.5.1 Chi-Squared Tests

Construction type vs. EER level and construction type vs. wall insulation

There appears to be a relationship (p = 0.029; n = 25) between the type of construction and the level of EER. Further analysis shows construction type and wall insulation are significantly correlated (p = 0.003; n = 25).

EER level vs. building type

The Chi-Squared test implies a relationship (p = 0.017; n = 25) between the building type and the level of refurbishment for the case properties. As 100% of the cells have a count of less than 5, the assumptions needed for the standard asymptotic calculation

of the significance level for the Chi-Squared test may not have been met. The exact results indicate a stronger relationship ($p = 0.013$; $n = 25$) (Table 6.5).

TABLE 6.5 Chi-Squared Test for EER level and building type

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)	Point Probability
Pearson Chi-Square	**32.875**[a]	**18**	**.017**	**.013**		
Likelihood Ratio	**29.380**	**18**	**.044**	**.038**		
Fisher's Exact Test	**21.487**			**.064**		
Linear-by-Linear Association	**7.706**[b]	**1**	**.006**	**.004**	**.002**	**.001**
N of Valid Cases	**25**					

a. 28 cells (100.0%) have expected count less than 5. The minimum expected count is .16.

b. The standardized statistic is 2.776.

EER level vs. energy efficiency appliances and lighting.

There is a relationship amongst the case properties between EER level and energy efficient appliances ($p = 0.045$; $n = 25$) (Figure 6.14). In contrast, there is no relationship demonstrated between EER level and energy efficient lighting ($p = 0.292$; $n = 25$).

EER level vs. neighbourhood deprivation

There is a relationship between neighbourhood deprivation and level of EER (p = 0.022; n = 25). This significance increases where the exact p value is used (p = 0.010; n = 25) (Table 6.6) because the number of cells with a count of less than five is 100%.

Figure 6.15 shows a spread of different EER levels across all neighbourhood deprivation levels. Interestingly low deprivation neighbourhoods have no high levels of EER cases in the sample. However, high level EER cases are spread amongst medium and high deprivation neighbourhoods. As seen in Figure 6.15, the 'medium deprivation' neighbourhoods included the widest spread of different EER levels followed by the 'high deprivation' neighbourhoods. That is, there is a relationship between EER and neighbourhood deprivation but, unexpectedly the relationship appears to be that higher levels of EER are more likely in higher deprivation neighbourhoods, and a wider spread of levels in medium deprivation neighbourhoods. However, the high – medium and high deprivation neighbourhoods did not include any solid walled case properties (Figure 6.16). The Chi-Squared test for construction type (e.g. solid wall, cavity wall) and neighbourhood deprivation shows no relationship (p = 0.085; n = 25).

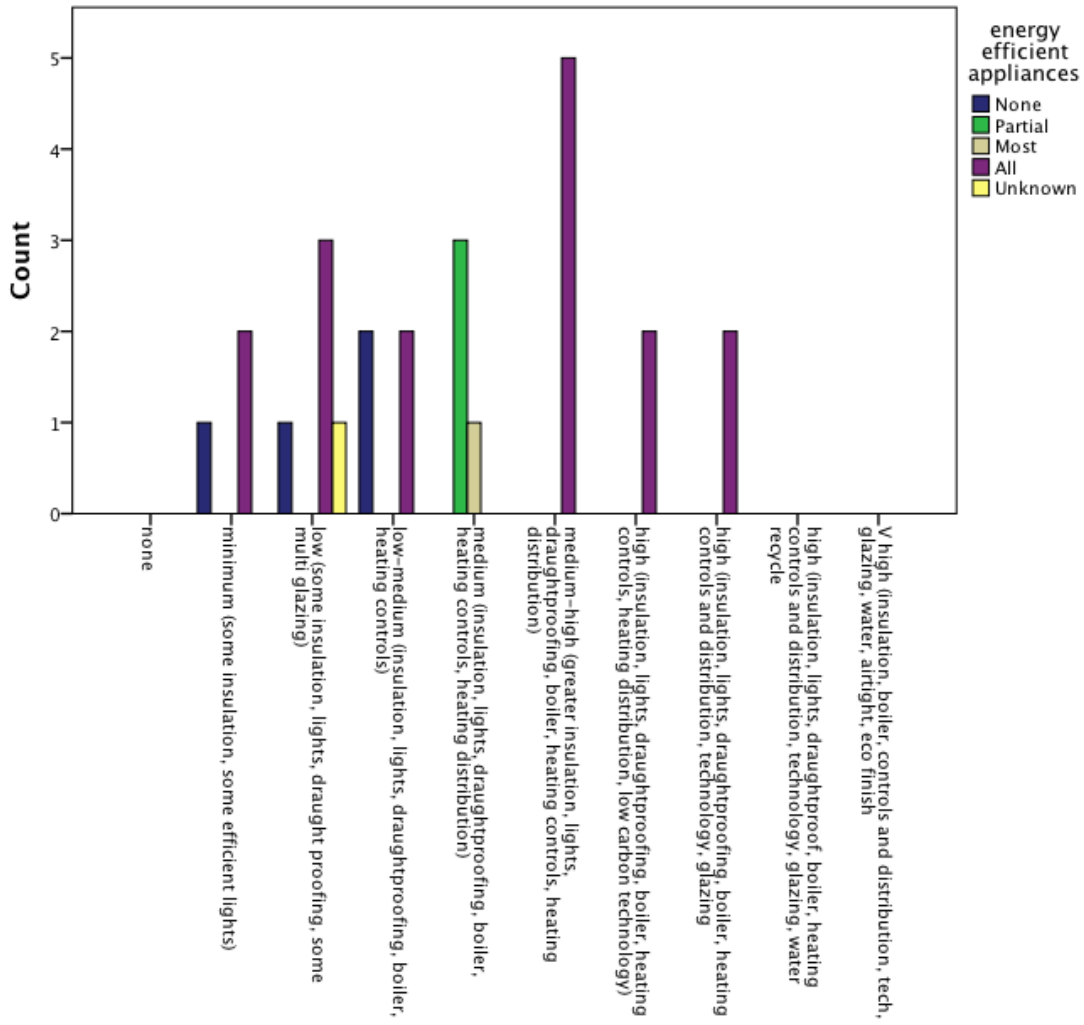

FIGURE 6.14 The frequency of case properties with energy efficient appliances based on their EER level

TABLE 6.6 Chi-Squared Test for EER level and neighbourhood deprivation

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)	Point Probability
Pearson Chi-Square	**39.836**[a]	**24**	**.022**	**.010**		
Likelihood Ratio	**36.329**	**24**	**.051**	**.031**		
Fisher's Exact Test	**28.651**			**.038**		
Linear-by-Linear Association	**.970**[b]	**1**	**.325**	**.339**	**.177**	**.020**
N of Valid Cases	**25**					

a. 35 cells (100.0%) have expected count less than 5. The minimum expected count is .08.

b. The standardized statistic is .985.

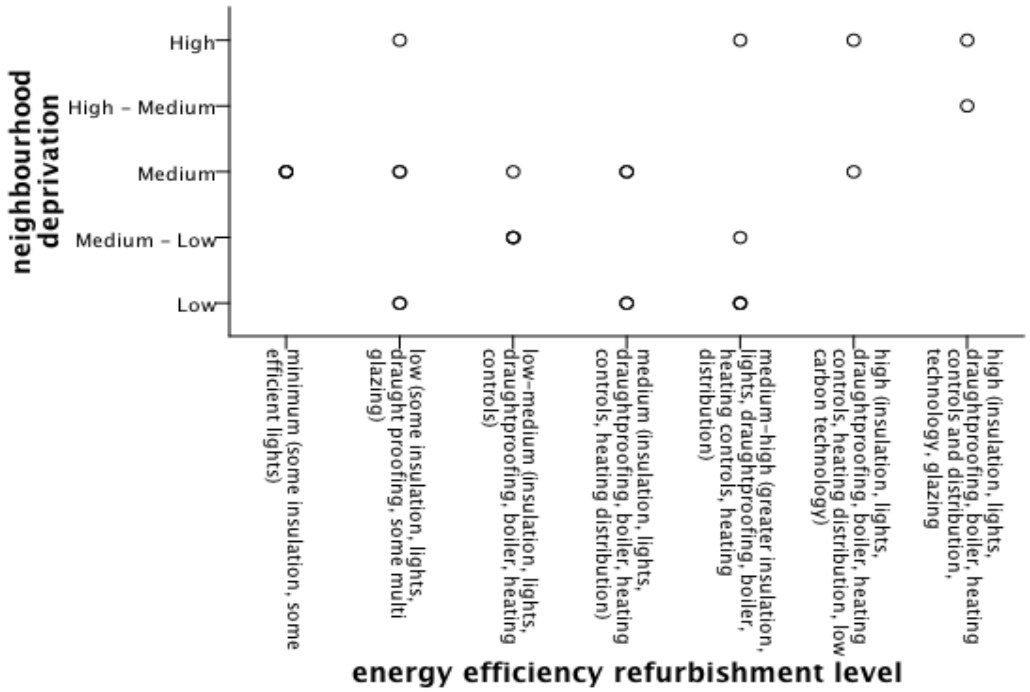

FIGURE 6.15 The distribution of EER levels across different levels of neighbourhood deprivation areas.

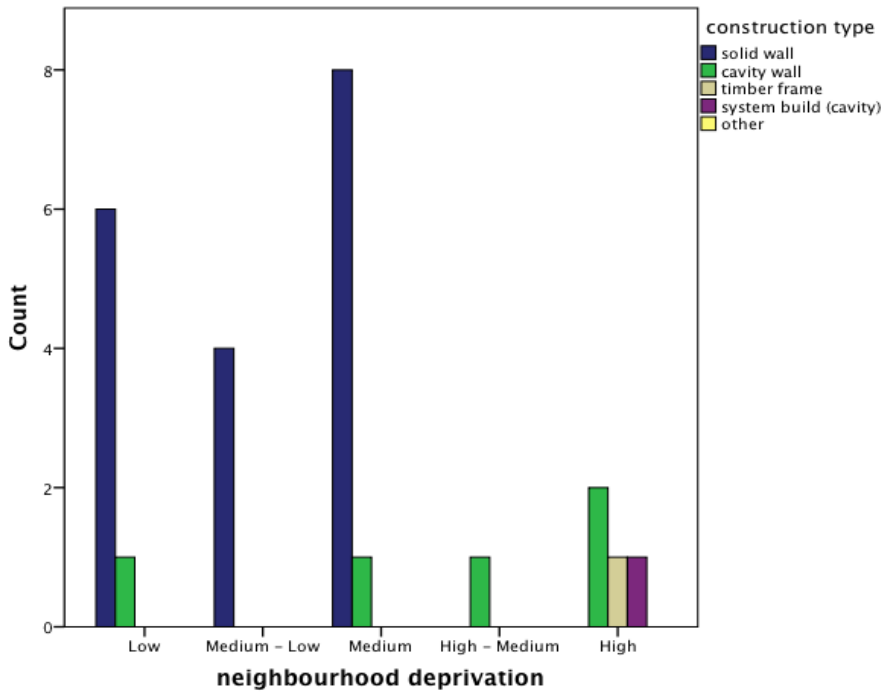

FIGURE 6.16 The proportion of construction types across different neighbourhood deprivation areas.

Where no relationships were detected

There does not appear to be a relationship between EER level and gender (p = 0.802; n = 25); education level (p = 0.533; n = 25); income (p = 0.642; n = 25); wall insulation (p = 0.063; n = 25); and property orientation (p = 0.558; n = 25). There was also no relationship detected between orientation of the property and the presence of low carbon technology (p = 0.638; n = 25).

6.6 DISCUSSION

Participants were more likely to have lived in their home for over 20 years (29.2%). They were predominantly female (60%), over 61 years old (37.5%), were retired (25.9%) and a high proportion had completed postgraduate studies (54.2%). Income was more evenly spread with a third of participants earning between £30,000 and £39,000 (33.3%). A high proportion of participants lived with a partner (48%), and

were more likely to have two (41.7%) or no children (37.5%). Those with children tended to have children over 18 years old (41.7%).

Participants were more likely to participate in groups focusing on environmental issues. Participants were likely to engage in the following environmental activities in order of proportion of responses: recycling (95.8%); shop locally (95.8%); shop Fairtrade (75%); growing own (66.7%); shop organic (66.5%); cycle to work (54.2%); and other environmental activities (29.2%).

In relation to energy saving behaviour participants engaged in the following practices: turning off appliances when not in use (87.5%); turning down thermostat (79.2%); adjusting thermostatic radiator valves (79.2%); washing clothes at 30°C (70.8%); turning appliances off at the wall (66.7%); and other behaviour (30.4%).

The primary number of cases were in a medium deprivation neighbourhood (36%), in suburban locations (52%). The greatest number of cases were mid-terraced or semi-detached (40%), inter-war (1920 – 1939) (32%) solid wall (72%) properties with a small or medium garden (40%).

The most common EER level amongst case properties was low (20%) and medium to high (20%). Properties mostly included double glazing (64%) and no wall insulation (68%) with 100 – 200mm of roof insulation (52%) and no floor insulation (88%). Draughtproofing was predominantly in the form of the integral draughtproofing in multiple glazed units (double or triple glazing) followed by no draughtproofing. This is perhaps surprising considering draughtproofing is promoted as being a relatively easy, low cost measure.

Over three-quarters of the case properties' lighting tended to be energy efficient (80%) and all energy efficiency appliances (64%). This is perhaps a reflection of the

recent free lightbulbs from energy companies and other organisations. Three-quarters of properties had a condensing boiler installed (76%), with the combination boiler (60%) being the most common type of condensing boiler installed amongst the case properties. A high proportion of the case properties included some form of secondary heating system (80%) with gas fires being the most common (32%) and open fires (28%). All the case properties included radiators as the main form of heating distribution, with double panel radiators being the most common type (52%). The main form of heating controls in the case properties included a thermostat and thermostatic radiator valves (80%).

Properties were more likely to be finished in conventional materials (92%), incorporated no low carbon technology (58.3%) and no water recycling (48%). Mechanical ventilation, although a requirement of the current Building Regulations for kitchens and bathrooms, was not included in almost half of the case properties (48%).

In relation to internal factors attitudes, beliefs and values, and priorities were ranked as the most important in terms of improving the energy efficiency of the participants' homes, and fashions and trends the least important.

The non-parametric analysis (exact Chi-Squared tests) suggest possibly relationships between construction type and wall insulation (p = 0.003; n = 25); EER level and neighbourhood deprivation (p = 0.010; n = 25); EER level and building type (p = 0.013; n = 25); EER level and construction type (p = 0.029); and EER level and energy efficiency appliances (p = 0.045; n = 25).

The relationships implied by the Chi-Squared tests demonstrate some expected and unexpected results. The strongest relationship was between wall insulation and construction type (e.g. solid wall, cavity wall) (p = 0.003; n = 25). Solid walls are considered 'hard to treat' in relation to improving their thermal performance, an

aspect which can be expensive, highly disruptive and involve the local authority (e.g. planning permission, conservation aspects). Therefore, this relationship was not unexpected. Similarly, relationships between EER level and building type (e.g. detached, mid-terraced) ($p = 0.013$; $n = 25$), and EER level and construction type ($p = 0.029$; $n = 25$) were demonstrated. This is expected as the form and type of construction of a dwelling does, to a great extent, influence how a property's energy efficiency performance can be improved and how much it will cost. For example, a solid wall property would require solid wall insulation to improve the thermal performance of the walls which will currently result in huge expense and varying degrees of disruption.

There is a clear relationship between neighbourhood deprivation and level of EER ($p = 0.010$; $n = 25$), but, as seen in the above data and Figure 6.15, this is not clear and is not as might be assumed – the relationship shown by the cases was that the properties in higher deprivation areas were those which had benefited from higher levels of EER, whereas those cases in medium deprivation areas tend to have a greater spread of refurbishment levels. However, there were no solid wall cases in high deprivation or high – medium deprivation neighbourhoods present in the sample (Figure 6.16). As mentioned above, solid wall properties are considered 'hard to treat', and until fairly recently (new applications closed in 2013) cavity wall and loft insulation was subsidised which may partially account for higher levels of EER being achieved in these neighbourhoods. However, no relationship was detected between construction type and neighbourhood deprivation ($p = 0.085$; $n = 25$).

The relationship between EER level and energy efficiency appliances ($p = 0.045$; $n = 25$) was not unexpected as the replacement of appliances with more efficient alternatives is relatively easy and low-cost. However, the relationship between energy efficient light bulbs did not appear to have a relationship with EER ($p = 0.292$; $n = 25$). Rather than suggesting low energy lighting has no role, this could simply indicate that, being an 'easy win' and relatively low cost action for owner-occupiers the installation of energy efficient light bulbs does not depend on a house having an EER.

There does not appear to be a relationship between EER level and wall insulation (p = 0.063; n = 25). One interpretation might be that, owner-occupiers do not have to install wall insulation to improve the energy efficiency performance of their homes, they can improve the performance through the installation of alternative measures such as multiple glazing, draughtproofing, low carbon technology, roof insulation and so on. Therefore, a solid walled property can still be considered to have a higher level of energy efficiency refurbishment where numerous other energy efficiency measures had been installed.

Similarly to wall insulation, EER did not apparently have a relationship with orientation of the property (p = 0.558; n = 25), and neither did the orientation have a relationship with whether or not low carbon technology was installed (p = 0.63; n = 25). Orientation could, for some low carbon technologies such as photovoltaic panels, affect the amount of energy generated and therefore the lack of a relationship is surprising. To take this analysis further, the relationship between heating system and low carbon technology was explored, and a relationship identified (p = 0.002; n = 25). This was expected, as solar thermal technology is not currently compatible with condensing combination boilers, and those properties with low carbon technology installed alongside a condensing combination boiler only had photovoltaic technology whereas the only solar thermal technology in the study was installed alongside a condensing regular boiler.

Unlike previous research into refurbishment of owner-occupied dwellings the analysis suggests that the number of (p = 0.553; n = 25) and ages of children (p = 0.084; n = 25 for child 1 and p = 0.211; n = 25 for child 2) do not have a relationship with EER. Similarly, past research has suggested that length of residence has a relationship with home improvements and energy works. However, based on the present study, length of residence does not appear to have a relationship with EER (p = 0.945; n = 25)

EER does not appear to have a relationship with income (p = 0.642; n = 25). In the current economic climate where UK income remains relatively static (Moore, 2012), savings interest rates are low and fuel prices continue to increase (*ibid.*) the author interprets these results of the present study as an indication of other priorities, families continuing to live up to their income level and difficulties in saving money, rather than better investment opportunities.

There does not appear to be a relationship between EER and gender based on the Chi-Squared analysis in the present study (p = 0.802; n = 25). This is despite the participants being predominantly female.

Education level did not appear to have an affect on EER (p = 0.533; n = 25), something which was unexpected as previous research on topics such as pro-environmental behaviour and home improvements have often included awareness and information as integral aspects of motivating behavioural change and action. Education was anticipated to contribute to this, but does not appear to have a relationship with EER. An interpretation might be that in Bristol awareness of environmental and energy issues is already widespread, and/or that the cost and/or disincentives of EER have a contributory role; that is, regardless of education level, there are stronger factors which govern whether or not an EER will be undertaken.

6.7 SUMMARY

Study participants were more likely to be female, over 61 years old, retired, and completed postgraduate studies. Income tended to be more evenly spread across the participants. They were more likely to have lived in their home for more than 20 years and live with their partner and have two children. Children were more likely to be over 18 years old.

Properties were most commonly in a medium deprivation neighbourhood and located in suburban areas. Mid-terrace and semi-detached properties dominated the sample.

Case properties were most commonly solid walled constructed during the inter-war period.

Participants were more likely to participate in groups focusing on environmental issues and participate in activities such as recycling; shopping locally, Fairtrade and organic; growing own; cycling to work. They were more likely to engage in behaviour such as: turning off appliances when not in use; turning down the thermostat; adjusting the thermostatic radiator valves; washing clothes at 30°C; and turning off appliances at the wall.

With regard to internal factors, participants more frequently ranked *attitudes, beliefs and values*, and *priorities* as the most important factor governing their decision to improve the energy efficiency of their home and fashions and trends as the least important. *Sense of respon*sibility, although commonly ranked high by participants tended to be the strongest internal factor when the mean rank was considered.

Based on non-parametric testing of the quantitative data used the Chi-Squared analysis there are four factors which have a relationship with EER: neighbourhood deprivation ($p = 0.010$; $n = 25$); building type ($p = 0.013$; $n = 25$); construction type ($p = 0.029$; $n = 25$); and energy efficiency appliances ($p = 0.045$; $n = 25$). Building and construction type both were expected as these will, to some extent, affect the degree to which a property can be refurbished and the cost of the works (e.g. cavity wall insulation vs. solid wall insulation). Although neighbourhood deprivation was expected to affect the level of EER, in reality case properties in higher deprivation neighbourhoods had been refurbished to higher energy efficiency levels. It is the interpretation of the researcher that this is, at least partially, attributable to the type of construction of the case properties in these areas and the predominance of the 'hard to treat' solid walled case properties in the other neighbourhoods surveyed.

No relationship was detected between EER level and the number or ages of children; the length of residence; income; gender; education; wall insulation; and building orientation.

The following chapter provides an analysis on the qualitative data focusing on internal factors and motivation.

CHAPTER SEVEN: QUALITATIVE DATA ANALYSIS: PART 1 – INTERNAL FACTORS AND MOTIVATION

7.1 INTRODUCTION

The present chapter outlines the findings of the qualitative data produced by the interviews. Interviews were transcribed verbatim and imported into the qualitative data analysis software, NVivo, and coded thematically (Braun and Clarke, 2006) to identify underlying themes and mechanisms. This chapter discusses the data in relation to the existing literature. The structure of this chapter is based on the conceptual model introduced in Chapter four. The chapter will contribute to answering the key research questions one to four introduced in Chapter one (Section 1.6):

1. Why do owner-occupiers perform domestic EERs?
2. What are the principal motivations for EER in the owner-occupied housing stock?
3. What are the drivers influencing owner-occupiers' motivations for EER?
4. To what extent do owner-occupiers' values influence their motivation for EER?

The chapter also achieves objective five (Section 1.5) - to analyse and appraise the relationship between owner-occupiers' motivation for EER and the motivation themes in relation to the conceptual model. This chapter will be loosely based on the structure of the conceptual model (Figure 4.2) to discuss participants' responses. It commences with a general discussion of motivations before investigating the internal factors relative to the qualitative data. It will present a discussion about awareness and approaches before finally summarising the chapter. Table 7.1 outlines the key sections and themes.

TABLE 7.1 Key sections and themes

SECTION		KEY THEMES
7.2	Motivations - general	Participants are motivated within reason, regardless of whether action has been taken; there are four principal motivation themes - economic, environmental, social, and waste.
7.3	Internal factors:	
7.3.1	Conceptual model	Original model provides the basic structure of the chapter
7.3.2	Values and perceptions	Essential as these govern other internal factors; foundation in childhood and growing up, daily interaction with environment, and work; will shape the principal motivation themes and the form of action
7.3.3	Decision-making	A process, and generally difficult for participants to grasp; shaped by the context and external factors
7.3.4	Time to consider works	Influenced by external factors such as availability of finance and urgency of works, as well as internal factors such as locus of control and priorities; two principal groups - fast acting and long acting, although participants could be both
7.3.5	Locus of control and self-efficacy	Participants have greater influence as part of a collective rather than as an individual; generally good self-efficacy within the home, higher self-efficacy individuals were more likely to have greater confidence in their own skills, positively affecting EER motivation
7.3.6	Sense of responsibility	Key to social and environmental motivation themes due to altruistic association; responsible to self, social circle and humanity as well as environment.
7.3.7	Trust	Known source more trustworthy; own research important; did not determine level of EER motivation but affected time to undertake works
7.3.8	Emotions	Important regarding to negative and positive reinforcement, and moral obligation; can affect the prioritisation of EER
7.3.9	Role of home	Functions of a home key in shaping type of motivation and the type of action
7.3.10	Image, 'self' and social norms	Image not a primary consideration; participants did not view social norms as a significant influence but associated with moral norms and emotion; social circle can share similar values and is associated with leading by example and information gathering
7.3.11	Fashions and tastes	Nominal to no influence

7.3.12	Compromises and priorities	Significant in relation to lifestyle, decisions involving cost, especially relating to making EER decision
7.3.13	Loss aversion	Participants will avoid borrowing funds to finance EER, although are more likely to do so where there is no alternative and works are urgent; they are also more likely to act when the affordability of their lifestyle and the role of home (e.g. comfort) is threatened (i.e. through increasing fuel prices). Associated with opportunity, length of time to consider works, and role of home
7.3.14	Expectations	Measures typically meet or surpass expectations; not a primarily conscious consideration, but can be affected by confusing and/or conflicting information
7.3.15	Waste	Disliked across all groups; a significant consideration with regards to social (e.g. time), environmental (e.g. pollution, landfill waste, embodied energy), and economic (e.g. money, replacement of elements in a good condition) aspects.
7.3.16	Awareness	Good general and broad awareness of environmental issues; awareness has grounding in childhood and growing up; daily interaction with the local environment; and work

7.2 MOTIVATION - GENERAL

The literature review (Chapter three) indicated that there are three principal motivations themes for EER and energy efficiency works: economic, environmental and social. The literature also indicated that people are motivated for different reasons, and that this will be dependent on their priority needs and desires, and whether they assign a value to the expected outcomes of energy efficiency works, amongst other factors outlined in Chapter three. Motivation is seen as an essential precursor to action. The present study finds there is a real need to motivate homeowners to ensure that, where appropriate conditions are provided, owner-occupiers can act. This contradicts a recent study by Bartiaux *et al.* (2014) who state that technological and economic models incorrectly focus on the need to motivate homeowners to perform energy refurbishments – existing studies do not tend to focus on motivation; rather previous studies have focused on technical aspects of EER, and pro-environmental behaviour, not motivation.

Participants in the present study were asked if they considered themselves as motivated to perform home energy efficiency works, and in what way they could be considered motivated. All the participants considered themselves as motivated – although Case 003 epitomised what other participants demonstrated within their interviews by saying '*within reason*'.

Motivation was reported, regardless of whether participants had undertaken works or not, and regardless of whether they demonstrated high environmental values or not. This suggests the concept that motivation is the precursor to action; that is, action does not have to manifest for an individual to be motivated to act in the future. However, it was also observed that reported 'motivation' did not always specifically reflect EER motivation. This was interpreted as participants potentially having an inaccurate view of their own motivations. Participants' justifications for being motivated generally ranged from being attributable to the *desire* to improve the energy performance of their home but in the absence of action, to the installation of low energy lighting, to the installation of multiple measures such as solid wall insulation and low carbon technology. In comparison with the three primary motivation themes highlighted by the existing literature, the qualitative data identified four principal motivators as driving energy efficiency works: environment, economy, social and waste. In addition to those motivation themes indicated by the existing literature, the waste motivation theme appeared to feature across many of the interviews. This could be seen as part of environment, economy or social factors, and will be further discussed below. The strength of these motivators depended on participant priorities, and by participant attitudes, beliefs and values. Attitudes, beliefs and values were, to some extent, governed by childhood and life experience.

Participants indicated implicitly or explicitly the varying strength of motivators, with some motivation dominating over others. Some participants had stronger environmental and comfort motivators, with the economic theme being a secondary motivation (i.e. the participant was aware they were unlikely to reach 'payback' where the measure reaches a point when it has met the capital investment through

savings). Other participants had different configurations of the same motivators. In some situations all motivation themes could work in parallel and be equally influential, no one theme dominating. Different configurations of the motivation themes are formed depending on the energy efficiency measure being installed. Considerations which can contribute to this include the level of capital investment and return on investment, not just for the overall EER but also for individual measures. Case 006 (female) expressed the relationship between three of the motivation themes, stating "*I'm aware of…environmental issues at the moment…and that's been a factor in having the work done although to warm the place up and save money on energy bills is a much bigger one*". Case 017, who demonstrated high environmental values demonstrated that even those with high environmental values can be predominantly motivated through the social (i.e. comfort) and economic themes, although the environment motivation theme still played a role:

> "*Financial [motivation] and this is a cold house. Too big motivations actually. And the idea of being …[a] better environmentalist, [having] a smaller footprint but the first two are more important in that sense with the house, yeah*."

The existing literature suggests that the economic motivation is important (Housing Forum, 2010; Nair *et al.*, 2010a; Nair *et al.*, 2010b; Grosche and Vance, 2009) and common across all income groups in the form of monetary savings on energy bills (DCLG, 2011a; Bichard and Kamierczak, 2009). However, it has been highlighted as only a small part of why owner-occupiers undertake works to their home (Wilson *et al.*, 2013). The participants of the present study suggests that economic motivation in the form of utility bill savings linking to affordable comfort is a strong motivation, but also a strong barrier in the form of funding the works. The most common configurations of these motivation themes amongst the study participants appeared to be:

(i) environment ≥ economic > social; and

(ii) social ≥ economic > environment

Where (i) represents the environment theme is of greater or equal strength as the economic motivation theme, but both are slightly stronger than social (i.e. comfort); and (ii) suggests social (i.e. comfort) is stronger or equal to the economic motivation theme, but both are stronger motivators than environment. Although there can be secondary (e.g. (i) social; (ii) environment) motivation themes, these 'secondary' motivations still influence overall motivation. These motivations partially support findings by Christensen *et al.* (2014) who state the top reasons for completing home improvements are comfort, reduction in energy bills, increase energy efficiency, and aesthetics. The waste motivation theme appeared to be a motivation theme for most participants, although this was often a subtle motivation theme and could be incorporated into all of the other motivation themes (environment – energy, carbon, resources; economic – money; social – time, resources) – although a number of participants expressed their dislike of waste (e.g. Cases 006, 008, 012, 013, 017), and was a motivation theme in relation to saving energy, water and money, it did not appear to be separate from the other four motivation themes; rather it ran in parallel to these. 'Waste' will be further discussed in Section 7.3.14.

A question was posed in Section 4.4 regarding whether owner-occupiers prioritise comfort above energy savings or the environment. Based on the qualitative data, the predominant motivation themes will differ between participants, and between projects and even between measures. The economic and social motivation themes will potentially drive some participants to undertake EER where they have lower environmental values, whereas those with high environmental values may be primarily driven by the environmental motivation theme. Motivation themes and their relative strengths appeared to be shaped by participants' internal factors. These internal factors will be discussed in the following section (Section 7.3).

7.3 INTERNAL FACTORS FOR EER

7.3.1 Conceptual Model

The conceptual model was developed in Chapter four (Section 4.8). This model will be amended to reflect the data in Chapter nine. The qualitative data will be discussed in relation to the structure of the existing model.

7.3.2 Participant Values and Perceptions

The existing literature shows that the values and beliefs of individuals in relation to moral norms and/or obligations are important (Martinsson *et al.*, 2011), and it is these moral norms which are key in motivating pro-environmental action (Stern, 2000) (Section 7.3.10). Where environmental degradation threatens what an individual values, they will feel a sense of responsibility to take action (Martinsson *et al.*, 2011), as well as what they perceive as right and wrong, and if inaction creates an internal dissonance.

Values were demonstrated throughout the interviews, typically rooted in childhood and life experiences. Those exhibiting stronger values towards the environment included Cases 002, 007, 008, 012, 014, 015, 017, 018 and 021. In contrast, cases exhibiting weaker environmental values included 001, 003, 015, and 024 with other participants generally ranging in between these. The strength of these environmental values typically resulted in the participants being motivated to undertake energy efficiency works to their homes for different reasons (i.e. environment motivation).

Values are connected to participants' expectations and whether such expectations are desirable. The changing expectation of owner-occupiers with regards to daily life, the home and thermal comfort has been highlighted by Judson *et al.* (2013) as a reason for undertaking improvement works. In recent studies, the different expectations of thermal comfort of different individuals has been shown to shape decisions to install particular measures or not (e.g. air conditioning) (Judson and Maller, 2014). However, as highlighted by Galvin (2014), as most owner-occupiers expect to have improved thermal comfort after a refurbishment, this can result in increased energy use (prebound or rebound effect). The rebound effect refers to the proportion of

energy savings following a refurbishment which is consumed by occupant behaviour change, e.g. additional energy use (Sunikka Blank and Galvin, 2012). The prebound effect refers to the pre-refurbishment situation where less energy is consumed than generally anticipated (ibid.). Both the rebound and prebound effects can result in large disparities between the predicted and actual energy savings (Booth and Choudhary, 2013).

Further, as found by Fawcett and Killip (2014), one motivation for performing EER is the '*expectation of increasing energy prices*' – therefore the expectation is that action will result in reduced energy bills. This is supported by the present study which found that participants were aware of the affordability of comfort. It can therefore be argued that not only is comfort (as part of the social motivation) valued, but it can be intrinsically linked to the economic motivation.

Whether participants valued the environment and how they related to it, and therefore whether they value positive environmental outcomes, can reflect how participants were motivated (i.e. whether they were primarily environmentally motivated or not). Participants' perceptions towards the environment was a positive one, although how participants defined it in terms of what it 'meant' to them differed from case to case. Participants had some difficulty in explaining what the environment meant to them, possibly reflecting the breadth of the term, as demonstrated by the uncertainty of case 004 who appeared to have difficulty in proffering a description, and was visibly and verbally uncomfortable – "*Erm, well I think it's quite important [laughs], er, sorry it's just I'm struggling*".

Generally, participants conceived that the 'environment' referred to both the macro (i.e. global climate) and micro (local climate and conditions), often considering it to heavily encompass nature (i.e. green space, weather, wildlife, and so on). This breadth of the participants' concept of the environment could also be seen in connection with

decisions the participants make as well as reflecting participants' values more generally.

Interviewees appeared to be generally concerned about the welfare of the environment, often demonstrating higher environmental values of these participants (e.g. Cases 002, 007, 008, 021). For example, Case 002 in Windmill Hill (medium deprivation) said:

> "I'*m seriously worried about it [i.e. the environment] but it doesn't really help anyone worrying, so, I try to be pragmatic. But the environment is really, I don't see it as being different from us…it's not humans and the environment, it's just part of* [one big system]"

7.3.3 Participant Decision-making

'Decision making', as discussed in Section 4.8.1, results in the adoption of action, the rejection of action in favour of an alternative scenario, or the maintenance of the status quo. The existing literature suggested that how decisions are made in relation to the home depends on multiple factors as outlined in Table 2.2 (DCLG, 2011a; Braun, 2010; Grosche and Vance, 2009; DCLG, 2009b; Baker and Kaul, 2002) but also includes how an owner-occupier perceives the role of the 'home', occupier priorities, their perception of 'self', social norms, and fashions and tastes (Stephenson *et al.*, 2010; Aune, 2007; Sirgy *et al.*, 2005; Kollmuss and Agyeman, 2002; Munro and Leather, 1999).

As a general term, not only did participants find the concept of 'decision-making' difficult to grasp but did not consider it as having an impact on their motivation to act in relation to their home. Rather than completely reducing or even removing the role of 'decision-making' from the conceptual model, this indicates that as a general term it is more readily conceived as a process rather than an internal factor. It also indicates that this aspect may be outside the awareness of participants. Participants could

decide to perform works alongside other urgent works for convenience and to avoid increasing costs in the future, as demonstrated by Case 008:

> "*…the electrics to be honest could have probably have waited but while we were having a load of plaster hacked off you might as well do the electrics at the same time*."

7.3.4 Time to Consider Works

How quickly participants performed works was connected to external factors such as urgency of the works (opportunity and physical structure), to economic aspects, the threat to social factors such as comfort, as well as locus of control, priorities and awareness. These factors are connected to the decision making process.

Wilson *et al.* (2013) suggest that financial constraints are not a barrier to performing works; rather they lengthen the time in making decisions. In their study on 'Superhomes' (homes which have undergone refurbishment resulting in a minimum of 60% reduction in carbon dioxide), Fawcett and Killip (2014) identify two categories in relation to time – the whole house refurbishment; and the phased with the most common form of works being phased, both having time implications. Fawcett (2014) suggests that, although there are limitations of achieving high reductions in carbon emissions through a phased approach, this might be more appropriate financially and in terms of disruption to perform energy works in planned phases in parallel with other building works when finance becomes available. In the present study, all participants had undertaken works in a phased way. This might imply the unrealistic view taken by policy and support mechanisms such as the Green Deal, which seek to encourage a whole house approach.

Participants in the present study could be crudely categorised into two main groups in relation to how long they considered undertaking building and energy efficiency works before they acted: those who acted quickly after conceiving a project and those

who waited a long time. This decision-making process and the length of time it can take was concisely described by Case 021 (female):

> "[It took us] *Absolutely ages* [to act]! *…if you'd watched me drawing pictures, and eventually we talked to our nephew who's an architect, and when it was finally done, he looked at it and he said "it had a very long gestation period, didn't it?!"…We usually get it right, but it does take us ages… Partly because we've both got different ideas about what's important. Partly because we're determined to research every last possible bit of information, which is why it took us nearly a year to get that* [AAA+] *fridge organised.*"

Those who waited to undertake works attributed this to 'wanting to get things right', but more frequently participants attributed this time lag to constraints on their finances (e.g. other priorities). The 'slow acting' group's notion of 'getting it right' could also be interpreted as loss aversion (i.e. aversion to poor investment decisions, poor or inappropriate choice, unproven effectiveness of measure, amongst others) (Section 7.3.13).

The fast-acting group included those who, on reflection felt they should have taken more time to consider the works. The latter group also included those who had acted quickly but had considered doing particular works prior to moving into their home (e.g. Cases 002, 004 and 008). As Case 008 explained "*The windows we didn't take very much time to think about, well I guess we did because we had a lot of this stuff ready to go when we moved in*".

Participants could fall into both groups by prioritising works, often based on the urgency of the works and availability of capital (e.g. water ingress vs. aesthetic works), reflecting two general ways of decision-making based on urgency. For example, where the roof was leaking (e.g. Case 008), water ingress occuring through defective render (Case 012) or a fire had occurred (Case 015) there was a sense of urgency in performing works. However, non-urgent works for the same Cases (008,

012, 015) were performed gradually when the opportunity and funds allowed. The prioritisation of works were often based on comfort in the home – making the space habitable. Fitting in the necessary, non-urgent works, also could be dependent on undertaking planned works, as highlighted by Case 008:

> "*…we've had to [take action] with some things but…other things we've done because we've wanted the house to be livable. Like…the electrics…could have probably have waited but while we were having a load of plaster hacked off you might as well do the electrics at the same time. So some of it has been prioritised because it fitted in with other stuff that we were having done. But when we moved in the roof was leaking for example, so the rendering, it was a process of elimination with the water coming in – so the roof was leaking, so we got that done; water was still coming in, we had the damp proofing done; and also because the plastering was just literally like falling off the walls*."

The two general categories of decision-making (urgent vs. non-urgent; long vs. short process) were rooted in economic aspects. Based on the qualitative data in the present study, financial constraints could be a barrier to immediate action – the length of time participants took to make decisions was not necessarily affected; it would affect their ability to act. That is, some participants already had a clear understanding of the measures they would like to install. Information on, awareness of, and appropriateness of available measures were indicated as having a more central role to time in *considering* works than costs.

7.3.5 Participant Locus of Control and Self-Efficacy

Individuals' locus of control has been identified by the existing literature as affecting their decision to act (Kollmuss and Agyeman, 2002; Stern, 1986), with those exhibiting a greater level of locus of control and self-efficacy more likely to have undertaken some form of action in improving the energy efficiency of their home. However, the level of action depended on other aspects such as economic factors and the physical building.

Participants were asked if they felt they could make a difference and change things for the better through their actions, generally and pertaining to the environment. In relation to general things, some participants exhibited a strong locus of control, particularly where they had key involvement in (Cases 009, 014 and 017) and/or had established a local community group (Cases 012 and 013). Some participants did feel they could make a difference relative to energy and energy efficiency in the home:

> Case 002: "*Yes, I do... Just by telling people about…things they could do or you know turning lights off when you go to someone's house, just following them around turning lights off. Yeah, definitely and I think I have got friends who, who have thought about things*."

The general view was the individual action only makes a small difference, but morally people should engage with such behaviour. Case 0009 concisely summarised this – "*Well I think it's important to keep trying to change things for the better…Because it improves life for everybody*". That '*it improves life for everybody*' seems to encapsulate the feelings of many of the participants, particularly those exhibiting high environmental values. This not only reflects moral norms of individuals but perhaps implies that such individuals were more altruistic, rather than purely interested in the environment, or that by improving people's lives – those in participants' immediate social circle and beyond - through protecting and/or improving the environment. However, participants generally felt they could not change, or significantly change things solely based on their own actions; rather, they felt that as part of a collective they could make a small difference, as stated by Case 006 (female) – "*…it's that idea of things done on their own don't really make much difference but if you're one of a group*". This demonstrates a lower locus of control in relation to making a difference environmentally if acting individually. However, there was a strong consensus that regardless of whether they could change things or not, morally people should try, again reflecting the moral norms of the participants, as explained by Case 001:

> "*I can't see that we can save the world by, even if everybody on earth took up low energy light bulb use, I'm pretty sure we're not going to save the*

> *world…If you want to save the world, assuming the world needs saving – it probably does, then I think we need to do a hell of a lot more than get everyone to change their lightbulbs and fit some loft insulation…. On the other hand, one should do the little bit you can and that's the bit I can do so that's what we've done.*"

Participants generally indicated a greater sense of locus control within their home. This suggests that they felt they could affect their immediate internal environment but less so in relation to their external environment.

Self-efficacy amongst the participants, was observed to be generally good. This is particularly relevant in the home where participants mostly appeared to have moderate to high confidence in their own skills and abilities to either perform some or all of the improvement works themselves (e.g. Cases 006, 010, 012, 021), or in commissioning such works (e.g. Cases 005, 007, 012, 013). This could vary depending on the type of measures, the extent of works, whether or not participants had previous experience in undertaking improvement works, and whether they had negative experiences with contractors or measures previously. This concept could also relate to whether participants felt capable of accessing appropriate information and measures. High self-efficacy appeared to have a positive affect on EER motivation, with those exhibiting strongest self-efficacy tending to have the most experience of home improvement works. This was interpreted as increased confidence in participants' skills through positive emotional reinforcement (successfully completing works previously) resulting in a positive affect on EER motivation for potential future action.

7.3.6 Participants' Sense of Responsibility

Sense of responsibility is inherently connected to participant values and beliefs, and is highlighted by the literature as a key component of the social motivation theme. James (2012) suggests the concept of responsible resource use (including energy) could inform the daily lifestyle choices and financial decisions; irresponsibility driving action.

Some participants in the present study expressed the desire to instill the value of the environment into children and/or others. This sense of responsibility to act in a pro-environmental way and to instill these values in others could be interpreted as a responsibility to preserve the environment for current and future generations. This was also identified in Fawcett and Killip's (2014) study on 'Superhomes', which was identified as one of the most popular reasons for undertaking refurbishment works. In the present study 'future generations' did not necessarily include participants' own children:

> Case 002: "*Well it's got to be people who… are either suffering a lot now due to climate change – I do believe something is happening...I do believe there's a problem with climate change and I do believe people are suffering now. If we can try and halt what we are doing…And it does worry me a lot… I know it sounds so cheesy – but future generations.*"

Some participants made it clear that, rather than feeling responsible to other human beings, they felt responsible to themselves and/or the environment (e.g. Case 011). Although participants felt a responsibility to act in an environmentally-conscious manner, this was not always to preserve the environment for 'future generations'; rather it is perceived as morally 'the right thing to do', fitting in with Martinsson *et al.*'s (2011) view that the values and beliefs individuals possess which result in moral norms or obligations can be strong motivators:

> Case 007 (female): "*I think it does come from conscious as well as 'that's what we ought to do', …just like you shouldn't throw food away…there are lots of things you shouldn't do – drop stuff in the street and be nasty to people. It's a sort of fundamental thing that you should look after your…immediate patch of the world and your wider world.*"

Case 007 (female)'s quote also relates to the negative feelings induced (e.g. guilt) (explored in Section 7.3.8) by not doing 'the right thing' (moral norms). This was also highlighted by other participants, such as Case 013 (female):

> Case 013 (female): "*I just think we're polluting the planet so much! And…I do feel guilty about it…. I think having a granddaughter now, our granddaughter will be 11 at the weekend, and you do … think 'what kind of future are they going to have?*"'

The desire to instill the value of the environment in others could also be interpreted as supporting Martinsson *et al.* (2011) who suggest that where an individual perceives environmental degradation as threatening their values they will be more likely to feel a sense of responsibility to act. In the case of EER, not all participants who valued the environment had undertaken extensive energy works, indicating that participants can be motivated but there are additional factors such as other priorities and constraints on capital which will determine whether they act.

Generally participants felt responsible to themselves, their local and global community, future generations and the environment itself. This 'responsibility' also was identified as a statement of personal values and the 'self' – "*to a degree you are making a statement when you do that*" - although this was not their primary motivation for undertaking energy efficiency improvement works. One interpretation of this not being a primary motivation is that, although some participants wanted to 'set a good example', 'lead by example', or simply portray their ideal self image, this perhaps is less central where larger financial costs such as building works are involved. This appeared to be a central consideration for all participants.

Some participants appeared to judge others for acting, in what they considered to be an environmentally irresponsible manner, trying to alter behaviour in a covert way:

> Case 014: "*I get very cross with my next-door neighbours…he will water his garden regardless of whether it's rained or not. And he asked me, he said 'you've had it [a water meter] put in, has it made a difference?' I said 'it's made a huge difference'. I didn't say… 'well it won't do for you unless you change the way you-' because I thought 'well you'll have one put in' and you*

> *realise it'll probably cost him more and maybe that'll help him change his ways*."

Participants with a keen interest in preserving or 'doing their bit' for the environment tended to also be interested in wider environmental issues and other aspects such as health and wellbeing, indicating some stronger sense of altruism, supporting Barr (2003) in his studies on pro-environmental behaviour. For some individuals, particularly Cases 008, 009 and 017 this could drive many of their daily lifestyle decisions:

> Case 009: "*I try to use as little fuel as possible, try to limit the amount of driving…compost things, recycle things, grow…some of our own vegetables on the allotment…try and switch things off when you're not using them….I do subscribe to Friends of the Earth and Greenpeace*"

Such altruism could be in relation to others (participants' social group and wider humanity) and/or the environment/nature. Concern regarding the wellbeing of the environment was not restricted to one age group, although this was a belief generally maintained by some participants, in younger and older age groups. Rather, the level of concern differed both within and across age groups. It seems the greater the concern for the environment the less likely the participant was to condone activities such as flying – "*I try not to bore people, but it does bother me, especially long distance flying*" (Case 002) - or sending items to landfill:

> Case 004: "…*with the baby you know I'm going to use cloth nappies because the thought of just putting all those nappies in those little bags and putting all those little bags in a little pile and putting that pile into landfill just sort of makes me feel quite icky.*"

The environmental concern, reflected particularly by Case 004 above, appeared to be associated with moral obligation, wastefulness, sense of responsibility and emotion. The greater the concern for the environment and dislike of waste, generally the

greater the observed dissonance and negative emotion regarding home energy efficiency amongst participants, as reflected in the following quote by Case 002:

> "*It's incredibly [in]efficient right now with single [glazed] windows – I'm a bit embarrassed that it's so leaky*"

7.3.7 Participants' Sense of Trust

For the study participants, trust was a mixed subject, and could act as a barrier and form part of inconvenience. Generally, 'trust' was connected with availability of trustworthy information and advice. Previous studies have shown that for measures to be adopted, the information, advice (Wilson and Dowlatabadi, 2007), and contractors and service providers (Chryssochoidis and Wilson, 2013; Stewart *et al.*, 2005) must be trustworthy. Chryssochoidis and Wilson (2013) suggest that information supporting decisions is deemed as important.

Participants in the present study suggested that they were more likely to trust information if it came from a known source such as a friend or relative, although the trustworthiness of these social sources depended on how dependable these characters were in general. How professionals and contractors conducted themselves (e.g. Case 004 and 013) and whether they had a vested interest in certain products would affect how likely participants were to trust such sources. A number of participants relied on the internet, and personal research and calculations (e.g. Cases 004, 005 and 006) over any other source of information. Previous experience played a significant role – where participants had experience of contractors through their own employment or previous experience could affect their trust levels. Those participants who had trust in a contractor (e.g. Case 004) or architect (e.g. Case 007), for example could affect how quickly they were to engage with suggestions or actually implementing the measures. However, this was not a primary determinant of whether or not participants were motivated to undertake energy efficiency works; rather it could affect how long it took to undertake works to a home.

7.3.8 The Role of Emotions

Although not the focus of the study, emotions appeared to have a role in directing motivation in the form of positive or negative feelings, particularly 'moral norms'. Positive and negative emotions have already been identified as having a role in influencing pro-environmental behaviour (Thomas and Sharp, 2013; Park and Ha, 2012). Feelings could arise from apparent gaps between owner-occupiers' actual and ideal selves, although predominantly participants reported to be happy with their self image. Instead, negative feelings such as guilt could be interpreted as a general feeling of doing 'something wrong' and therefore being socially criticised, rooted in ingrained values, but as Case 004 (low deprivation neighbourhood) highlights:

> Case 004: "[A responsibility to] *Myself I suppose… yeah I don't think society is going to come and tell me off for putting the heating on but I kind of feel like I ought not to because … there's no need. There's no real need for it and it seems a bit extravagant*."

A number of participants also expressed feeling and attempting to avoid negative emotions such as an 'icky' feeling (Case 004), embarrassment (e.g. Case 002), and guilt (e.g. Case 013). This could be in relation to wastefulness (e.g. energy, resources) or to moral norms. The 'icky' feeling discussed by Case 004 regarding sending disposable nappies to landfill was interpreted as a negative emotion, and demonstrates the participant's feeling of doing something 'wrong' or going against personal values. This was interpreted as motivation to avoid a dissonance with internal values, supporting Festinger's Cognitive Disonance Theory. Further, it loosely supports pro-environmental theories such as Schwartz's norm activation theory (Onwezen *et al.*, 2013) and Stern's value-belief-norm theory (Jansson *et al.*, 2011) which postulate the altruistic concerns about others people and/or valued objects will activate feelings of moral obligation. This may not result in behavioural change where: (1) people fail to recognise the importance of such a change for themselves and others; or (2) change is not considered feasible (Bechtel and Churchman, 2002). In the case of (2), although change may not be feasible, moral obligation is activated, thus Festinger's theory can

result (*ibid.*), creating internal discomfort due to a perceived gap between the actual and ideal self.

According to psychology research, positive emotions towards an activity are more likely to result in 'interaction enhancement' (i.e. task reinforcement); negative emotions result in decreased interaction (Frijda, 2010). However, even where a positive emotion towards an activity such as EER exists, it can be negated through negative emotions associated with linked aspects such as a lack of trust of contractors or professionals, or where individuals doubt their skills to perform or commission energy improvement works. Consequently, the individual is unlikely to be motivated to take action (Ford, 1992). However, Carrus *et al.* (2008) found that negative emotions such as guilt or fear can prompt ecological actions, supporting the findings of the present study.

Emotion can motivate further action or result in the decision to terminate action (Ford, 1992). Previous studies have identified a link between the lack of motivation to undertake home refurbishment and "*negative psychological attitudes towards renovation, which can include low trust in contractors*" (Haines and Mitchell, 2014, p.464). This could, however, result in individuals performing much of the works themselves (DIY) where they feel sufficiently competent to do so (Peng, 2013). The 'DIY' option can also be a way of attempting to save money on the refurbishment costs, as seen in Fawcett and Killip's study (2014).

Less imperative goals can be given priority due to more compelling emotions (i.e. making the individual feel good) or where there is a lack of resources (i.e. time, money, energy) (Ford, 1992) for the refurbishment. However, in the current study, a number of the participants, their previous or current difficulties in sufficient resources (e.g. Case 005, Case 012, Case 021) or with negative experiences with contractors (e.g. Case 009) did not appear to negate the motivation to undertake energy efficiency works.

7.3.9 Role of Home in EER

Aune (2007) identifies that people see the role of home in different ways. How people perceive and interact with their home differs between people (Gram Hassen, 2014), and this will affect the nature and level of their daily energy consumption. For refurbishment to successfully reduce carbon emission and home energy use, home practices and norms need to be taken as a starting point for refurbishment design (Gram Hassen, 2014). Yet recent literature does not appear to explore how occupants perceive the role of home, something which will shape owner-occupiers' decisions about what to install and why.

The majority of participants viewed '*home'* as separate from '*house'*, the latter forming a building and the former extending to something more conceptually complex, but generally taken to mean a place of permanence with an emotional attachment, and participants' personal tastes and needs. Only two participants (both male – Case 005 and Case 023), considered the terms 'home' and 'house' as synonymous. Participants also highlighted the need to own a property for it to be a 'home', and the 'making' of a home to be an important aspect for some of the participants, as demonstrated by Case 007 (female) who stated "*part of making the new home which works for us*". This was also dependent on participants' priorities:

> Case 022: "*I'd rather spend the money on things like holidays and experiences together [with my family] than have the latest gadgets and a showroom type home….I want it to be warm and I just want it to be dry and safe for the kids so they can be just basically happy and feel that they have a place to come and be safe and play*."

Owning and 'making' a home could be seen as providing a greater opportunity to improve the energy efficiency of the owner-occupied housing stock, particularly when giving consideration to the functions of a home. There was a general agreement amongst participants that a 'home' should provide certain functions as reflected in Table 7.2. These functions are broadly consistent with Maslow's Hierarchy of Needs, and with Aune's study on energy in the home (2007).

TABLE 7.2 Interpretation of key functions of a home based on Maslow's Hierarchy of Needs

LEVEL IN HIERARCHY	PARTICIPANTS REQUIRED HOME FUNCTIONS
Physiological	Functionality, basic facilities, safety, security, comfort
Social engagement	Comfort, a welcoming environment, a platform for activities and fun
Personal esteem	Functionality, comfort, a welcoming environment, a platform for activities and fun
Self-actualisation	A platform for projects for self-fulfillment and learning

Some of the functions agreed on by the participants are repeated within Table 7.1 demonstrating the ability of such functions to help to fulfill multiple levels within Maslow's model. A home should provide basic physiological needs, and where these are threatened (e.g. poor security, defective elements such as boilers or leaks) participants will typically seek to remedy these depending on the urgency of the works in relation to how the habitability of the home is affected. Participants also appeared to seek a home which was conducive to social engagement for the occupants and visitors. Comfort and a welcoming environment for guests appeared important to the participants. Personal esteem appeared to be related to comfort and self-image but also to a well functioning home, a welcoming environment and a platform for activities to enable the pursuit of other interests and achievements. Self-actualiation appeared to be related to enabling participants to pursue activities to satisfy learning and curiosity; that is, for self-fulfillment and learning. These are summarised in more detail in relation to the traditional perception of Maslow's Hierarchy in Table 7.3. Table 7.3 also incorporated 'social interaction within the home' (Section 7.3.9.1).

TABLE 7.3 Interpretation of key functions of a home based on Maslow's Hierarchy of Needs – 2

MASLOW'S HIERARCHY			ALTERNATIVE DESCRIPTION		CONTEXT OF HOME AND EER
LEVEL		MOTIVATION	MOTIVATION	TYPE OF MOTIVE	
1	Physiological	Comfort		Homeostatic	Comfort
		Calm	Curiosity		Shelter
		Fatigue	Sleep		Basic facilities (e.g. water)
		Sex	Sex		Functionality
		Hunger	Hunger		
		Thirst	Thirst		
2	Safety	Security	Aggression	Non-homeostatic	Security
					Stability
					Safety
					Comfort
3	Social engagement	Free expression	Self-presentation	Social motives	Platform for social interaction, activities and fun
		Sense of warmth	Cooperation		Welcoming environment
		Sense of growing together			Comfort
4	Personal esteem	Confidence	Achievement	Self-integrative motives	Functionality
					Comfort
					Platform for activities and fun
					Welcoming environment
					Image
5	Self-actualisation	Curiosity	Cognitive	Cognitive motives	Platform for projects for self-fulfilment and learning
			Consistency		
Adapted from Wagner (1999) and expanded					

There were some participants who, unlike others, were interested in the technical aspects of the works and sought to learn more about measures through the application of these to their own home (e.g. Case 005). Based on Maslow's Hierarchy, this reflects self-actualisation. In reality, EER was undertaken to simultaneously meet a number of the levels put forward by Maslow (e.g. comfort, functionality, security, welcoming environment, a platform for social interaction). It was not observed to be undertaken for one sole level.

7.3.9.1 Social interaction within the home

In addition to the basic functions above, the home was also seen as an arena for social interaction, as demonstrated by Aune (2007). This was indicated by a number of the participants, and summarised by Case 008:

Case 008: …we have a lot of BBQs and we have a lot of BBQs where friends come over and so it's important to have a place to welcome people and stuff like that and to hang about with your friends, not just, certainly we don't just live, we don't just sleep in the house.

These aspects of the home are connected to the beliefs, attitudes and values of the participants, contributing towards the decisions made in relation to the works they perform to their homes. If these valued aspects are threatened, participants felt it reduced the 'homeliness' of their house, for example, Case 003 emphasised that "*the damp upstairs which makes it less homely… nothing goes mouldy … it's just the corners of the room*". The reduction in 'homeliness' did not necessarily result in action to retain or regain such values – action depended on multiple factors including affordability and practicability of the measures required, and the inconvenience entailed, with Case 003 explaining he had delayed taking action mainly due to the inconvenience of taking action and the disruption involved. This also extended to barriers to improving the energy efficiency performance of participants' homes (Section 4.6.2 – barriers to action).

The home is a place for social interaction for occupants as well as for their visitors. It should be a comfortable place where the participants felt capable of hosting others, thereby providing facilities and functions to deliver this. Where this was an important aspect for participants, they appeared to be more motivated to perform future works to provide this; where participants prioritised other aspects or they felt their home already provided a suitable platform for interaction, this appeared to diminish their motivation to invest in modifying their home and potentially improve its energy efficiency.

7.3.9.2 'Home' and the environment in EER

A rarely explored area in the existing literature is how decisions about works to the home are driven by the concept of the home and its role and the perceived concept of the environment. Fawcett and Killip (2014) identify eight key motivations and influences on motivation through interviews with 'Superhome' owners, incorporating environmental and home comfort aspects. Both the 'home' and 'environment' were aspects which could interact to contribute to the present study's participants' final energy efficiency decisions.

Participants generally suggested that the decisions to undertake specific types of work were affected by both their concept of the environment and the role of 'home'. The affects of the concept of environment and home could be equally balanced, as stated by Case 016, "*This question of the double glazing is very directly relevant to the environment; it's partly wanting to create a congenial environment inside the home but it also has to do with escaping heat*". This affect of environment and the role of home on improvement decisions tended to vary between participants and types of home improvement and energy works; that is, some participants held 'environment' as having a stronger impact on their decisions than 'home', as concisely stated by Case 011, "*it's our home so I want to express my sort of need to help the environment by improving it with more measures*"; and vice versa. This also varying between measures installed – "*the solar panels aren't really related to an image of "home" in a way, they're just there on the roof*" (Case 021, male).

In relation to improving home energy efficiency, 'environment' and 'home' could be so intertwined in participants' decision-making that it was difficult for participants to ascertain whether their choice in the measures were affected more by one of these concepts over the other, particularly where the participant portrayed high environmental values, such as Case 017:

> "*I put that double radiator in because it was too cold in here so that was about warmth [and therefore 'home'] I suppose. But …in a way no, no they've [i.e. the home improvements] been more about environment and being warm. Well warm might be part of the home thing*"

7.3.10 Role of Image, 'Self' and Social Norms for EER

Motivation theories such as Maslow Hierarchy, Festinger's Theory and Self-Discrepancy Theory, and pro-environmental studies (Park and Ha, 2012) have suggested that action can be influenced by 'self-' and 'social image' (e.g. Festinger and Self-Discrepancy) and how these interact with social norms (Maslow, Festinger and Self-Discrepancy). Where individuals' behaviour is in conflict with their ideal image or where the behaviour is abnormal in relation to their perceived social norms, Festinger's Theory and Self-Discrepancy Theory suggest these individuals will adopt or stop behaviour to close the gap between their ideal and actual selves (Jackson, 2005) or to conform with social norms. At its foundation, this is based on participant perceptions. However, in the present study participants found it difficult to define what they and/or their home actually portrayed, and some participants were observably uncomfortable and/or uncertain.

Interestingly, participants all commented during the interviewer's visit, often in an apologetic way, on their homes being messy or untidy, even where this was not observed in reality. Some participants felt this reflected their self image:

> Case 017: "*It probably says I'm quite messy, I don't care much about minimalism…So it's eclectic, it's not minimalist, it's not tidy, it's not modern so … yeah it probably does reflect who I am*."

It is inferred that Case 017's above quote implies a difference between participants' perception of their home and what is acceptable in society, and reality. Despite the difficulty in defining this image, participants agreed that the home portrayed an 'image' to wider society. Further, many of the participants agreed that they had an 'environmental image' although most did not feel this was intentional. Some participants felt they were not as 'environmental' as they should be, either not meeting their image (Case 025) or in comparison with neighbours (Case 016). Case 016 highlighted the feeling of embarrassment regarding appearing less energy efficient than his neighbours:

> "*…when it snows and the snow on our roof melts more quickly than the snow on other people's roofs, I feel very slightly embarrassed [laughs], but I think most people who know us around here would know that's the case because we're skint. So that doesn't trouble me terribly much at all.*"

The embarrassment described by Case 016 again implies a perception of 'right and wrong' (moral norms) in regards to energy efficiency as discussed in Section 7.3.8. As discussed in Section 7.3.6, this could reflect pro-environmental behavioural theories (e.g. value-belief-norm theory and norm activation theory), and potentially result in a gap between the actual and ideal self, causing an individual internal discomfort (Festinger's Theory and Self-Discrepancy Theory). Discomfort in the form of embarrassment was also highlighted by other participants, for example Case 002 who explains that her house was "*incredibly [in]efficient right now with single [glazed] windows – I'm a bit embarrassed that it's so leaky*". Stern (2000) suggests that 'moral norms' are key for motivating pro-environmental action. Participants' sense of embarrassment and 'right and wrong' suggests that this can also be applied to owner-occupier motivation for EER.

Interestingly, no participant volunteered the notion that their home portrayed an 'eco' image. When asked, whether portraying an environmental image was conscious or not, views between participants differed with some (e.g. Case 011) agreeing it was, and others (e.g. Case 016) believing it was not:

> Case 016: "*…well I think it must do inevitably…it's not something that I consciously pursue; I can't possibly afford that…I'd like to think, probably, that image doesn't matter terribly much to me.*"

Counter to pro-environmental studies (e.g. Barr, 2003) which have recognised social norms and image as important, generally participants agreed that social norms and image did not form a big part in their motivation to perform energy efficiency works, EER or even general works to their homes. However, Nolan *et al.* (2008) have shown normative influences are not generally recognised by people, with a tendency to under-report the importance of these in favour of participants' own preferences. It was recognised by a number of participants in this study (e.g. Cases 002 and 008) that they socialised with others who shared similar values, implying that amongst participants' direct social circle undertaking energy efficiency works were likely to conform to social norms. 'Social acceptance' could be further emphasised where participants looked to friends and family for recommendations on measures to install, although this was more likely attributable to trustworthy information on measures from known sources.

Predominantly the 'environmental image' was considered to be acceptable and participants were happy to portray such an image, although not all participants believed it to be socially acceptable. The consensus was that, although society generally does not consider it an acceptable image to portray, it was becoming more acceptable over time, with Bristol recognised as potentially more accepting than other places. Even where participants considered society as unaccepting of the 'eco' image, they did not generally consider this acceptance to be something that concerned them.

Social acceptability was, by some participants, attributed to Bristol and its 'normalisation' of a number of environmental actions (e.g. curbside recycling, cycling) and its title of European Green Capital 2015. One participant highlighted this – "*I think it's still sneered at by some people but I think it's pretty main stream now. Particularly in Bristol – it's a pretty green city*" (Case 017). Acceptability was

recognised by Case 020 as dependent on which part of society they belonged or the people they socialise with.

Despite participants not openly acknowledging the influence of social norms, perhaps the Case 020 quote implies that, for some participants, an environmental image is not an acceptable image to portray within their social circle because it goes against the social norms of that circle, and therefore is not an image they should actively pursue. However, counter to this is that, even those believing it was socially acceptable did not all demonstrate strong motivation to take action to improve their home or had not undertaken action. Case 021 demonstrated an environmental image and consciousness throughout their interview, and had already taken action in terms of larger energy efficiency works to their home, yet they reported that their friends considered them unusual.

Excluding those with a strong sense of leadership in energy efficiency (what some authors have termed 'pioneers' – e.g. Fawcett and Killip, 2014), an interpretation is that, other than low carbon technology, the majority of energy efficiency works are not visible to society or the occupiers; at most, the majority of *visible* works are only observable to occupants and visitors. This supports the findings of Bichard and Kazmierczak (2009) and Barr (2003) who found that for social norms to have an impact on actions, they must be readily visible. Wilk and Wilhite (1985) found that invisible, 'unglamourous' measures such as draughtproofing were found to be unattractive to owner-occupiers, something reaffirmed by Judson and Maller (2014) who found that most interviewees had installed visible measures (e.g. photovoltaic panels, solar thermal panels, double glazing). In the present research, the immediate social circle could potentially influence participants' decisions via social norms, but as a factor 'social norms' is likely to have less influence than other factors. Social norms could also be introduced through forms of media (television, magazines) although this has been discussed under 'fashions and tastes' (Section 7.3.11).

Some participants, particularly those such as Case 002 who exhibited strong environmental values, felt there was a gap between the image their actual home and their ideal home portrayed demonstrated motivation to take action based on the self image portrayed by the home and whether this was an acceptable image or one which created a dissonance, reflecting Festinger's Theory and Self-Discrepancy Theory and negative emotions, as discussed in Section 7.3.8:

> Case 002: "*I'm really lucky to have a house on three floors… so I just think it probably doesn't reflect me really because…I can't really believe I live here…definitely the new [double glazed] windows and things like that [will help]… I'd love it to be more efficient. I think the woodburner is great. Because I work in wood and so the timber stuff reflects my personality…I'd love there to be solar hot water…. and ideally, you know a new efficient boiler and all that sort of thing…It's incredibly [in]efficient right now with single [glazed] windows – I'm a bit embarrassed that it's so leaky*"

Case 002 not only indicates that action to replace single glazed windows with double glazing is based on improving the energy efficiency of the property in order to reduce her dissonance, but later suggested the desire to improve the comfort of the home, reduce energy bills, and contribute to environmental aspects. This highlights the complex nature of motivation for EER. A further dissonance was introduced regarding image; although most participants reported being content with their actual image, others indicated some tension:

> Case 010: "*if anyone were to ask me…I was probably a bit of a fraud, because… I would like to be able to say I don't care, you know like the Victorians and say well it doesn't matter I can ruin someone else's back yard because it won't affect me...so I always have that sort of, guilt is the wrong word but well its like if someone questions me closely well I'm probably not as green as I would like to be.*"

Case 010's above quote indicates a tension for some participants – the desire to behave irresponsibly but the moral obligation to behave differently and to conform to

the norms of their social circle. The role of social norms appeared to be a contradiction throughout many of the interviews: participants believe they do not care about conforming to such 'norms', superficially not recognising the importance. However, they did appear to be affected to some extent by social norms, particularly relative to their direct social circle. This perhaps indicates that social norms are a minor underlying factor for home energy efficiency improvements.

Those who exhibited lower environmental values or had already installed multiple energy efficiency measures typically reported being content with the image their home currently portrayed to society They felt no gap existed between their ideal and actual 'self' images, regardless of whether they felt their actual image was 'eco' or not. Based on the Festinger and Self-Discrepancy theories, this type of individual is less likely to be motivated to act. However, this was not always the case – whether or not a gap between ideal and actual selves exists, action appeared to be more dependent on other priorities and factors (e.g. economic constraints, children) (Section 7.3.12).

When asked, it was individuals who reported being content with the image their home portrayed who typically stated they would not install energy efficiency measures to their home if money were no object. Although contentment with self image could explain inaction, as indicated by the following exchange between the female and male participants in Case 020, this inaction might be attributable to availability of appropriate products and lack of knowledge about options (Section 7.4), potentially in addition to other priorities:

> female: "*No, I don't know if I would actually. I'd go on a lot of holidays and come back here. What would I do to it? There's not actually that much you could do to it. I've considered having a conservatory but it doesn't fit with the house because of the way the back garden is laid out. It doesn't feel like there's an awful lot you could do with it.*"
>
> male: "*The next thing I think about is solar panels*."

female: "*Possibly, but I really don't know enough about them"*.

Participants' perceived 'actual image' appeared to be influenced by their friends, with participants commenting on whether they were performing to similar levels or under- or over-performing relative to their social circle. As stated by one participant, "*I wouldn't say I'm on the forefront a sort of warrior eco warrior but I am certainly aware of the things…I lag slightly behind my friends but I'm…ahead of the population as a whole*" (Case 010). This comparative performance, however, did not guarantee their motivation/demotivation or action/inaction to improve the energy efficiency of their homes.

There was awareness amongst some participants that performing environmental and energy efficiency behaviour or actions was more likely due to the fact that people tend to surround themselves with friends and others with similar values to themselves, as indicated by Case 002:

> "*…a lot of my friends are 'environmental' actually; …we probably hang out together because of it…I think that does affect who you hang out with. People [who] blatantly ignore the environment I think I probably wouldn't end up being that good friends with them*"

A participant's social circle sharing similar environmental value could, in part, be attributable to making EER or energy efficiency works socially acceptable and visible, increasing awareness within a social network and wider community, and leading by example, something emphasised by some participants as important – "*I want to try and inspire other friends and maybe people don't think about the environment…but then a by-product is that they are not even trying, it helps nature and stuff and if I can inspire that in… people that I know then that's a good thing*" (Case 011)

7.3.10 Role of Fashions and Tastes in EER

The question of whether an individual's desire to portray a trendy, 'eco' image was asked in Section 3.7. This did not appear to be the case in any of the twenty-five interviews: participants indicated no interest in portraying a 'fashionable' image. Participants did not believe they were significantly influenced through fashions to improve the energy efficiency of their home. Some considered fashions to have an influence by increasing general awareness, reducing the cost of measures and improving availability of products. There was some suggestion that influence from the media could be subconscious, but this was acknowledged to be minimal. Rather, within the home, participants are more likely to be influenced and motivated through their own values, preferences and priorities as well as capital constraints and product availability.

7.3.11 Compromises and Priorities

Competing priorities have been identified as a principal factor in the decision to undertake energy efficiency works (Judson *et al.,* 2014; Chryssochoidis and Wilson, 2013; Munro and Leather, 2000; Munro and Leather, 1999). Participants clearly showed the need to prioritise work in relation to other works, and in relation to other areas of their life. Comfort, functionality, and aesthetics have been identified by Haines and Mitchell (2014) as being commonly prioritised by owner-occupiers. In the present study, compromises were expressed by participants, and concisely formulated by Case 024 (female):

> "… *I think we have done the bare minimum when it comes to the external because you'd just run out of money so you know you do what's the most urgent…on the priority list*"

Priorities were not isolated to building maintenance and works, but often included holidays and children, as highlighted by Case 021 (male) who stated "…*having not done it for years because the kids were around and money was tighter. Then there was money available*". Case 021 (male and female) were retired and resided in a low deprivation neighbourhood in a Listed property, highlighting the relevance of

financial constraints and the need to prioritise across deprivation neighbourhoods, but also highlights the importance of financial opportunity.

Although other factors such as children and creating a weather-tight, secure home could be prioritised over energy efficiency improvements, children and grandchildren could also be a motivator in terms of improving the home, as demonstrated by Case 016 who stated "*I think that making my daughters comfortable in their bedrooms is certainly linked to the idea of home for me and I'll give that priority now*", also demonstrating the prioritisation of comfort, particularly the comfort of others.

Priorities and compromises were not confined to home improvement decisions. Participants also highlighted the need to make compromises in terms of the environment in relation to lifestyle options (i.e. eating less meat; flying less), reducing waste by tolerating previous owners' tastes, or by choosing products with a high environmental footprint if those products have better thermal resistance:

> Case 006 (male): "…*I was very conscious that high density foam isn't very environmentally friendly ... And it's always a balance …But on the counter side of that is by putting all the insulation inside this house…it's cut the amount of energy use from the house. So, sooner or later the greenhouse gases and…environmentally unfriendly materials that went into making that will be counter balanced…by the CO_2 savings*"

Such decisions were based on the participants' values, awareness and priorities. For example, some participants appeared to value micro generation of energy over embodied energy, and other participants embodied energy over micro generation. Compromises also existed in relation to the type of products some participants found environmentally acceptable verses practicality, aesthetics and affordability, as summarised by Case 011:

> "…*it's kind of what is the best environmentally thing I can get away with for the price and the aesthetic it's the optimum thing so sometimes it will be more environmental but we've got a water butt out by the front door which maybe*

> *doesn't look that attractive but I really wanted that so I was happy to compromise on the aesthetic*"

Compromises also extended more generally to environmental actions and strongly reflected participants' priorities, such as keeping a garden for recreation rather than producing food (e.g. Case 016) or driving to avoid having a detrimental affect on work:

> Case 024 (male): "*I drive to work every day, do I have to drive to work every day possibly not I could probably buy a bike probably cycle but then quite often because my job is unpredictable I could be called out during the day or I would have to run an errand that wouldn't be cycle-able during the day and then that would compromise my business if I didn't have that at my disposal*"

Compromises also were present within the present study's households where attitudes, beliefs and values of the inhabitants differed. This was summarised by Case 022:

> "*I'd like to be a lot better than I am and a lot of it is that I might feel a certain way but it's trying to get the other people in the house to do the same thing so, the bit about switching things off at the wall and not having things on standby. I might see it in a certain way; my husband certainly doesn't.*"

The central role of compromises and priorities found in the present study supports Haines and Mitchell (2014), who found compromise between household occupants potentially causes tension and 'stagnation', "*resulting in a less than ideal outcome"* for home improvements (p.472).

In some properties, particularly where participants had been in residence for less than three years, existing features did not appear to match participants' values. Case 007 had been in residence less than a year and demonstrated high environmental values, stated (female) "*there's double glazing just about everywhere but we sort of slightly*

baulk at some of the decisions they [the previous owners] made that wouldn't be ones we made which about how the house was set up". Although participants were aware of this gap between their personal values and the existing property features, it did not necessarily result in works being undertaken to reduce this discord. Works typically only occurred where works were necessary to ensure the home was sufficiently functionable for participants. This could be interpreted as either a value and belief compromise, but is more likely to reflect the prioritisation of other values such as avoidance of unnecessary waste (time, money, effort, material, and embodied energy), particularly where the condition and functioning of the property was satisfactory.

7.3.12 Participants' Loss Aversion

Loss aversion was demonstrated in most of the interviews, particularly pertaining to the financing of the works. Previous research has also shown that borrowing money is a last resort for owner-occupiers (Fawcett and Killip, 2014). This has direct implications for schemes such as the Green Deal.

The existing literature suggested that people are loss averse favouring the status quo (Christie *et al.*, 2011), overestimating potential losses and underestimating potential gains. This is considered to have an influence on motivation. Loss aversion, an individual's perception of risk, and regret avoidance are linked with social norms (*ibid.*), as well as anxieties about the unknown and potential negative effects from EER (Zundel and Stieβ, 2011). The inaccurate estimation on losses and gains verses the status quo might explain why the concept of payback periods, which are speculative, is less favourable than the concept of affordability (Fawcett and Killip, 2014).

Participants expressed interest in grants and incentives such as the Feed-in Tariff (where they had savings or financing to fund a technology installation), but most agreed their wish to avoid taking on any form of loan. Where works were urgent, such as a leaking roof, credit cards or loans were seen as a possible option, but for non-

urgent works, participants stated they would prefer to go without whilst saving for the works. When the Green Deal was explained (a loan at an interest rate of seven to nine percent; attached to the house rather than the individual; repayments made through savings on energy bills) many of the participants were even less interested because they were unsure about the affect on the resale value on their home, or they did not want to incur any form of debt. Some participants, particularly those demonstrating greater financial concerns and with observed need for some building improvement works, said they would be potentially interested in the Green Deal but would need to read the terms and conditions.

Loss aversion could be linked more generally to 'opportunity', the length of time participants took to consider works, and the perceived role of 'home'. That is, where a function of the property fails (e.g. roof leak, boiler malfunction), or where an incentive is offered (e.g. free or subsidised cavity wall or loft insulation), participants appeared more likely to act sooner to ensure the perceived functions of their home continue to be met. Although not guaranteed, this appeared to increase the likelihood of a quicker response for many participants.

7.3.13 Expectations of EER Measures

According to the Maslow, Vroom and Expectancy-Value theories, an individual is likely to act where they value the outcome. Based on 'self-regulation' motivation is 'goal directed' and people will anticipate desired outcomes and develop strategies to attain these (Seo *et al.*, 2004). Outcome expectations are central to motivation theory, whether explicit or implicit, as to act, individuals must seek to attain some outcome, and that outcome must have some value for the individual. The greater the desirability of the outcomes for the individual, the more likely they are to be motivated to act. Tan (2008) suggests that action will be taken only when the expected outcome complements what an individual values. Interestingly, 'expectation', although a key consideration in any refurbishment or building works programme is considered rarely in energy efficiency studies. For participants in the present study, their expectations were directly linked with the level of existing experience or knowledge, the amount of

research they had undertaken, and the availability of information. This also appeared to link with the time spent considering the works and therefore to loss aversion. Regardless of the source, if information is difficult to access, confusing or has a mixed message this appeared to diminish participant motivation for energy efficiency improvements.

Participants who had installed energy efficiency measures reported that these had delivered on expectations or surpassed them, although one participant (Case 003) reported that their partner had expected a new combination boiler to result in greater savings on their utility bills.

Previous research has indicated people have greater motivation to act where the threat of losing something they value exists (Knight Lapinski and Rimal, 2005). Linking to loss aversion, findings from the present study could be interpreted as supporting this in the context of affordable comfort (heat or energy) (i.e. taking action where affordable comfort is threatened). However, such an interpretation does not explain why owner-occupiers do not currently maintain such conditions. Instead, this is interpreted as supporting the economic and social (comfort) motivation themes.

7.3.14 Concept of Waste

Waste was commonly raised by a number of participants, but has not been particularly explored by previous studies on home energy efficiency or motivation. However, it appeared to be a central factor in participant decisions in relation to the home and their lifestyle, supporting Fawcett and Killip's (2014) recent findings identifying waste as one of the primary motivations for undertaking 'Superhome' refurbishments. In the present study, waste was discussed in a range of contexts (e.g. generally, instilling values in children, composting food waste, furniture, and energy). Case 008 concisely stated *"I think particularly my bugbear is waste; whether that's things or energy or whatever. So to try and minimise the amount of wastage is important to us*", something also reflected by many other participants (e.g. Case 004,

006, 012, 013, 017), particularly in the home. It is therefore unlikely that EER will be undertaken where the condition of the existing home is good as this would lead to waste (i.e. materials, money, time).

As a pro-environmental behaviour, recycling is much discussed in the existing literature (e.g. Thomas and Sharp, 2013; Barr, 2003; Chan, 1998). Recycling appeared to be broadly related to participant environmental values and waste – although all participants recycled (perhaps indicating a normalisation of this practice in Bristol), this was done to varying degrees and could reflect the strength of environmental values. Although this generally supports findings by Barr (2003) who found situational and psychological factors had greater influence than values, the degree of recycling can reflect strength of environmental values and aversion to wastefulness.

7.5 SUMMARY

Participants had economic, environmental, social and waste motivations. Although these could act in parallel, one or two of these were more likely to dominate. In the absence of action, participants can be motivated to undertake EER through four motivation themes – environment, social, economic and waste. The effectiveness of a drive to foster these themes will be based on the owner-occupiers' internal factors and context (external factors), as discussed in the following chapter – Chapter eight.

How participants view the role of their home can also shape their motivation for EER, which measures are selected, and the desired outcomes. The perceived function of the home and/or participant perceptions of the environment can also contribute to decisions regarding the measures selected for home improvements. Participants generally agreed a home should provide: basic facilities; safety and security; comfort; a welcoming environment; a platform for activities and fun; and enable social interaction. The expectation of measures in retaining or improving such functions can help direct the motivation to improve particular elements within a home. Where measures had been installed, participants all reported their expectations as met or surpassed.

The shape motivation takes will be dependent on internal factors. The internal factors which featured more strongly amongst participants included: attitude, beliefs and values; priorities; the role of home; loss aversion; and sense of responsibility. Moderate internal factors appeared to include: locus of control; trust; self and image; expectations. Weaker internal factors: social norms; and fashions and tastes. Decision-making was ascertained to feature, but difficult for participants to grasp, and more likely to act as a process rather than an internal factor.

Participants' locus of control generally differed, but overall participants were likely to believe they could not make a wider difference solely through their actions through home improvements beyond improving the internal home environment for family and guests. However, they were more inclined to believe they could make a difference collectively and through increasing awareness through their social circle. Participants were more likely to act where their social circle shared similar values and/or had performed similar works, although this was not always the case and was not recognised by participants as having a significant affect. For some, leading by example was of greater importance than conforming to social norms.

Image, although reported by participants as not having a significant role, varied between participants – those wishing to lead by example were more aware of the image they and their home portrayed. Reflecting an environmental image was generally agreed as currently being more acceptable in Bristol than other locations, although participants generally believed this type of image was not portrayed consciously. Participants were motivated to behave and act in a way to meet their own values as much as possible, providing themselves with a self image which did not conflict with their values, providing this did not conflict with other personal values (e.g. generating more waste).

Emotions featured as an internal measure of participants' action or inaction. Negative emotions such as guilt or embarrassment link to moral norms and sense of

responsibility. This can also be linked to loss aversion, which is an important aspect for EER – participants prefer to avoid borrowing finance to perform works, favouring saving where works are not urgent. This has direct implications for schemes such as the Green Deal. This also has links to compromises and priorities, where competing life demands can constrain finances and potentially prevent action, but only suspends motivation.

Compromises and priorities were identified throughout interviews, from prioritisation of resources (time, money, energy), to prioritisation of improvement works, to compromises between conflicting values of occupants. Environmental compromises in relation to aesthetic and practical outcomes were also identified (e.g. the retention of existing features).

The time spent by participants in considering works varied between individuals and projects. Generally, there were two groups – those who acted quickly and those who took a long time. However, it was works perceived to be urgent to make a home habitable or retain desirable functions that were typically undertaken quickly; perceived less urgent works were often considered over a longer time period.

Beyond the increased awareness through media or similar sources, fashions were not considered to have an effect. Participants favoured their personal preferences, shaped by their own values and the constraints of their physical environment.

Internal factors alone are not sufficient to explain the strength of participants' motivation themes – external factors will contribute to this and to how this motivation manifests as action. The following chapter will discuss the role of the external factors in shaping participant motivation.

CHAPTER EIGHT: QUALITATIVE DATA ANALYSIS PART 2: External Factors

8.1 INTRODUCTION

The present chapter focuses on the findings of the qualitative data produced around the external factors affecting owner-occupier motivation. As with Chapter seven, Chapter eight discusses the findings relative to the existing literature. The findings of this chapter will contribute to answering key research questions one to three introduced in Chapter one (Section 1.6):

1. Why do owner-occupiers perform domestic EERs?
2. What are the principal motivations for EER in the owner-occupied housing stock?
3. What are the drivers influencing owner-occupiers' motivations for EER?

The chapter will also contribute to Objective five (Section 1.5) - to analyse and appraise the relationship between owner-occupiers' motivation for EER and the motivation themes in relation to the conceptual model. External factors are an important aspect to motivation as these can help shape not only the internal factors over time, but also shape the form in which the action takes, and the opportunities and barriers owner-occupiers might face where they seek to physically realise their motivation. The chapter will be structured into four principal sections – physical structure, opportunity, economic, and incentives and barriers, before finishing with a chapter summary. The principal sections and key themes are highlighted in Table 8.1. This chapter commences with a brief discussion of the role of external factors in relation to internal factors in EER motivation.

TABLE 8.1 Key sections and themes

SECTION		KEY THEMES
8.3	Awareness and approaches	Participants had varying ideas about what they would install if money were no object, although good level of knowledge of possible measures but uncertainty regarding applicability to their own home was generally reflected; some participants valued generating their own energy more highly than efficiency of products and embodied energy, whereas others felt more strongly about efficiency and embodied energy; works are typically undertaken gradually overtime
8.4	Physical structure	Suitable measures; cost of measures; condition of property; potential loss of existing features; eligibility of grants
8.5	Opportunity	Defective building fabric or services; existing plans to undertake works; moving into a new property; receiving a lump sum of money
8.6	Economic factors	Return on investment; interest on savings; access to finance
8.6.1	Return on investment, interest on savings and access to finance	Payback period; access to finance generally or at attractive rate; affect on EER motivation varies; aversion to incurring debt in favour of savings (and going without); affordability of works and energy
8.7	Incentives and barriers:	Savings on bills; comfort; grants, loans and schemes; capital costs; inconvenience; information; product availability; time
8.7.1	Incentives	Savings on bills; comfort; grants, loans and schemes
8.7.2	Barriers	Capital costs; inconvenience; information; product availability; time

8.2 EXTERNAL FACTORS, INTERNAL FACTORS AND EER MOTIVATION - GENERAL

Motivation is inseparable from the context in which it is bounded, motivational and emotional states being generated to enable humans to adapt to their physical and social contexts (Reeve, 2005). EER motivations are multifaceted and potentially complex, incorporating more than just the economic motivation, as discussed in Chapter seven. There often appeared to be an interplay of factors – between internal and internal factors, external and external factors, and internal and external factors where internal factors are those potentially intangible factors which exist within a person, and external factors are situational (context-related). The interplay between these factors will shape how owner-occupiers are motivated and how this motivation manifests (i.e. the type of action and measures).

8.3 AWARENESS AND APPROACH TO EER

Awareness is identified as a barrier by the existing literature and is highlighted as necessary, particularly in the realm of pro-environmental behaviour. This is taken to mean awareness of possible actions, the awareness of social pressure to conform (Bichard and Kazmierczak, 2009; Barr, 2003) as well as awareness of wider environmental issues. The existing literature has also highlighted that, although there has been a government focus on increasing information and awareness parallel to economic incentives, awareness itself does not guarantee action, a flawed view based on economist rationale (Yohanis, 2012; Barr, 2003; Kollmuss and Agyeman, 2002). 'Awareness' could be interpreted as an internal or external factor, and although it appeared to be an interaction of both, it was interpreted in the present study to be predominantly an external factor whilst being shaped by internal factors.

In the present study, participant awareness of the wider environmental issues and the need to improve the energy efficiency of their homes was generally very good amongst participants across all neighbourhood deprivation levels and age groups. This awareness had roots in childhood experience and growing up; regular interaction with the local environment; work; or a combination of these factors.

Childhood and growing up

Childhood experience was identified by a large number of participants as being connected with their eco-consciousness, whether this was due to bird watching, the values instilled by their family, the social norms of the area or similar:

> Case 008: "*I studied environmental science at uni so I picked that degree because it was something that I was interested in and … [the town where she grew up] has always been at the forefront of kind of a lot of environmental initiatives mainly because they've got a lot of money. So you've always had to recycle … they had recycling points all over the town…! There, you know there were three within a few minutes walk from our house so when they went over to picking up curbside collection everyone did it because it was so much better than what we had had before. So I think that probably helped as well because we just grew up with recycling at least paper and glass.*"

Childhood and growing up could incorporate studies and travel, and this could be argued as increasing participants' awareness of the wider environmental issues, and possible options for mitigating their environmental impact, as indicated by Case 018:

> "*…because of my experience of being in India and Senegal when I was thinking about those kind of things and trying to live simply, before it became popular. I went to Bristol University and to the Schumacher lectures and 'small is beautiful' and things like that.*"

Daily interaction

Participants' regular interaction with the local environment was identified as increasing participant environmental awareness. This could include experiencing the local environment and climate through walking or cycling, through to participants growing their own food. In discussing gardening, Case 013 (male) demonstrated his priorities in relation to his home, where he and his wife had moved home less than a year before and had spent a number of months improving the thermal performance of the fabric, primarily for comfort and economic reasons:

> Case 013 (male): "*Last place I had three veggie plots, flower beds and everything and as you can see it's just gravel at the moment. That will be changing. … The house is the first thing, getting the house right*."

Unlike other participants, some participants identified that growing food was not primarily done for environmental reasons – "*we do quite a lot of growing. But that's almost as much for fun as for anything else*" (Case 003). This highlights differences within the study regarding participant values and beliefs towards similar actions.

Work

Employment could impact in a variety of ways: some participants saw home energy improvements as a way to experience the effects first-hand, so they could better advise others –"*a way for me to do some of these things that I'm constantly telling other people to do. To experience it first hand* " (Case 005); installed measures reflecting part of the personality gained through their workplace (e.g. Case 002); or feeling the pressure through social norms amongst colleagues (e.g. Case 024, female).

In Section 7.3.10 it was noted that participants may not have taken action or be motivated due to contentment with their self-reported social image, but that this could also be attributable to the availability of products or the lack of knowledge. The lack of knowledge of energy efficiency products appeared to reflect lower motivation to improve energy efficiency of the home than those with greater knowledge. This could be interpreted in two ways: those participants with the greatest level of knowledge of energy efficiency measures were those who had already installed or were in the process of installing such measures; those who were considering taking action and had therefore undertaken independent research. Both imply that a higher level of motivation is closely linked with product awareness.

When asked what participants would hypothetically install if money were no object, some participants demonstrated a good level of awareness of available options, others

a poor awareness. Although good awareness was partially attributable to some participants having already undertaken some energy improvement works, others who had not acted and had previously showed limited motivation to act did proffer some suggestions. Some who had yet to act, however, indicated that they did not know what would be appropriate for their home, although they still made some suggestions based on existing knowledge. This implies a difficulty exists in selecting not just the most appropriate measures for a home when the opportunity exists, but possibly the selection of the most appropriate information, possibly against the finite time resources of the owner-occupier. This does not necessarily terminate motivation, but it can present a barrier to action.

If money were no object, interestingly, no two participants volunteered the same response to this question, although participants' answers generally included insulation, low carbon technology, and window replacement. The latter two options could be interpreted as a preference for installing visible measures supporting previous studies (Judson and Maller, 2014; Judson *et al.*, 2014). Some participants reported they would only install loft insulation (Case 004), whereas others suggested they would move house and build their own property incorporating energy efficient measures and technology (Case 010). Not only did this demonstrate different values and priorities, awareness of available options and applicability to each context, but also the importance of the financial constraints (even if money were hypothetically no object) and, therefore, the economic dimension in EER.

Although interest and awareness in the environment was generally good, participant views differed in terms of their actions in terms of attenuating their impact. Some participants embraced the idea or had even installed low carbon technology:

> Case 017: "…[I] *try to keep off flying because it's a huge imprint. And that's why I got a solar panel. I'd really like a PV panel when I've got enough money. So the environment is something that … almost runs my life ... Everything I do…I think what affect it will have on the local and the national and the world environment*."

Whereas others expressed their skepticism or concern regarding the embodied energy of such systems and therefore the overall environmental impact, where embodied energy is defined as the term used to describe the total energy required to create a material, incorporating extraction, processing, refining, transporting and installing the product into its final position (Plimmer *et al.*, 2008). Concern regarding the efficiency of such products was demonstrated by Case 006 (male) who stated that photovoltaic panels are "*getting slightly better but they're still less than 20% efficient and the figures I've been reading are like 12% efficient*".

Those who were interested in installing low carbon technology but had not done so reported a number of reasons for not taking action, including intention to move property, lack of capital, poor return on investment, poor incentives for certain technologies, not having optimal conditions, and other priorities (e.g. 'fabric first' approach, existing financial constraints). A number of participants commented on the difference between incentives for electricity-generating technology and heat-generating technologies. The participants indicated the constraints on capital and the lack of a level playing field between electricity-generating technology (e.g. photovoltaic panels which benefit from the Feed-in Tariff) in comparison with heat-generating technology (e.g. solar thermal). The Renewable Heat Incentive was introduced after the research interviews were conducted.

As discussed above, participants' environmental awareness tended to be all encompassing. This did not always translate into action, either due to barriers such as restrictions on finances (including other priorities); a lack of trustworthy information, knowledge of where to access such information, or being overwhelmed by conflicting information; or physical building restrictions:

> Case 016: "*Solar panels I did investigate very seriously indeed. I think I went to three different companies and got three very, very different stories from them and didn't feel I could trust any of them in the end. So the reason I didn't was, it all boiled down to finance in the end; the question of whether these*

> *energy measures would pay for themselves and I wasn't convinced in our case that they would*"

Most participants had undertaken phased energy works to their home, rather than a 'whole house' EER. Based on the qualitative data, people made improvements gradually as priorities changed (e.g. children left home), the capital became available (e.g. cash lump sums through retirement or redundancy, accumulation of savings), and the opportunities, to undertake improvements arose. This supports findings from Killip and Fawcett (2014) who found that EERs were typically undertaken gradually.

8.4 PHYSICAL STRUCTURE

The physical structure of the homes was clearly a factor in the decisions in how to improve home energy performance. This featured in respect to the availability of suitable measures (e.g. insulation for solid walled properties); cost of the measures; the disruption entailed in the installation of the measures; and the potential loss of any existing features.

> Case 004: "…*interesting … as soon as you say you lose the features that's a 'no' because there's a balance to be had which is making the home as efficient as you can and retaining the character of the home and if I wanted a box with no character then I would have bought a new build. And I didn't, so I guess it's making the best of what we have here and I'm happy to do that, but not at the cost of* [losing the features]"

The potential loss of existing features was seen as unfavourable across age groups and, interestingly even by those exhibiting high environmental values (e.g. Case 021). Participants valued existing features and accepted that there could be compromises regarding energy efficiency and retaining key elements of the existing physical structure. Where the property was in a Conservation Area (Case 021), this further limited action in relation to energy performance improvements, and could also limit eligibility for grants.

8.5 OPPORTUNITIES FOR ENERGY IMPROVEMENTS

Existing literature has suggested that energy efficiency works are more likely to be performed by those already planning a home refurbishment (EST, 2010a) and that those most likely to be planning such works are those with a growing family (Caird *et al.*, 2008). The notion of a phased approach has been indicated by previous research as preferred by owner-occupiers (Fawcett, 2014; EST, 2010a). According to Wilson *et al.* (2013) a quarter of renovations are 'triggered' by events which are outside the patterns of ordinary life, most commonly where 'something breaks'. Based on the present study, Wilson *et al.*'s quarter is an underestimate as many of the energy efficiency related works in the present study were reported to be triggered by opportunity. Based on the interviews, 'opportunity' could incorporate:

- Defective building fabric (e.g. roof, windows) or services (e.g. boiler);
- Existing plans to perform an extension or works;
- Moving into a new property;
- Receiving a lump sum of money (e.g. redundancy or retirement)

Defective elements formed the most urgent works participants undertook. This could include defects resulting from previously installed energy efficiency measures as explained by one participant who stated "*The roof done was because on this end water had got in and, where that stuff had pushed it up, rotted out the wood, and this corner here dropped … 'cause I said to you one day 'there's a crack up there. That doesn't look right!' and I looked at it from out there and the guttering was lower this side than it was… So I got up and had a good look and it was absolutely rotten as hell… the [gable] ladder bit which supports the tiles had to be replaced with new wood. And that was all because of that [retrofitted insulation], I'm fairly certain because there was tonnes of it! It was everywhere*!" (Case 006, male). This could have useful lessons for current and future programmes such as the Green Deal.

How quickly the works were done depended on the urgency of the works, other priorities, and economic factors thus demonstrating an overlap between internal

factors (Chapter seven) and external factors. Participants were unlikely to undertake works for the sake of doing works, preferring to perform works in the most cost and time efficient, least wasteful way possible. For example, where a participant was considering undertaking a loft conversion they were more likely to report waiting to install more loft insulation so the works could be done in parallel. Where participants could fund the works, it was reported that they were likely to undertake a large number of necessary works upon moving into their home over the first few years, as explained by Case 008, below, and they were less likely to undertake additional works where they were considering moving:

> Case 008: "*we knew the radiators would need doing eventually but we didn't know how urgently they needed doing so we didn't have any central heating. The only radiator that worked was the one in the hall and there was a … really pathetic radiator in the purple room which gave off a tiny amount of heat. … the floor in the lounge had to be replaced because it was rotten and the joists were rotten underneath…and they were doing loads of damp stuff in there, so they took off that radiator so those were the only two radiators*"

Works could also be opportunistic where grants were being offered to subsidise energy improvement measures such as insulation, particularly where the participants were in the process of moving into their property or already planning works, as stated by Case 012 (male) "*Some of it was opportunistic as well… So when the cavity wall thing came along…I thought 'crumbs! Get the walls insulated for £200!' so that was opportunistic*".

General building works, whether these incorporated energy improvement aspects or not, ranged from redecoration to re-rendering to structural alterations, and rebuilding or replacement (i.e. after a fire – Case 015), but such works were often observed by the interviewer as providing a potential opportunity for improving the energy efficiency of an element, regardless of whether the opportunity had been taken by participants. Participants did not always appear aware of the opportunity these works had provided, and once the general works had been performed it was highly unlikely

participants were open to considering changing them. This was interpreted as participants' aversion to waste (money, material, time, effort) and dislike of avoidable disruption. Those who had been aware of the opportunity to include energy efficiency measures with general works but had decided not to, typically cited cost, aesthetic and practicality of such products as the reasons for deciding against the inclusion of such measures.

Participants did not typically perform energy efficiency works in isolation; that is, participants tended to perform energy efficiency works in conjunction with other general building works. As highlighted by Case 012 (male), although some building works could have an energy efficiency aspect to it, energy efficiency was not generally reported as the main driver for works, despite Case 012 demonstrating high environmental values:

> "*We had the back wall of the house rendered. That has got an energy aspect to it…because [the render made] the wall's slightly thicker but that wasn't the primary reason for doing it. The primary reason…was that the pointing on the back wall was poor; we were getting some damp coming through into the bedroom, occasionally into this [living] room so that's sorted that.*"

Where a property had been extended, participants did not report performing significant works to the main property in addition to such additions. So where an extension was added, the energy efficiency of the existing property was not improved in parallel with this. Often minor works could, however, be performed to the main property at a different time. This was outlined by Case 021 (female) who stated their extension was "*probably the most important change we've made, in that we've replaced a very cold, tiny little extension that had a flat roof and leaked…very poor insulation – virtually none…. So that's the biggest investment that we've made, the biggest single investment. And the draught-proofing, and insulation in the roof*". This was interpreted as the participant's focus on the performance of the extension as independent from the main building rather than part of the building, but possibly implying further lost opportunity, and possibly lack of awareness of performing

improvement works to the main structure, even in respect to low cost measures where funds were restricted at the time of the extension. Further, unless energy efficiency measures were put in place within the extension at the time of its construction, participants appeared unlikely to add energy improvement measures to these structures later. This was attributed to participant awareness of the energy measures in place in the main building at the time of decision-making - *"I was surprised … I moved in because I thought it [the loft] was fully insulated. And that shows how much my knowledge has grown since I bought the house because I didn't take as much notice of these things when I bought it…I did check but…it said 'is there enough insulation – yes' and it turns out there was 100mm, not 300mm*" (Case 005) - and/or priorities including availability of capital.

Existing research disagrees over whether owner-occupiers have a good knowledge of available measures or not. IFF Research (2012) suggests owner-occupiers have a good awareness of measures whereas EST (2010) suggest the converse. The present study found such awareness to vary significantly.

8.6 ECONOMIC FACTORS

Economic factors are a central aspect within the existing literature and the present study. These form part of the economic motivation theme, but 'economic factors' are not synonymous with 'economic motivation'; economic factors contribute to economic motivation theme, but these factors also include economic barriers such as capital costs (Section 8.7.2.1). Economic factors are considered a barrier to works (Housing Forum, 2009; Meijer *et al.*, 2009; Stewart *et al.*, 2005;) (Section 8.7.2.1) but also an incentive to perform works (i.e. utility bill savings) (Section 8.7.1.1) (DCLG, 2011a; Bichard and Kamierczak, 2009). Wilson *et al.* (2013) suggest that owner-occupier attitudes towards saving money are less important than other factors such as quality of life, and that capital costs of works do not inhibit people from considering refurbishment. The present study supports the principal view of the existing literature that economic factors are both a motivation and a barrier for participants to perform energy efficiency works to their homes. Economic aspects clearly played a central

role for participants – "*I'm aware of…environmental issues…and that's been a factor in having the work done although to warm the place up and save money on energy bills is a much bigger one*" (Case 006, female).

Economic factors such as capital costs and utility bill savings are discussed in Section 8.7.

8.6.1 Return on Investment, Interest on Savings and Access to Finance

Participants could be divided into two groups – those for whom the payback period of energy efficiency measures was an essential consideration in undertaking works to their home and could contribute to their decision to install a different measure due to more favourable returns; and those who recognised that certain measures may not be attractive in relation to payback periods but looked to perform the works regardless. The former group comprised of a greater number of participants than the latter. Those participants for whom the return on investment was of importance exhibited the influence of subsidies on their decisions to install particular measures. For example, Case 005 sumarised his decision to install photovoltaic panels as "*the return on investment for PV [photovoltaic panels] was better than [solar] thermal even though the actual installation was more costly [for the former]…so that was very much the driver around that and I've held off on solar thermal [until there is a more favourable return]– I've still got some space… on the front [roof]*".

Whether participants could access finance at attractive rates, or finance at all, clearly affected their ability to undertake works, although the affect on EER motivation varied. For example, although Case 005 found access to finance difficult, his EER motivation had not diminished. He explained he was in receipt of the lower Feed-in Tariff rate, and his lag in installing photovoltaic panels was because "*I just couldn't get it at the original price [Feed-in Tariff] because I couldn't get that amount of loan and I didn't have the savings to contribute. But half the price I could get a loan. And ultimately it's the same return because the Feed-in Tariff halved but the price halved, so the return's the same*". This was also reflected by some other participants, who had

attempted to find finance previously to capitalise on the higher Feed-in Tariff rates, but had been unable to do so (e.g. Case 017), and continued to investigate ways of gaining measures either at minimal or no cost to themselves (e.g. Cases 017 and 022) and/or gain greatest return on investment through tariffs (e.g. Cases 005 and 017).

Where possible, participants would rather pay for the measures themselves as opposed to incurring debt, and therefore a number of participants were willing to 'go without' something until they could pay for it themselves, or where there were grants available. Case 014 explained this as "*I know that I tend to want to try and have the best that I can afford and therefore if I can't afford it then I won't do it and I will live without that thing rather than do a half-way measure or getting into debt to do it*". This emphasises the desire to avoid debt. The concern appeared to be particularly regarding future circumstances, the affordability of repayments, and unexpected capital outgoings, particularly relating to urgent works to the house such as a leaking roof. This concern was emphasised by a number of participants, and epitomised by Case 008 who stated "*I just don't like it hanging over me…I would really worry… what if one of us lost our jobs …things are a bit desperate out there*". Further, other than mortgage repayments, participants liked being relatively 'debt-free' – "*it's a really nice feeling not having debt for the first time…now I don't have student loans anymore, [husband's name] doesn't have student loans*" (Case 008). Participants appeared to prefer having flexibility to make future lifestyle and home improvement decisions without being constrained by debt. However, the same participant (Case 008) also highlighted that they would consider loans where works were urgent, an opinion which appeared to be shared by other participants:

> "*…if for example something happened with the house urgently, you know, say the roof suddenly went again and we thought while we're here we may as well get a loft conversion and insulation and blah blah blah, we don't have the money, maybe I would consider getting a loan and then I would probably look for the best deal and the best combination of deals in order to do that…But there isn't anything that I can't wait… to save to do*"

The aversion to loans to finance works is a view shared by a number of participants (e.g. Cases 007, 014, 020, 024), and supports Fawcett and Killip (2014) who highlights the importance of affordability rather than payback periods (Section 7.3.13). This is further supported by findings in a report by the Centre for Sustainable Energy (CSE) (2012) who found 70% of participants would not consider undertaking a loan to pay for energy efficiency improvement works for their hard-to-treat properties; all respondents reported they would consider undertaking these works if 100% grant funded.

Interviewees across age groups (working age to retired) demonstrated an awareness of affordability of works and energy, as demonstrated by Case 012 (male), who stated performing EER works "*was partly to improve the house but also partly because we knew we were heading towards retirement and you don't want to be forking money out on utility bills*". Further this was also often connected with producing a comfortable home, and this notion of affordability is therefore associated with their concept of 'home' and its functions.

8.7 INCENTIVES AND BARRIERS TO EER

8.7.1 Incentives

The principal incentives identified by the interviews in relation to external factors (i.e. beyond improved comfort and well-being), to performing EER and energy efficiency improvements include utility bill savings; and grants, loans and schemes.

8.7.1.1 Savings

Interviewees expressed the savings on utility bills as being a driver for performing energy saving works to their properties, whether they had already acted or not, regardless of neighbourhood deprivation or age group. As Case 021 (female) stated "*I'm quite aware of our energy bills and how we can try and get them down*".

As a driver, utility bill savings typically did not exist in isolation; the notion of improved comfort or waste reduction were often mentioned in parallel with savings on utility bills, as demonstrated by Case 016: "*lagging was very important and of course I partly do that to keep fuel bills down but I also do it because I don't want heat to be wasted*". Therefore there is an association of savings with internal factors (Chapter seven). Such parallel considerations were also true in other contexts, particularly where larger capital outlay (i.e. spending) was involved, such as purchasing a car (i.e. Case 004). Since EERs involve large capital outlay and therefore this is likely to involve complex, multifaceted motivations for undertaking the works, whether or not these works are feasible for the participant at the time.

For some participants, the monetary saving was not the principal driver for the installation of energy efficiency measures or energy generating technology. Instead, aspects such as carbon reduction (e.g. Case 005) formed the main drive for installing energy efficiency measures. Although monetary saving was not the primary motivation for participants like Case 005 – "*money saving is not hugely important*", capital cost, for the same participant had been, and continued to be a constraint in the installation of measures. He explained "*I couldn't do the solar panels when I wanted to originally because I couldn't get the loan. I can't do the underfloor at the moment because the whole overall package that I want to do, including knocking down the wall, I don't have the money for that right now*". Therefore, although some participants are not principally motivated by economic factors, these factors still play a significant role.

8.7.1.2 Grants, Loans and Schemes

Interviewees generally agreed that incentives would be useful to enable energy works to be performed sooner. Some participants had already benefitted from incentives such as the reduced VAT rate (Case 008), cavity wall insulation and/or loft insulation (e.g. Cases 012, 013 and 014):

> Case 014: "…*increased the loft insulation as a result of an offer from the City Council. It was one that if I'd had anyone under 16 or over 60 I would have*

had for free, but as it was I paid a nominal amount. And they were offering at the time cavity wall insulation and/or loft insulation. I don't have cavity walls"

Other participants had benefitted from programmes such as the Feed-in Tariff (e.g. Cases 005, 009, 015), as outlined by Case 015 who stated "*we were fortunate enough to have the solar panels before the cut-back by the government* [i.e. the reduction in the tariff unit rate in December 2012], *so they were installed before that*". The choice of the term '*fortunate*' in this quote encapsulates how a number of participants felt towards grants and subsidies overall – that it was the minority who benefitted from a number of these schemes, although many participants had already received subsidised loft and/or cavity wall insulation.

A number of participants had indeed been influenced in the choice of measure (e.g. photovoltaic panels over solar thermal panels) based on the Feed-in Tariff. The interviews were performed prior to the introduction of the Renewable Heat Incentive, and therefore this gap between incentives demonstrated the lack of a level playing field between technologies. Exacerbating this lack of a level playing field was the incompatibility between technologies, as highlighted by Case 005 who stated "*I looked into it [the Renewable Heat Incentive] for that [solar thermal panels], and we found out at that point that my boiler wasn't compatible, so when I get around to doing that it'll have to be in combination with getting a new boiler*". This additional cost of replacing existing, functioning technology such as a boiler appeared to deter participants from considering the installation of solar thermal panels.

Some participants had benefitted from schemes such as photovoltaic panel 'rent-a-roof' (based on Feed-in Tariff income) (Case 022) and a loan-based scheme (Bristol Home Energy Upgrade), a Green Deal pilot scheme (Case 003). Case 003 explained he would not consider undertaking larger loans such as the Green Deal if repayments were going to be substantial, but based on a nominal repayment for a boiler under the Bristol Home Energy Upgrade stated the company had "*said we'd be eligible for fifty per cent of the boiler installation…it was just part of the survey. They came round, we*

paid them sixty quid and they said you can have that done….So we took advantage of that". This implies that participants could have strong economic motivation, providing it did not negatively affect their daily expenditure or lifestyle. Case 022 explained that she was motivated to improve the energy efficiency of her home "*when it's of no financial cost to me 'cause there's only so much that you can do. Everything costs so much! The solar panels we couldn't have afforded to do that on our own and, ok someone else is getting the benefit of it for, you know, they're getting the money from the government, but we're still benefitting as well so I kind of like the fact that we were doing our little bit for the environment*". This is interpreted as some participants being motivated provided the economic considerations do not affect their daily lifestyle or financial outgoings. Participants such as this tended to reflect more strongly the economic motivation theme. However, generally participants viewed schemes such as 'rent-a-roof' as a disincentive to action, as outlined by Case 008:

> "*…we did look at getting…solar panels and we probably will do that eventually when we've sorted everything else out but to be honest I would just do it. I would save up and do it. I mean [husband's name] is much better at financial things than I am and he looked at…these companies that come in and put sol- [solar panels on your roof through Rent-a-Roof schemes], and he was like 'it's just not worth…', you know if you've got the money upfront your better off doing it*"

There was a general consensus amongst participants that, although incentives would be useful, it would not be sufficient to motivate participants to undertake energy works; participants need to be motivated without the incentive to undertake works, and the works be facilitated sooner through access to incentives. This was concisely summarised by Case 008 who explained incentives "*didn't affect our decision but it was a bit of a bonus, so when we had the windows renovated some of the things had 20% VAT, or 15% or 17.5% VAT when we had it done… So that wasn't a reason to get it done but it was a bit of a bonus*". This suggests that incentives are needed where, providing the participants are already motivated to perform the works, at the time at which participants are looking to perform the works. However, Case 008 demonstrated the risk of 'free ridership', whereby participants who would have

performed the energy efficiency works to their homes without an incentive then benefit from such an incentive, generally supporting findings by Grosche and Vance (2009).

Where an attractive incentive was not on offer, e.g. for low carbon heat, some participants implied or stated that they would not or could not install solar thermal panels, in comparison with the incentives on offer for electricity-generating technology (e.g. photovoltaic panels):

> Case 021 (male): "*We have been thinking about solar thermal, because actually you can get along the side wall on the next floor up, and it would be right against the water tank, so it'd be ever so easy to do. But nobody offered us a grant for that, or a Feed in Tariff."*
>
> Case 021 (female): "*The feed in tariff was a huge incentive*"

Since the change in grants and subsidies (e.g. cavity wall insulation), participants from both lower and higher income backgrounds and deprivation neighbourhoods reported not being eligible for financial aid despite it potentially being of use. As outlined by Case 004:

> "*…it sounds ridiculous to say but we kind of earn too much to ever get any kind of help with these sorts of things. Which I should be grateful, well I am grateful that we earn enough to not be considered….to not need the help, but at the same time we do need the help…we're not multimillionaires here.*"

In addition to ineligibility of participants for financial aid, the accessibility of current grants was highlighted as a further issue in terms of feasibility of the works. This was particularly identified by Case 021, who lived in an end of terrace, solid walled property within a Conservation Area:

> "*we are thinking about external insulation and that's been an issue because the house is in a conservation area so we can't put it on the front, and most of the grants require you to do all the walls. And we can't [because it's a*

terrace]! So that's been put in abeyance at the moment until we can hopefully find some help that's available"

Works such as solid wall insulation can be expensive (Meijer *et al.*, 2009), and potentially prohibitively expensive where attempting to achieve significant reductions in carbon emissions (Stafford *et al.*, 2011). This was reflected by the lack of solid wall insulation in the present study, with participants such as Case 017 recognising the inability to install wall insulation in the future without sufficient monetary incentives. Around 7.8 million homes of Britain's existing housing stock comprises of solid walls (DECC, 2012b), which are generally considered to have inferior insulation (Palmer and Cooper, 2013), with a vast number of these properties incorporating party walls (i.e. terraced or semi-detached buildings) (DCLG, 2014) posing detailing challenges. Where all walls require insulation, this could result in a wide number of dwellings being ineligible. Additionally, aspects such as Listed Building and Conservation Area status can further affect the practicality and financing of the works, potentially reducing the feasibility, as demonstrated by Case 021.

8.7.1.3 Green Deal

Launched in January 2013, there is very limited literature on the Green Deal. Providing upfront finance to householders to improve home energy efficiency performance (Williams *et al.*, 2013), the existing literature has already recognised the poor uptake of this scheme amongst owner-occupiers (Fawcett and Killip, 2014). Wilson *et al.* (2013) suggests that for a value proposition, owner-occupiers need lower upfront costs, reliable contractors and reduced disruption – the Green Deal offers this, but to date uptake has been low, with just 2,828 households with 'Green Deal Plans' in progress by the end of May 2014, with just 1,372 'live' plan (measures already installed) (DECC, 2014). Participants were asked if they knew of and understood the Government's new mass building energy performance improvement scheme, the Green Deal. Most had heard of it, but most of the participants did not understand or fully understand it to be a 'low-interest' loan. Once explained, the general consensus was that the concept was not a favourable one, summarised by Case 001 as, the Green

Deal being "*a loan would, is a disincentive to take it up*". In June 2014 the Government introduced the Green Deal Home Improvement Fund, a grant scheme to encourage greater uptake of the Green Deal. It closed in July 2014 due to rapid uptake of the grants. Although this scheme was introduced after the data collection took place, perhaps its popularity reflects the public's preference for grants over loans.

There were some participants who were interested in this scheme (Cases 002, 003 and 016) depending on the terms and conditions, although Case 003 was not interested in funding larger energy efficiency works through the scheme linked to the amount and manageability of the resultant monthly installments. Interest appeared to be fostered amongst those who knew the physical property required general improvement works but did not have the savings to facilitate this, and viewed the Green Deal as a potential opportunity to act sooner. This was highlighted by Case 002:

> "*I've heard of it, but I didn't know it was a loan…I'd be really interested because…if you get the Feed in Tariff now it might not be there forever... And if it enabled us to do it, it's just so expensive, it adds up with scaffolding and…we'd need a new boiler 'cause we've got a combi [boiler]. And…we haven't got the cash to do that so if there was a way doing it when we couldn't otherwise do it then yeah, I'd be interested in looking at the terms*"

Some participants (e.g. Cases 005 and 017) who already had some knowledge of the scheme also highlighted that, although they would be interested in the Green Deal, there were challenges of combining it with other works or with other financing. As explained by Case 005, "*the works I'm looking at doing would be difficult with the Green Deal because the only major work would be the underfloor insulation and because I'm doing that in combination with the underfloor heating it's how you get Green Deal finance in there*".

The unfavourable Green Deal interest rates on offer at the time, something some participants (e.g. Cases 005, 008, 025) also commented on, Case 008 stating "*You'd be better off getting a credit card*". Participants also emphasised the disincentive of

the loan being attached to the house and/or the potential of 'putting off' potential future homebuyers or providing homebuyers with greater bargaining power - "*I don't like the idea that you have got to sell it with a loan on it I am convinced that would have an impact on selling it I am sure it would and you would have people chipping you on the price because you have got this loan and I think it is pretty rubbish*" (Case 024, female).

Overall, participants were uncomfortable with the fact that the Green Deal was a loan, as there was a general adversity towards any form of loan, and expressed an interest in grants. This was explained by Case 007 (male) who stated "*I'm not too happy with loans anyway…I think gone are the days of paying off the mortgage, you know…Even at a good deal, it wouldn't attract me at all. Whereas, say, 'we will give you a grant to do it' would attract me*". The current difficult economic climate was further highlighted as an issue in relation to the Green Deal, making it even less appealing to the participants. As stated by Case 024 (female) "*why would you take on especially in this economic climate, why would anyone want to take on yet more debt. I don't think people do and understandably*".

The suggestion that participants did not want the burden of more debt was a clear theme when discussing the Green Deal, indicating a strong sense of loss aversion (Section 7.3.13) amongst many of the interviewees, and concern over the affordability of future payments. This was true across demographics and neighbourhood deprivation types. This was summarised by an exchange between Case 013 (male and female), residing in a high deprivation neighbourhood:

> (male): "*Not really [interested in the Green Deal] because when we looked at it we looked to see if we could afford it and do it, because, like I said, I'm just newly retired but Betty has been retired a couple of years. Only saying that, if we can afford to do it, then we can do it. If we can get a grant towards it then we can do other things*…"
>
> (female): "*Basically if we could've afforded it we wanted to pay for it ourselves and then it's done and dusted.*"

The preference amongst participants was to fund works through mechanisms other than borrowing through the Green Deal or other loans, supporting findings by Fawcett and Killip (2014) regarding preferring to avoid borrowing to fund works. This could be partially due to the level of interest connected to the Green Deal, and a recognition that not only can better interest rates be accessed elsewhere (e.g. Case 005), but also that such a rate can stifle people's interest in the scheme (e.g. Case 025) – "*you can get cheaper…* [interest rates]*. So that makes me even less interested… if I want to do something I would just do it*" (Case 025).

8.7.2 Barriers to EER

Barriers have been mentioned in previous Sections and in Chapter seven. This section will aim to summarise the barriers in relation to external factors as identified by the participants.

8.7.2.1 Cost and Inconvenience

The cost of works and inconvenience were both highlighted in the present study as important in relation to prioritising works (i.e. urgent works first; less disruptive works first) and in relation to the other occupant needs. It appeared to mitigate participant motivation to perform works:

> Case 009: "*if it were less problematic and possibly less expensive I would consider doing some more… the only alternative [to improve the energy performance of the house] would be to insulate it on the inside which would require a huge amount of disruption and expense*."

Cost and inconvenience - often referred to in the existing literature as 'hassle', have been identified as barriers to home improvement works by the existing literature (EST, 2010a) (Section 3.2.5). Although cost has previously been highlighted as a primary barrier in the existing literature (Housing Forum, 2009; Meijer *et al.*, 2009; Stewart *et al.*, 2005;), more recently, Wilson *et al.* (2013) suggest that upfront costs are not a barrier to the decision to undertake works, rather such constraints lengthen

the time taken to decide. Wilson *et al.* (2013) also suggest the need for lower upfront costs, reliable contractors and less disruption (inconvenience).

Inconvenience has been cited by recent research in the context of owner-occupier home improvements (Chryssochoidis and Wilson, 2013; Wilson *et al.*, 2013). Cost and inconvenience were common themes when talking with participants about barriers to action, regardless of age, neighbourhood deprivation and environmental values, as stated by Case 010, "*Can I say not just money but inconvenience*". Case 009 concisely summarised these issues, and demonstrates the need to prioritise works in relation to urgency and habitability:

> "*Well it's a question of getting round to it really. And in living in a space, I mean there are obviously certain things that you do more or less straight away like get rid of all the Artex. But it's the sort of thing that you do bit by bit, given the fact that you're living in the house, you know, you're trying to use your finances wisely. The fact that every time you decide to do something you've got to move loads of other stuff round the house in order to create the space to do it.*"

The perception of inconvenience existed even when participants recognised the need for works to be performed. Case 003 had known he needed a new roof since moving in three years before based on home survey, and intended to undertake a loft conversion but had continued to delay taking action. This was justified based on "*it's going to be…six weeks of disruption, where we have to possibly move out of the house…it's just the hassle, I can't be bothered with it at the moment*". Inconvenience could also be connected with how the participant viewed their home as an extension of themselves, and the intrusiveness of building works, highlighted by Case 020 (female) who stated "*having your house ripped apart. I remember feeling – when we had the double glazing and actually the central heating – that it does really feel like an operation*". It is therefore viewed in relation to emotion, anticipated negative emotion reducing observed EER motivation.

Inconvenience also linked closely to the availability of appropriate products (e.g. cavity wall insulation is less disruptive than solid wall insulation) (Section 8.7.2.2), and to 'waste' (Section 7.3.15) in relation to only performing work when a home requires it, as summarised by Case 007:

> Case 007 (female): "*The wall insulation things are tricky, aren't they? Because they're…either coming inwards or going outwards and that's problematic…if your house is basically working and set up already, I can see the value of it in principle and if you move into a house that needs doing up then you do might well do it, especially if it had the amount of space that this house has; to lose four inches or six inches or whatever you lose on the walls wouldn't be a problem in most of the rooms*."

Capital cost was a significant consideration for all the participants, as was whether there were existing constraints (i.e. priorities – Section 7.3.12) on their capital. As summarised by Case 012 (male) (high deprivation neighbourhood):

> "'*Cause some of that was…opportunistic and [we] grabbed it [i.e. incentives] … so money plays a huge part in all of this stuff…Whether it's spending out on utility bills, or whether it's investing in energy efficient stuff… that is a dimension to it without a shadow of a doubt*."

In the context of costs, to facilitate decisions about whether to act, participants appeared to attempt balance of the cost of the works, potential return on investment in comparison to interest on savings, savings on utility bills, access to incentives (e.g. the Feed-in Tariff) and savings verses loans. This was done to differing levels, potentially linking with information (Section 8.7.2.2) and awareness (Section 8.3). The balance between costs and benefits is something identified by Stafford *et al.* (2011) who state it may be technically feasible to increase the energy efficiency performance to deliver a performance close to low-carbon new build, but the question is more about whether sufficient benefit can be gained against a reasonable cost.

Although the Green Deal provides for reduced inconvenience and capital cost 'requirements' to provide a more attractive value proposition, it has not only had poor uptake to date (Section 8.7.1.3), but also the present study's participants have indicated that they would prefer to fund the upfront costs of non-urgent works including energy efficiency improvements themselves rather than incur debt (Section 7.3.13), even if it took a prolonged period to accumulate sufficient funds. This supports findings by Fawcett and Killip (2014).

The availability of finance in relation to other priorities (Section 7.3.12) is associated with capital costs. After having a highly energy efficient kitchen extension and smaller energy efficiency works performed to their home in a Conservation Area, when asked why they had not acted sooner, Case 021 (female) commented "*timing, having not done it for years because the kids were around and money was tighter*". This was a theme across all deprivation groups, with Case 021 falling into a low deprivation neighbourhood. The existing literature indicates that those in upper incomes groups are most likely to want 'eco-refurbishment' (Peters *et al*, 2010; EST 2007; DCLG, 2009b), but in the present study there were examples of more extensive levels of energy efficiency improvements across income groups, although the motivations could vary. However, the economic motivation of saving money on bills appeared across all income groups. This was interpreted as all income and neighbourhood deprivation groups have priorities and constraints on their capital, and that all groups were therefore interested in saving money on utility bills not only to improve financial constraints, but also to increase fuel affordability, and affordable comfort.

8.7.2.2 Information and Products

Two other barriers identified by both the existing literature (Section 3.2.5) and the present study include access to accurate, reliable information (incorporating trust of the source and knowing where to access such information) and information on the availability of appropriate products. As highlighted by Case 008, "*you don't know what [is] out there until someone tells you*". In relation to undertaking home energy

works, the information barrier could also be in combination with cost and inconvenience (hassle), a decision could be affected by "*how much hassle it is, how much upheaval, what will it cost, erm, and how readily available the information is to as how efficient it is likely to be*" (Case 003). To enable greater uptake of energy efficiency measures in owner-occupied homes, there was a need for "*Good information, reliable information about the energy savings in a simple format. And money*" (Case 020).

All the participants had access to the internet to varying degrees and therefore participant recognition of the need for reliable information was interpreted less about access to information but awareness of where best to go for the more applicable, trustworthy information. This overlaps with the internal factor of 'trust' (Section 7.3.7).

Without existing knowledge about where to access information, existing connections with contractors, or experience in building works, participants appeared to have a reduced motivation to act, favouring acting in relation to other activities. This supports Vroom's theory, suggesting that people will act where they feel they are capable and have existing skills.

8.7.2.3 Time as a Resource

Time as a resource was important in terms of undertaking environmental actions and/or energy efficiency works. This could be a constraint for some participants, "*Because I'm self-employed, I have had times in my business when I've just had to focus all my energy on that*" (Case 018). However, one participant (case 008) who had reflected strong environmental awareness and values throughout the interview, suggested that as a resource, time was an excuse for not taking action in the context of environmental behaviour as well as energy efficiency improvements – "*there's almost a bravado around not doing things I guess, maybe in some groups – 'oh I don't bother with that because I'm too busy' or…'I'm more important' because I'm busier, I'm too busy to do that thing because my lifestyle is so hectic*".

Time constraints could also be in parallel with financial constraints, where the latter requires owner-occupiers to perform as much of the works themselves, but time constraints prevent this. This was particularly reflected by Case 016 - "*I'm constrained…by what I can afford to do myself so that's partly money, that's partly time*". This raises the skill and capability aspects – according to Vroom's Theory, people are more likely to act where they feel they possess sufficient skill and if they feel capable of completing the task. If they do not, they are unlikely to be motivated to act.

8.8 SUMMARY

External factors are situational factors (context-related), whereas internal factors (Chapter seven) are those which exist within a person. These interact to shape EER motivation. The external factors that shaped participant EER motivation and energy efficiency improvement action include the physical structure of the property, opportunity, economic aspects (costs, savings, available grants and schemes) inconvenience, information, availability of appropriate products, and time as a resource.

A property's physical structure will dictate the feasibility of improvements through costs and available measures. It will also affect the level of disruption and hassle owner-occupiers will experience. Where a property has existing physical features, owner-occupiers will seek to retain these, sacrificing potential energy efficiency performance improvements. The opportunity to improve the energy efficiency performance of a property also depends on the condition of the physical structure and the building services such as heating systems.

Opportunity was highlighted by participants as a principal factor in undertaking works where opportunity can refer to the physical condition of the property, existing improvement plans, moving house or receiving large sums of money. This will catalyse motivation into action, although whether owner-occupiers perform the bare

minimum works or seek to install the highest energy efficient measure they can afford will depend on their internal factors and the access to available, appropriate measures.

Economic factors are central to whether motivation to act is translated into action. Not only does this relate to the internal factor, *priorities* but it is also dependent on the balance between costs and benefits. Participants could be categorised into two groups – the majority using 'payback period' as an essential consideration verses the minority who perform works regardless of the payback period. This can reflect the different decision processes, motivations and priorities. Utility bill savings were a consideration but not always the principal driver. Generally, participants look to perform works at the optimum opportunity – where they can gain greatest benefits for least cost, and this can include appropriate access to grants and incentives. However, owner-occupiers will not perform works for the sake of it; they will look to perform works they consider appropriate to their internal and external context and therefore any incentives must look to support this.

Predominantly the Green Deal was not looked upon favourably by participants, and this is supported by other studies. As seen in Chapter seven, people are loss averse and unlikely to take on any form of loan, particularly in the current economic climate. They are even less likely to undertake such a loan which is attached to their property with uncertain implications on the resale value. Participants favoured saving and grants over borrowing finance to improve their home.

The cost of improvement works was considered a major constraint. Although it did not necessarily terminate motivation, costs suspended motivation and this is likely to be associated with priorities. Participants also considered hassle to be a constraint to works, and this appeared to result in a reduction in motivation to undertake works, particularly the most disruptive, in preference for avoiding hassle for as long as possible. This could result in some deterioration in the home's physical functioning,

resulting in later action where the opportunity arose or works became urgent. This will also depend on existing constraints on time.

Information and participant awareness have a role. These are important when suitable opportunities arise. Awareness of both the macro and micro environment appear to help shape participant motivation type, both potentially stemming from childhood, growing up, travel, work, and regular interaction with the environment. This will also shape participant attitudes, values and beliefs, which shape the other internal factors and therefore motivation. Awareness of appropriate products and reliable information can help facilitate or even prevent action. Reliability and trust of information, measures and contractors, as well as acquaintances providing recommendations were all aspects of the internal factor of *trust*, with the general consensus agreeing they are more likely to trust their own research and recommendations over previously unknown sources. Knowledge of appropriate, reliable sources of information and suitable measures varied considerably. Generally, unless participants had previous experience of performing building works (general or energy efficiency), they could find it difficult to decide on the best solutions. This was observed as reducing motivation to act, increasing the motivation to undertake other daily habits participants had the existing skill to perform.

Chapter nine discusses the quantitative findings in relation to the qualitative, drawing together the data presented in Chapters six to eight in relation to research Objective five and the key research questions. It also presents a refined conceptual model.

CHAPTER NINE: DISCUSSION AND REFINEMENT OF MODEL

9.1 INTRODUCTION

This chapter presents a discussion of the quantitative and qualitative findings presented in Chapters six to eight in the context of the wider body of knowledge and drawing on the earlier literature review. The key findings from the empirical data and this discussion are used to refine the conceptual model. The chapter is structured around the original research questions and corresponds directly to the fifth objective of this study, namely *to analyse and appraise the relationship between owner-occupiers' motivation for EER and the motivation themes in relation to the conceptual model*.

9.2 RESEARCH QUESTIONS AND SUMMARY TABLE

Chapter one outlined the following five research questions:

1. Why do owner-occupiers perform domestic EERs?
2. What are the principal motivations for EER in the owner-occupied housing stock?
3. What are the drivers influencing owner-occupiers' motivations for EER?
4. To what extent do owner-occupiers' values influence their motivation for EER?
5. Which motivational theory or hybrid of theories 'best fits' domestic EER?

The analysis of the qualitative data answered the first four questions and this will be outlined in the following sub-sections. A discussion of the findings will then be given in relation to question five.

Tables 9.1 a – d outline the principal motivation themes, external and internal factors elicited from the interviews. A full table is provided in Appendix G.

TABLE 9.1a Internal factors, external factors and motivation themes

INTERVIEWEES	Case 001	Case 002	Case 003	Case 004	Case 005	Case 006	Case 007	Case 008	Case 009	Case 010	Case 011	Case 012	Case 013	Case 014
Gender	Female	Female	Male	Female	Male	Female	Female and Male	Female	Female	Male	Female	Female and Male	Female and Male	Female
Age (years)	50s	26 - 30	36 - 45	26 - 35	26 - 35	46 - 55	61 - 70	36 - 45	61 - 70	56 - 60	36 - 45	56 - 60	61 - 70	46 - 55
Location	Knowle	Windmill Hill	Henleaze	Henleaze	Bedminster	Henbury	Henleaze	Southville	Windmill Hill	Bedminster	Windmill Hill	Whitchurch Park	Whitchurch Park	Henleaze
Deprivation level	Medium	Medium	Lowest	Lowest	Medium	Medium to High	Lowest	Medium to Low	Medium	Medium to Low	Medium	High	High	Low
KEY THEMES														
Economic motivation	Important - common sense			Important		Economical to run important			Second most important	Sensible		Important	Important	Equal importance with environment
Environmental motivation		Important		Important	Important	increasing energy efficiency important	Important		Most important		Important	Important	Important	Equal importance with economic
Social motivation	Comfort	Warmth	Important		Comfort main driver; tool for learning	Comfort a priority;	Comfort; additional useable space	Comfort	Third importance - comfort	Comfort and self satisfaction		Comfort	Comfort	Comfort most important
Waste motivation	Important	Important	Important	Important		Important	Important	Important	Important			Important	Important	
Values - childhood and/or life experience	Factor							Factor	Factor	Factor		Factor	Factor	
Locus of control (whether personal choices determine what happens to you)	Good but variable. Not environmentally	Good	Variable. Limited environmentally	Variable.	Good	Variable. Group effort best		Good, but limited impact. Group effort best	Yes	No	Yes, but variable	High	Yes, but small	Good
Self-efficicacy (belief in own ability)					High	High	High			Moderate		High	Moderate to high	Moderate
Sense of responsibiliy	Yes, good citizenship	Yes, to people	Yes	Yes, to herself	Yes, to the developing world and future generations	Yes, to future generations	Yes, ethically, spiritually; stewardship	Yes, to herself, child, and people	Yes, developing countries and future generations	Yes, to the world but doesn't fulfill that resposbility	Yes, to nature and people	Yes, to society and the greater good	Yes, to the planet and grandchild	Nominally
Lead by example		Yes	Partly		Yes	Yes		Yes			Yes	Yes	Partly	Yes
Trust	Variable	Variable	Variable	Variable	Personal knowledge	Variable	Generally good	Variable	Variable	Variable		Variable	Good	Variable
Emotions		Embarrassment		Guilt, obligation, anger									Guilt	
Role of home (not image)	Important	Important	Important	Important	Unimportant	Important	Important	Important	Important	Important	Important	Important	Important	Important
Self		Desired environmental image; lead by example	No	No	No			No	No					Eco image normal; leading by example; not a conscious image
Social norms	Yes	Social circle similar values	No. Some influence from neighbours visually doing work				Variable	Social circle similar values	No	Social circle has some influence	No, attempting to influence social circle	No, attempting to influence social circle	No, but attempting to influence neighbours	No, but attempting to influence social circle and others
Moral norms	Yes			Yes			Yes		Yes			Yes	Yes	

TABLE 9.1b Internal factors, external factors and motivation themes

INTERVIEWEES	Case 015	Case 016	Case 017	Case 018	Case 019	Case 020	Case 021	Case 022	Case 023	Case 024	Case 025
Gender	Male	Male	Female	Female	Female	Female and Male	Female and Male	Female	Male	Female and Male	Male
Age (years)	Over 70	61 - 70	56 - 60	46 - 55	61 - 70	56 - 60	61 - 70	36 - 45	61 - 70	36 - 45	61 - 70
Location	Redland	Redland	Southville	Windmill Hill	Whitchurch Park	Whitchurch Park	Clifton East	Bedminster	Stoke Bishop	Bedminster	Henleaze
Deprivation level	Medium to Low	Medium to Low	Medium	Medium	High	High	Low	Medium	2nd lowest	Medium	Lowest
KEY THEMES											
Economic motivation		Significant aspect; affordability	Important	Important; afforability	Important - energy bills		Equal importance with social (comfort) and environment. Inter-related	Important; affordability	Equally important with environmental motivation	Important	Important
Environmental motivation	Most important	Small part	Important	Important	Very important		Equal importance with social (comfort) and economic. Inter-related		Equally important with economic motivation		Important
Social motivation		Comfort	Warmth and comfort		Comfort	Important	Equal importance with environment and economic. Inter-related	Warmth	Comfort	Warmth; comfort	Comfort for family
Waste motivation		Important	Important		Important	Important				Important	Important
Values - childhood and/or life experience				Factor	Factor			Factor			Factor
Locus of control (whether personal choices determine what happens to you)	Variable	Variable	Good	Good	Ok - small but makes a difference. Not vast changes	Good	High	Good	Poor	Variable. Incremental and group impact	Variable
Self-efficicacy (belief in own ability)	Moderate		Moderate	Moderate	Good	Moderate	High				High
Sense of responsibiliy	Yes, to the planet	Yes, to the future and planet	Yes, herself, family and friends	Yes, to the Earth	Yes	Yes, to the planet and family	Yes, to future generations	Yes, to the future and family	To himself	Yes, for children and future generations	Yes, to humanity
Lead by example	Yes				Yes		Yes	Partly			
Trust	Good	Variable	Variable	Poor	Variable - let down by 3 companies. Trust acquaintences more	Variable	Variable	Good	Issue	Good	Variable
Emotions		Guilt; embarrassment								Guilt	
Role of home (not image)		Important							Not important		
Self		Not a conscious image	Leading be example; don't consciously portray an image in the home	Not a conscious image	Not a conscious image, but acceptable in society	Not interested in an image	Lead by example	Not a big consideration beyond garden	Not important but home portrays self image		Don't live up to the image
Social norms		No	Some influence from social circle. Attempting to influence others	Some influence from social circle		No	No			Nominally - influence from social circle	No
Moral norms											

TABLE 9.1c Internal factors, external factors and motivation themes

INTERVIEWEES	Case 001	Case 002	Case 003	Case 004	Case 005	Case 006	Case 007	Case 008	Case 009	Case 010	Case 011	Case 012	Case 013	Case 014	Case 015	Case 016
Gender	Female	Female	Male	Female	Male	Female	Female and Male	Female	Female	Male	Female	Female and Male	Female and Male	Female	Male	Male
Age (years)	50s	26 - 30	36 - 45	26 - 35	26 - 35	46 - 55	61 - 70	36 - 45	61 - 70	56 - 60	36 - 45	56 - 60	61 - 70	46 - 55	Over 70	61 - 70
Location	Knowle	Windmill Hill	Henleaze	Henleaze	Bedminster	Henbury	Henleaze	Southville	Windmill Hill	Bedminster	Windmill Hill	Whitchurch Park	Whitchurch Park	Henleaze	Redland	Redland
Deprivation level	Medium	Medium	Lowest	Lowest	Medium	Medium to High	Lowest	Medium to Low	Medium	Medium to Low	Medium	High	High	Low	Medium to Low	Medium to Low
KEY THEMES																
Fashions and tastes	Nominal	Moderately	No	Nominal	No	Nominal	Nominal		No	Moderately	Moderately; unconscious	Nominal	No	No	Moderately	Nominal
Compromises and priorities	Yes	Yes	Yes	Important	Yes	Important	Yes	Yes	Yes	Yes	Important	Important	Yes	Yes		Yes
Loss aversion			Variable				Issue	Issue			Issue		Issue	Issue		
Expectations					Difficult to say	Met		Perceptions-based	Variable			Exceeded	Met			
Awareness (relating to works)		Work-related	Survey	Personal research; unaware of other measures	Increased through work experience	Personal research and experience	Personal research	Professionals and personal research			Issue		Professionals			Neighbours
Physical structure				Condition is an important factor; liveability		Issue	Issue					Condition is important factor	Condition is important factor	Condition and defects factor	Condition and defects factor	Condition and liveability important
Opportunity		Timing with moving in and general improvements	Timing with other works; incentives	Timing with other works, particularly when moving in		Important	Important	Timing with other works; planned vs. urgent works	Timing with replacement needs	Timing with moving in and defects	Timing with moving in and improvements	Important	Important	Important; timing with defects and condition	Important (fire damage)	Timing with moving in and condition
Economic (external factor)								Consideration		Issue	Issue	Important	Important			
Savings					Important	Important	Important	Unrealistic	Important			Important	Incentive; important; unlikely to reach payback	Important		
Grants, loans, schemes	Important but wouldn't be sufficient to undertake works	Not eligible for help	Helpful	Not eligible for help	Uncertainty	Grants required certified installers and increased overall costs	Loans disincentive; mixed message through incentive mix	Important but wouldn't be sufficient to undertake works	Not eligible for help	Would perform works without help anyway	Incentive	Incentives helped (cavity insulation)	Incentives helped (loft insulation); not loans. More help would be useful	Incentives helped (loft insulation); no interest in loans	No help given beyond Feed-in Tariff	More grants needed
Green Deal	Not an incentive	Would consider	Would consider	Would need more information	Considering but can get more favourable financing					Skeptical				Unlikely to consider a loan		Would need more information
Cost	Issue	Issue	Issue	Issue	Issue	Consideration	Consideration	Issue	Issue				Issue	Important		Issue
Inconvenience	Issue		Issue	Issue	Issue		Issue		Issue	Issue						
Information	Family members			Internet	Own research	Partner	Internet	Issue. Internet				Own experience	From contractor	Various		
Practicality, and product availability		Improving	Issue	Issue	Issue		Issue	Issue	Issue			Issue			Issue	
Time considering and implementing works		Long	Long	Short	Long	Long	Short	Short and long	Long		Short and long	Short and long	Short	Long	Short and long	Long
Installed anything, money no object	Windows	Windows; solar thermal; PV	PV; wind turbine	Wall insulation; loft insulation						Self-build			Solar thermal; underfloor heating	PV; water butt; bathroom insulation	Floor insulation	Windows; wall insulation; energy efficient appliances; floor insulation; replace kitchen fan
Expected future time of residence	Uncertain															

TABLE 9.1d Internal factors, external factors and motivation themes

INTERVIEWEES	Case 017	Case 018	Case 019	Case 020	Case 021	Case 022	Case 023	Case 024	Case 025
Gender	Female	Female	Female	Female and Male	Female and Male	Female	Male	Female and Male	Male
Age (years)	56 - 60	46 - 55	61 - 70	56 - 60	61 - 70	36 - 45	61 - 70	36 - 45	61 - 70
Location	Southville	Windmill Hill	Whitchurch Park	Whitchurch Park	Clifton East	Bedminster	Stoke Bishop	Bedminster	Henleaze
Deprivation level	Medium	Medium	High	High	Low	Medium	2nd lowest	Medium	Lowest
KEY THEMES									
Fashions and tastes	Moderately	Nominal	No	Nominal	Nominal	Nominal	No	Moderately	No
Compromises and priorities		Yes		No	Yes	Important	Important	Important	
Loss aversion			Yes. Linked to values		Variable	Issue	Variable	Issue	
Expectations				Exceeded	Exceeded				
Awareness (relating to works)	Personal research and friends	Issue	Variable	Issue	Issue				
Physical structure		Condition and liveability important	Condition and liveability important	Condition and liveability important	Condition and liveability important	Condition and defects	Condition and defects	Important; liveability	
Opportunity	Timing with defects and subsidies	Timing with moving in and condition	Timing with necessary works and with grant offered for insulation, and Feed-in Tariff	Timing with defects	Timing with moving in, condition and capital availability	Timing with condition, defects and capital availability	Timing with condition and other works	Timing with moving in and improvements for liveability	Timing with moving in, changing requirement and defects
Economic (external factor)			Important (wait for accumulated savings to pay for work)	Significant issue		Most important	Payback for external wall insulation a barrier	Threshold of spending	Important
Savings			Important		Important		Important		Important
Grants, loans, schemes	Important; had loft insulation installed previously under grant		Not enough. Reduced Feed-in Tariff will deter people. Had insulation grant		Unlikely to payback without grant (EWI); important		Not eligible	Grant or free installation would be useful	Not interested in assistance
Green Deal	If possible to combine Green Deal with grants	Possibly consider		Disincentive		Consideration dependent on job security		Uninterested; unattractive	Not interested
Cost	Issue	Issue		Significant issue	Issue	Issue	Issue	Issue	Issue
Inconvenience		Issue		Issue		Issue			
Information	Friends		Important - 'if you don't know anything, you can't do anything'		Family		Unreliable/issue. Own research and word of mouth	Local newsletter	
Practicality, and product availability		Issue			Issue				
Time considering and implementing works	Short and long	Short	Long	Long	Long	Long	Mixed	Short and long	Long
Installed anything, money no object	Wall insulation; PV	Windows; heating system			More PVs; wall insulation; windows	Thermostat		Reconfigure living area; woodburning stove; windows; replace bathroom	PV
Expected future time of residence		Couple more years						Not long	Within next 2 years

9.2.1 Why Do Owner-occupiers Perform Domestic EERs?

The participants performed domestic energy efficiency works and EERs for multiple reasons, as indicated by previous studies (e.g. Judson *et al.*, 2014). More often than not, the works were performed when an opportunity arose, generally supporting previous research (e.g. EST, 2011). In the present study, the works were wholly or partially necessary to retain the function of the home. This functioning could incorporate comfort for occupants and visitors - the aim to improve the comfort of the home for occupants and visitors, as found by previous studies on home improvements (e.g. Munro and Leather, 1999), creating a greater sense of 'welcome' was typically an additional aim of performing works across participants. It could also be driven to maintain or improve the functioning of a 'home' based on how the participants perceived the role of the home as indicated by previous studies (e.g. Aune, 2007). This could include strong social aspects (incorporating comfort and a platform for social interaction) – this social motivation appeared to be reflected across participant socio-demographics and neighbourhood deprivation.

The 'environment' was a stronger reason for performing energy efficiency works and EERs generally for those who attached greater value to the environment. This environmental reason could be further extended, albeit as a minor reason, for those demonstrating lower environmental values through the feeling of embarrassment, guilt, comparison with neighbours and general moral obligation.

9.2.2 What are the Principal Motivations for EER in the Owner-occupied Housing Stock?

Owner-occupier motivations for EER are multiple and complex. Broadly, there are four primary motivation themes for EER in owner-occupied housing. These are economic, social, environmental and waste. Participants were typically motivated to undertake EER by two or more of these motivation themes. The strength of these motivations can change over time, between projects, and even between energy efficiency measures within the same project. An owner-occupier's principal

motivations have foundations in their internal factors, but will also be shaped by their external factors. For example, an owner-occupier may have been raised to dislike waste (values – an internal factor) and therefore the perception of wasting materials, energy, money, or resources may contribute to their overarching motivation to undertake EER. Further, internal and external factors often interact to shape EER motivation. For example, increasing fuel prices (external factor) may threaten an owner-occupier's perception of the role of 'home' (internal factor) and the need for affordable comfort.

As demonstrated by Table 9.1a – d (Section 9.2), owner-occupiers' motivation themes did not appear to differ considerably within the study where allowing for age groups and deprivation levels. Motivations could differ slightly within such age and neighbourhood deprivation groups. The primary EER motivation themes for participants were broadly confined to between two and four of the themes (e.g. environmental and social; economic and environmental, and so on). Rarely did owner-occupiers install energy efficiency measures or undertake EER based on just one motivation theme. Configurations of motivation themes for EER did not appear to significantly differ between socio-demographic groups, although they could differ within these groups.

In Chapter two, Table 2.2 presented multiple factors highlighted by the existing literature (DCLG, 2011a; Braun, 2010; DCLG, 2009b; Grosche and Vance, 2009; Baker and Kaul, 2002) as affecting decision-making in the home. This included socio-demographic characteristics of the household, and external factors such as ownership status, property characteristics, neighbourhood, and economic conditions (Table 2.2 for a full list). However, based on the quantitative data presented in Chapter six, socio-demographic characteristics (including number of children, ages of children, education level, income, amongst others) did not appear to have a relationship with EER. Interestingly, neighbourhood deprivation had a relationship with EER, where the higher the deprivation, the more likely the participant was to have installed a greater number of energy efficiency measures. Although no 'hard to treat' solid walls

were present in the high and medium to high deprivation neighbourhoods, no relationship was detected between neighbourhood deprivation and construction type (e.g. cavity walls, solid walls). Further, some properties in high deprivation neighbourhoods were reported to have challenges in retrofitting wall insulation despite not having solid walls (e.g. Case 013).

The frequency of higher level of EER in high and medium to high deprivation neighbourhoods could imply, where funds become available for energy efficiency measures it is those in these neighbourhoods who are more likely to act. It might also imply that these are the neighbourhoods which have been targeted by subsidies and grants first, although this did not appear to be consistent with the qualitative data. However, based on the qualitative data this was interpreted as a number of these cases in these neighbourhoods having the opportunity to install a greater number of measures, due to retirement, recent house moves, and/or defective building elements. Property characteristics (construction type and building type) did have an association with EER. This has been interpreted as relative to the applicability, suitability and affordability of measures in relation to different types of construction and building types. The applicability of measures based on construction types have been highlighted in previous studies (e.g. Williams *et al.*, 2013).

9.2.3 What are the Drivers Influencing Owner-occupiers' Motivations for EER?

Drivers have been interpreted as those subcategories of motivation which contribute to overall motivation. The key drivers can be categorised under the four principal motivation themes (economic, environmental, social and waste). Table 9.2 provides examples of such drivers. Drivers are not all likely to act simultaneously; like motivation themes, different drivers will be stronger than others for different owner-occupiers. There is also overlap between the drivers in relation to the motivation categories, demonstrated particularly through sense of responsibility, and loss aversion. This indicates the inter-related nature of motivation and of drivers, where 'drivers' are a sub-motivation theme.

Table 9.2 does not include capital costs for the works or the cost of loans and debts. These are barriers rather than drivers. It does, however, include *loss aversion*. Loss aversion can double as a driver as well as a barrier; when the function of a home (including comfort) or lifestyle is threatened, people are likely to be more strongly motivated to act.

Incentives and grants have not been included as a driver as, although such financial assistance appears to catalyse motivation into earlier action, it was not reported by the participants to be a main driver or motivator; it could shape the form in which the motivation takes, such as the Feed-in Tariff encouraging the selection of photovoltaic panels over solar thermal panels, where the latter originally did not benefit from a subsidy. In regard to such incentives not being the main driver for motivation, this could increase the likelihood of free-ridership as indicated by Grosche and Vance (2009).

The data demonstrated multiple factors influencing owner-occupier motivation to perform EER. These included aspects categorised as the building, the environment, social, and economic. Barriers facing owner-occupiers included inconvenience, time, and mixed messages. Loss aversion is a key consideration for owner-occupiers in terms of financing projects, but can also double as a driver where a lack of action threatens the function of the home and/or participants' lifestyles.

TABLE 9.2 Motivation themes and key driver

MOTIVATION THEME	DRIVERS					
Economic	Savings on utility bills	Financial security	Affordable comfort	Availability of capital *(including large lump sums following retirement, redundancy, house moves - linked to opportunity)*	Investment alternatives	Loss aversion
Environmental	Environmental protection	Environmental improvement	Sense of responsility	Environmental enjoyment	Loss aversion	Sense of responsility
Social	Role and function of home *(including comfort, social interaction)*	Leading by example	Moral norms	Sense of responsility	Loss aversion	
Waste	Economic resources *(e.g. money)*	Social *(e.g. energy, time)*	Environment *(e.g. materials, energy, nature)*			

9.2.3.1 The Building

Two of the four relationships with the level of EER achieved identified by quantitative data (Chapter six) were the building type (e.g. terrace, detached) and construction type (e.g. solid wall); these factors are also indicated in Tables 9.1a - d (Section 9.2) in relation to factors affecting decision-making in the home. A third relationship associated with the building was identified between EER level and the presence of energy efficiency appliances, but not the presence of low energy lightbulbs. How a building functions as a home, its architectural features, its condition relating to opportunity, and the availability of appropriate, cost-effective measures have been highlighted by the qualitative data (Chapter eight) as factors influencing owner-occupiers' EER motivation.

9.2.3.2 Environment

The 'environment' is a broad concept, categorised by participants in relation to scale (macro and micro), nature, and wellbeing. As a factor, the environment appeared to have a varying affect on participants' EER motivation. In a study by Bartiaux *et al.* (2014) it was found that in four European areas (Denmark, Latvia, Portugal and Belgium), only participants in one area (Wallonia in Belgium) undertook energy efficiency works for environmental reasons, perhaps indicating the varying effect of this on EER motivation and potential for motivations to vary considerably geographically. This factor was shaped by participants' attitudes, beliefs and values; childhood and growing up; travel; daily interaction with the local environment; and work experience. The environmental footprint of the occupant was a consideration, particularly for those with stronger environmental values and sense of responsibility. The desire to maintain, preserve and/or protect the local environment, moral obligation (i.e. moral norms), and a sense of responsibility to family, wider humanity (local, national and international), nature, and the self all contributed to this factor. The general increase in social acceptability of an environmental image and pro-environmental behaviour in Bristol was also considered to drive the normalisation of this behaviour amongst the wider public, but the absence of this did not appear to prevent motivation or action. This could imply that this behaviour is becoming what

Bartiaux *et al.* (2014) considers to be a 'practice' in relation to a more collective approach and practice. Aspects such as recycling and the installation of low energy light bulbs is considered to comply with the notion of 'practices', but these were not shown by the quantitative data to be associated with EER. EER is not a standard practice, even amongst the study participants. The reason for this is interpreted as attributable to the multifactorial, complex nature of EER, and due to the barriers to implementation, particularly cost.

9.2.3.3 Social

Social factors appear to affect participants' EER motivation to varying degrees. Owner-occupied homes have a social image but this is generally created unintentionally or as a secondary consideration. Participants did not believe they intentionally created an 'eco' self image, and typically reported being content with their current self image. This is counter to other studies which have claimed people place greater value on image associated with their home, particularly relating to historic buildings (Judson *et al.*, 2014). The present study implies the lack of application of Festinger's theory and Self-Discrepancy theory in relation to dissonance created by gaps between the actual and ideal self in the context of EER. Some participants reported negative emotions such as embarrassment or guilt about not acting in a more environmentally conscious manner, or because their home was larger and less energy efficient than they felt it should be. This appears to support both Festinger's Theory and Self-Discrepancy Theory**.**

Those desiring to lead by example generally appeared to wish to demonstrate to their immediate social circle and their wider community the ability to lead a 'normal' life with greater environmental consideration. However, this is not sufficient to ensure action. Social or environmental motivation alone will not be sufficient to ensure a high level of EER – there are compromises and priorities for all socio-demographic and neighbourhood deprivation groups, centering on economics. For most participants, the concept of affordability of works must be considered in parallel with the economic, social and environmental benefits of the works at any time.

A number of participants desired to motivate others by leading by example. They attempted to visually and/or verbally motivate others to take action in relation to lifestyle or the home, demonstrating that such behaviour or action is not abnormal, nor requiring abstaining from luxury or comfort. This leadership could be in relation to participants' social circle and/or through employment. However, participants generally recognised they were more likely to surround themselves with friends who shared similar values and beliefs, and therefore such pro-environmental motivation and behavour would be less likely to be considered 'abnormal'. Some participants (e.g. Case 021) contradicted this, reporting their friends consider them to be abnormal due to their environmental actions. Rather than 'normalisation' within a social circle due to shared beliefs and values, it is plausible that owner-occupiers gain ideas and information about possible measures and actions they can implement in their own home from members of their social circle - a trusted source and enabling owner-occupiers to see the measures in context, supporting findings of other studies which have found family and friends the most trusted and important source of information regarding energy saving measures (e.g. Tigchelaar *et al.*, 2011). In the present study, this was demonstrated by some participants who suggested they had noticed small and medium energy efficiency measures installed by members of their social circle resulting in either their installation of the measure, or their intention to install a similar measure when they could afford to do so.

Leading by example was not the sole reason for undertaking energy efficiency works or EER, neither did it form the primary reason in conjunction with other drivers. Participants 'created' a home to compliment their attitude, beliefs and values, making compromises with other household members where necessary. Decisions regarding the form of action included meeting their perceptions of what functions their home should deliver. This included functionality; basic facilities; safety and security; comfort; a welcoming environment; a platform for activities and fun; and a platform for social interaction. A comfortable home for occupants and visitors was a priority when creating a home. This appears to support Maslow's (1954) Hierarchy and Aune's (2007) conceived role of home. It could also be perceived as contributing to ego-centricity in the form of comfort and self-interest. Although previous research

suggest individuals can be placed on an altruistic-ego centric continuum (Schwartz and Blinsky, 1987; Schwartz, 1992; Bichard and Kazmierczak, 2009), the key motivation themes demonstrated through the empirical data suggests that whilst this can be the case, it can also be true that participants can be both ego-centric (i.e. through comfort and energy bill reductions) *and* altruistic (i.e. through environmental improvements and enhanced wellbeing for others).

Despite the social aspect of leading by example and increasing participants' knowledge base through their social circle, participants considered social norms not to have a particular affect on their motivation, or decisions to perform EER or similar works. The social pressure to act in relation to pro-environmental behaviour or improve the energy efficiency performance of a home were recognised by some participants as resulting in negative emotions (e.g. guilt, embarrassment), particularly where they were able to compare themselves to others in their social circle or community. This reflects moral norms, which appeared to have a greater affect than social norms, although the two are linked. Participants' views of 'right and wrong' appeared to create a dissonance through negative emotions. Although they did not expect society to reprimand their 'wrong doings', they felt they should act in the 'right way' for themselves and for mankind. This is directly associated with social norms due to the perception of 'right and wrong' within a particular society, as well as closely associated to emotion.

Based on the idea of participants making comparisons within, and gaining knowledge from their social circle, the use of open door events as a community-based approach (e.g. Bristol Green Doors) may provide a method of increasing action by enabling owner-occupiers to shape their motivation into action. This supports Berry *et al.* (2014), who suggest that community-based approaches facilitate information giving, sense-making, and enable comparisons to be drawn.

9.2.3.4 Economics

Economics was a strong factor in terms of whether or not people had undertaken or could undertake works to their home, although its affects on EER motivation could vary. Generally, it was observed that where participants had a change in lifestyle and priorities (e.g. retirement; moving into a new home with a partner) this had facilitated motivation to action, with the ability to undertake larger-scale works due to greater availability of capital. Both the motivation and the opportunity had to exist prior to this for the owner-occupiers to be inclined to invest these funds in this type of work.

This is a factor of counterparts: accessibility to finance in the form of grants and savings were indicated to improve the likelihood of participants undertaking works, as indicated by CSE (2012); loans and debt would generally deter most participants - unless the works were urgent participants expressed a preference for going without until sufficient savings could be accumulated to fund the works. Incentives such as the Feed-in Tariff generally swayed a decision in favour of eligible technology but would not be the primary motivation for undertaking works, although it would potentially facilitate undertaking the works sooner. Potential savings on utility bills are important, particularly for affordable comfort, and the ability to continue living in a particular home. As stated by Stern (2000) (Chapter three), more expensive behaviours such as the insulation of a home is likely to be strongly influenced by economic factors. As a barrier, cost will be discussed in the following section (Section 9.2.3.5).

9.2.3.5 Barriers

Barriers to EERs are well reported in the literature, as discussed in Chapter three. The existing literature has suggested there is a range of barriers (Dowson *et al.*, 2012; Watts *et al.*, 2011; Whitmarsh *et al.*, 2011; EST, 2010; Gyberg and Palm, 2009; Housing Forum, 2009; Meijer *et al.*, 2009; Stewart *et al.*, 2005; Barr, 2003; Henryson *et al.,* 2000; Munro and Leather, 1999), including information, knowledge and awareness, cost, inconvenience, feedback, availability of measures, inexperience,

exemplars, trust, priorities, social factors, and motivation. The following section will discuss the barriers which were identified by the empirical data - costs, inconvenience, time, information and loss aversion.

Cost

There were a number of barriers to EER, perceived and real, which affected participant motivation for EER. The cost of energy efficiency works and EERs was cited by participants as the primary barrier to action. This included the capital cost of the works and the cost of loans. The cost of the works is one of the principal inhibitors of performing energy efficiency works or undertaking an EER, supporting the existing literature (Housing Forum, 2009; Meijer *et al.*, 2009). Wilson *et al.* (2013) have suggested that upfront costs and lack of capital do not prevent the consideration of home 'renovation'. The present study suggests, that although capital costs and access to funding can prevent action, it does not necessarily terminate motivation. It can, however, suspend or reduce motivation. It is interpreted by the present study as a barrier to action, and a potential threat to motivation.

Participants generally also recognised that, if possible, certain works should be performed together or delayed until they can be installed together for efficient use of capital, thus relating to the waste motivation theme. This could be partially seen as supporting Fawcett (2014), who suggests that phased works enables people to spread the cost of the works, undertake improvements in conjunction with normal repairs, when the opportunity is most fortuitous, highlighting 'timing' as important.

Most of the participants were adverse to debt and, therefore, would prefer to pay for works from savings rather than take on loans. This included being adverse to loans like the Green Deal which is attached to the house rather than the individual, attributed to not wanting to take on any form of loan and/or risking affecting the value of the house. Although these economic barriers represented internal and external constraints, they did not generally reduce motivation; rather they delayed action.

Priorities would redirect motivation and funds, and potentially suspend motivation for EER until works became affordable or with reduced risk, but if motivation already existed, a reduction in this due to economic barriers was unlikely. This type of barrier may, however, stall increases in motivation for owner-occupiers with low motivation for EER.

Inconvenience

Inconvenience was another principal barrier to participants undertaking energy efficiency works or EERs, supporting previous studies (e.g. Wilson *et al.*, 2013; EST, 2010). This could also incorporate the 'hassle' of finding a preferable, trustworthy contractor, supported by other studies (e.g. CSE, 2012). This concept could be the perceived inconvenience rather than actual inconvenience. Participants were aware that there would be some level of disruption as a result of major works, but they appeared to try to avoid this until they could no longer put it off, or when the minimal level of disruption would occur (i.e. moving into a new house). Inconvenience, although recognised by participants as typically unavoidable in relation to larger energy efficiency works, appeared to reduce motivation. Most participants indicated that they would typically avoid inconvenience as much as possible, and were more likely to act where the functioning of the home was threatened (e.g. defects arise, comfort reduced) and/or where the inconvenience could be minimised (e.g. after moving into a new home, whilst urgent works were necessary). Although Fawcett (2014) suggests that the passage of time can enable people to recover from the impact of inconvenience, even those who had experienced minimal or no inconvenience through improvement works within the last few years appeared to be keen to avoid inconvenience. This was interpreted as the participants experiencing negative emotions in relation to the invasiveness of works and their home and their lifestyle. Participants appeared to measure the level of disruption against the necessity of acting (urgency), maintaining the status quo, and other priorities. Although motivation is still required for participants to act when favourable conditions arise, motivation will not only be suspended but also appeared reduced when considering inconvenience.

Time

Time as a limited resource was cited as a constraint by some participants in terms of prioritising other demands, and is also associated with inconvenience. This supports previous studies (e.g. Wilson *et al.*, 2013) which suggest that for action to occur, the complex set of factors owner-occupiers will incorporate in their decision-making process includes an assessment of whether they possess sufficient time, resources, skill, and knowledge. In the present study, time was interpreted as part of the participants' 'resources', supporting findings of pro-environmental behavioural studies (e.g. Kollmuss and Ageyman, 2002; Stern, 2000).

Energy efficiency works and EERs require a level of time investment (i.e. for research into products, alternative solutions, contractors). The level of time investment needed varied between participants due to each having differing levels of existing knowledge and contacts, but was generally perceived as requiring a large level of investment, particularly where participants had high environmental values and preferred to install products or use contractors with high environmental credentials. The aspects of time and cost can be connected to compromises and priorities, particularly relating to family, and lifestyle. Costs, and priorities and compromises can also be associated with the retention of the architectural features of a home. This was also found in a study of improving the sustainability of historic (heritage) housing, distinctive features were considered to be 'worth retaining' (Judson *et al.*, 2014). Although the present study supports this finding, the desire to compromise on energy efficiency measures in favour of architectural features where homes included such features was interpreted as linked to the participants' original decision-making when selecting a home, and the value they attached to these features.

Information

Research into suitable measures and contractors was directly associated with time limitations and self-efficacy. Mixed messages, particularly regarding incentives, or conflicting information, and difficulty in accessing relevant, appropriate information

about suitable products and contractors were also indicated as a barrier to works or were even demotivating for the participants. Fawcett and Killip (2014) also suggest that conflicting information or advice was experienced by participants in their study on 'superhomes', causing delay and stress. This negative experience (i.e. stress) could be seen as a negative reinforcement, potentially risking demotivating later action amongst owner-occupiers.

Although the existing literature has suggested that information is a barrier, it typically suggests that information is an issue in relation to owner-occupiers' lack of awareness about possible measures (e.g. EST, 2010). Although to some extent, this is accurate, it ignores the reality of owner-occupiers being able to perform independent research through internet searches and other sources of information, as seen in the present study. The issue in the present study was that, to perform research into suitable measures, there needs to be an existing level of understanding about what could be done so that owner-occupiers do not feel overwhelmed by the level of information available, and which are the most reliable sources of information. Owner-occupiers identified a need to trust the information source, and were more likely to do so where the source was independent and/or already known to them.

Loss aversion

Predominantly, participants were loss averse particularly with regards to economic factors. Therefore, participants were less inclined to take on loans where works could be financed by other means and/or where works were not urgent. This supports CSE (2012) who found 70% of respondents would not consider undertaking a loan to pay for home energy efficiency improvement works, and Fawcett and Killip (2014) who state borrowing money is a last resort for owner-occupiers undertaking larger EERs. Some participants could also be considered as loss averse in regards to actual energy efficiency and general building works, and therefore were keen to undertake a large amount of research into the available options and therefore generally take a longer time to act, and therefore linking to the time barrier.

9.2.4 To What Extent Do Owner-occupiers' Values Influence Their Motivation for EER

Owner-occupiers' values are central to EER motivation as they will shape other internal factors, their emotions and decision-making process. Not only will they shape the principal motivations driving EER but owner-occupier values will also shape the specific measures installed within a given context.

Participants' values appeared to be rooted in childhood and life experiences, affecting the principal motivation themes for energy efficiency works and EER. Those exhibiting high environmental values were more likely to take some form of action within the constraints of their external factors. Their action is likely to be more strongly driven by environmental motivation. This is despite an overall low locus of control amongst participants, who generally agreed one person's actions would have a nominal affect on reducing carbon emissions and the environmental impact of housing. Self-efficacy appeared to have some role in whether participants had or were intending to act; it appeared to have a negative affect on motivation overall across all groups. Those with high environmental values were likely to act as result of moral obligation and to avoid a dissonance with their own values. Economic and social motivations will also have a role for these individuals, due to the recognition by participants that the cost of installing measures, affordable comfort, and the functions of home remain key considerations. These individuals could also want to lead by example, resulting in an overlap between environmental and social motivations. Participants demonstrating moderate to strong locus of control were more likely to be those who also suggested they wanted to lead by example and demonstrated high environmental values.

Participants with lower environmental values were primarily driven to act by economic and social motivations. Social motivations include wanting to make a home more comfortable for occupants and visitors. A social image was not considered to be particularly important, except perhaps the image reflected to some participants' social circle, although this was often a lesser consideration.

Economic factors were a factor across all participants, regardless of environmental values, deprivation of the neighbourhood or socio-demographic groups. This is a complex factor because it can be both a motivator and a barrier. As a motivator, it links to values such as waste, and other factors such as priorities and compromises. Economic factors include savings on utility bills; this is central, but it can also be closely connected with social factors such as comfort (including affordable comfort) and fuel security.

Participants' values are directly associated to their concept of waste; participants generally demonstrated a dislike of waste in all forms (e.g. energy, money, time, materials). Parnell and Popvic Larsen (2005) have similarly suggested that some people engage in energy efficiency home improvements to avoid waste. The values associated with waste were founded in childhood and/or life experience, but could be further developed through regular interaction with the local environment and through work. The waste motivation theme appeared to have an affect across all groups, participant values shaping the nature of the waste motivation theme (i.e. waste of money, energy, environment, time, and so on).

9.2.5 Which Motivational Theory or Hybrid of Theories 'Best Fits' Domestic EER?

The motivation theories which appeared to be most relevant to EER were outlined in Chapter two. These included Maslow's Hierarchy, Vroom's Theory, Festinger's Theory, Prospect Theory, Expected-Value Theory, and Self-Discrepancy Theory. Based on the empirical data, the motivation theories discussed do not wholly apply to owner-occupier motivation for EER, although they present concepts which can be applied to varying degrees to EER motivation. The empirical findings suggest that the following concepts should be incorporated into a motivation theory for owner-occupier EER:

- Meeting different needs and priorities;
- Self-efficacy and locus of control;

- Individuals value the expected outcomes;
- Loss aversion;
- A reduction in inconsistency in internal values;
- Moral norms;
- Social norms;
- Reduction in the gap between actual and ideal self, social image particularly in relation to leading by example;
- Emotion;
- Context (incorporating opportunity).

The role of these factors vary, as outlined in Table 9.3 through 'major', 'moderate', 'moderate to minor' and 'minor' categories. Factors which are not given sufficient consideration by the main existing motivation theories but need incorporating, are also indicated. These will also be closely linked with the internal factors and refinement of the conceptual model. A discussion of these motivators now follows.

9.2.5.1 Major Motivators

Meeting different needs and priorities was based on Maslow's Hierarchy, and reflected strongly by the participants. This was in relation to the EER decisions, but also when to convert motivation into action based on the competing needs and priorities of participants' contexts (e.g. children, lifestyle, economic constraints). This could be closely linked to the internal factor – the *role of home*, as the perceived functions a home should fulfill could reflect the different needs and priorities of a household.

9.2.5.2 Moderate to Major Motivators

Self-interest**,** sometimes defined as 'ego-centricity' (Section 9.2.3.3), forms part of the concept of 'self'. Although 'self' appeared to have a minor role in motivation theory,

self-interest formed a concept which overlaps with the economic and the social motivation themes. It is interpreted here as including an interest in saving money on utility bills (economic motivation theme) and improved comfort (social motivation theme), as defined as Nolan *et al.* (2008), and therefore forms a significant aspect of EER motivation, supported by the empirical data of this study. However, Turaga *et al.* (2010) suggest that, in relation to pro-environmental behaviour, individuals who are solely self-interested would not perform such behaviour (e.g. recycle, drive electric vehicles, purchase 'green' products), despite these types of behaviour being observed by the authors. This has direct relevance for the present study, which found that

TABLE 9.3 Motivation theories and key concepts relevant to EER

MOTIVATION THEORY		Maslow's Hierarchy	Vroom's Theory	Festinger's Theory	Prospect Theory	Expected-Value Theory	Self-Discrepancy Theory
MAJOR ROLE							
1	Meeting different needs and priorities	✓					
2	Self interest, e.g. in form of comfort, bills and fuel security					✓	
MODERATE TO MAJOR ROLE							
3	Individuals value outcomes	✓	✓			✓	
4	Loss aversion				✓		
MODERATE ROLE							
5	Locus of control and self-efficacy		✓			✓	
6	Reducing inconsistency in values			✓			✓
7	Moral norms			✓			✓
MODERATE TO MINOR ROLE							
8	Social norms	✓	✓				✓
MINOR ROLE							
9	Gaps between actual and ideal image, and social image			✓			✓
10	Self, self-image, self-identity			✓			✓
OTHER ASPECTS							
11	Emotion	✓		✓	✓	✓	✓
12	Context	*All*					

participants were not solely motivated by just one motivation theme, and although self-interest was demonstrated by these individuals, a degree of altruism was also present, often through the environment and/or waste motivation themes.

Locus of control and self-efficacy are concepts used in Vroom's Theory and Expected-Value Theory. Although participants generally felt they only had a nominal affect on carbon emissions and the environment overall, they were more likely to have already translated their motivation into action if they had a moderate to high locus of control overall.

Participants who were involved with other environmental and/or community groups typically demonstrated higher locus of control. This also appeared to be closely associated with moral norms - participants expressing the view that whether or not they could 'change things for the better', they ought to try. Self-efficacy in the form of participants feeling they had appropriate and sufficient skill and capability to access appropriate information and energy efficiency measures appeared to have a major role in EER motivation, with those who exhibited greater self-efficacy more likely to be planning on installing energy efficiency measures, or had already undertaken works. Those with the strongest self-efficacy levels tended to be those who had experience with installing energy efficiency measures or general home improvement works. This could be through employment or through previous renovations. Those who had a medium level of self-efficacy appeared to have already undertaken some research into possible measures.

Maslow's Hierarchy, Vroom's Theory, and Expected-Value Theory suggest that individuals need to value the expected outcomes for motivation to exist. For participants to be motivated to perform EER they needed to value the expected outcomes. This could include anticipated improvements in thermal comfort, reduced energy bills, a more congenial internal environment for occupants and guests, and reduced carbon emissions. Although participants reported previously installed

measures meeting their expectations, some participants also reported not expecting a significant difference in comfort or conditions, or uncertainty about the outcomes for those yet to act. In relation to the functions of the home, participants appeared to aim for measures to retain and/or improve the role of home, and therefore participants were likely to be motivated based on their expectation of the outcomes relating to the functions fulfilled by the home.

Prospect Theory, developed from Festinger's theory (Zundel and Stieβ, 2011) by Kahneman and Tversky (Levy, 1996) formalises the concept of loss aversion (Abdellaoui *et al.*, 2007). Under Prospect Theory, people interpret the potential outcomes as gains and losses in relation to a reference point, being more sensitive to potential losses (Abdellaoui *et al.*, 2007; Novemsky and Kahneman, 2005). As an issue in the present study, loss aversion was expressed by seven participants in the qualitative data as an issue for EER motivation and related works. Two further participants suggested that loss aversion could have a variable affect. This supports the concept of loss aversion under Prospect Theory. Individuals will value things differently depending on their context, and in relation to a reference point (Abdellaoui *et al.*, 2007). Based on the empirical data of the present study, loss aversion has a broader affect: unless the works were urgent, participants preferred to wait and accumulate the necessary funding through savings rather than incurring any form of debt. A number of participants took a long time before performing non-urgent works; this was partially attributable to funding but also partially to the desire to make the 'right' decision. 'Getting it right' reflects the participants' perceived risk of 'getting it wrong', and therefore reflecting another aspect of loss aversion relative to EER.

In relation to EER motivation, loss aversion did not appear to significantly attenuate motivation; rather it was more likely to in a longer time period prior to catalysing motivation into action, i.e. until the participant had undertaken sufficient research, had accumulated sufficient funds, and/or were eligible for an incentive to attenuate financial risk. Alternatively, where a loss was perceived in relation to current lifestyle (e.g. comfort) through inaction, this could catalyse motivation into action.

9.2.5.3 Moderate Motivators

Festinger's Theory and Self-Discrepancy Theory incorporate the concept of inconsistent values, with the former theory suggesting individuals will sometimes change their beliefs to fit their behaviour rather than changing their behaviour to fit their beliefs (Brekke and Johansson-Stenman, 2008). In the present study, the role of inconsistent internal values appeared to have a moderate role in EER motivation. There appeared to be a greater impact of inconsistent internal values - the perceived gap between ideal and actual self. For example, an individual has a strong aversion to waste and their house wastes significant energy resulting in high energy bills, but the existing condition of the house is good. Any improvement works would result in waste of money and embodied energy in the form of the replacement of materials which are in a good, serviceable condition as well as disruption, and inconvenience to occupants. Their aversion to waste is therefore dissonant, and according to Festinger's Theory, the individuals will change their beliefs to reduce this dissonance. This was seen to varying degrees during the interviews, but this was more commonly attributable to compromises and priorities, although a reduction in inconsistent internal values did have a role.

Moral norms appeared to have a stronger influence than social norms. Ek and Söderhold (2007) suggest that it is difficult to distinguish between moral and social norms in practice. This difficulty of distinguishing between the two can be attributed to the intrinsic association between these concepts – moral rules exist in all human societies (Baumeister *et al.*, 2007) and thus are based on the norms of a particular society. It has been suggested that one difference is that social norms are conditional, whereas moral norms are unconditional in relation to compliance (Dubreuil and Grégoire, 2013). Both are considered to be associated with emotion (*ibid.*). Based on the data in this study, social norms are the practices commonly performed within a society, whereas moral norms are those which are associated with 'right and wrong'. However, social norms are distinguished here as actions commonly practiced within a society. Moral norms are also inherently linked with a sense of responsibility and with attitude, beliefs and values (Ek and Söderhold, 2007) – they are associated with

participants' sense of 'right and wrong'. Moral norms can be considered as Dubreuil and Grégoire (2013) propose - "*the norm of 'everyday Kantianism' (do what would be best if everyone did the same)*" (p.144).

9.2.5.4 Moderate to Minor Motivators

Social norms feature to varying degrees in Maslow's Hierarchy, Vroom's Theory and Self-Discrepancy Theory. Based on the empirical data, social norms have a moderate to minor role. Participants generally perceived social norms had a minor or no affect, but with regards to the influence of their social circle and gaining information about suitable measures to install in the home, social norms have a stronger role than participants believe. In a study by Nolan *et al.* (2008), their participants considered descriptive norms (neighbours' behaviour) to have the least effect on energy conservation behaviour, when the data demonstrated it to have the greatest affect on their behaviour, over environment, saving money or being socially responsible. This implies that individuals may not be aware of the real affect of social norms on their EER motivation. However, social norms are considered to be less important than personal norms (Thøgersen, 2006) in the form of an individual's attitude, beliefs and values in the context of EER motivation, as well as environmentally responsible behaviour (*ibid.*).

Social norms can provide a means of comparison, facilitating emotions such as guilt and embarrassment. These emotions can either help to sustain motivation, or can result in changes in participants' beliefs and values to reduce their internal dissonance, based on Festinger's Theory and Self-Discrepancy Theory. The existing literature suggests that people tend to avoid situations where they feel pressure to conform to social norms due to negative emotions elicited in comparison with their own behaviour (e.g. guilt, embarrassment), if social norms conflict with their own self-interest (Brekke *et al.*, 2008). Based on the empirical data, the former is more likely, and where participants are unable to act, their EER motivation becomes either suspended or reduced, being replaced by more immediately achievable tasks.

9.2.5.5 Minor Motivators

Although similar, unlike the dissonance created between participants' internal values, the gap created between participants' actual and ideal selves, and the role of their social image portrayed by their home and improvements to their home plays a minor role in relation to EER motivation. Based on Festinger's Theory and Self-Discrepancy Theory, individuals are expected to be motivated by gaps between the ideal and actual self. This appeared to have a nominal affect in the present study. Participants did not appear to be aware of what their actual or ideal self images were, and suggested that they were mostly content with what their home portrayed to society. It had more of a role in relation to emotions such as guilt and embarrassment in association with social norms, and also where the participant wished to lead by example in relation to their social circle, and therefore cannot be excluded.

Self-Discrepancy Theory presents the concepts of self, self-image and self-identity. This appeared to have a minor role in EER motivation. Participants did not generally perceive a gap between their ideal and actual selves, and did not intentionally create an image based on their home, unless expressly desiring to lead by example, although this in itself was a secondary consideration. However, here is a divide; 'self' also incorporated self-interest, as discussed above.

9.2.5.6 Other Motivators

Emotion, although not always explicitly included, is a primary component of motivation. This is particularly relevant to the home, which has been recognised to be an emotionally-laden place (Wilson *et al.*, 2013). In the motivation theories presented in Chapter one, the most obvious manifestations of emotion are through cognitive dissonance (Festinger's Theory and Self-Discrepancy Theory); self-efficacy and locus of control (Vroom's Theory and Expected-Value Theory); social norms (Maslow's Hierarchy, Vroom's Theory, and Self-Discrepancy Theory). However, emotion has a greater role in motivation, particularly EER motivation.

Emotion is defined by Thøgersen (2006) as a form of self-administered reinforcement (negative - guilt, loss of self-esteem; positive – pride, security, increased self-esteem). This can either sustain motivation and encourage action, or reduce or terminate motivation, depending on whether it forms positive or negative reinforcement (Rolls, 2000), sometimes referred to as 'appetitive' and 'defensive' (Lang *et al.*, 1998) or 'appetitive' and 'aversive' (Lang and Bradley, 2010). In contrast, Baumeister *et al.* (2007) define emotion as a feedback system. This can incorporate anticipated emotional outcomes, with individuals avoiding or performing an action depending on their emotion expectations (*ibid.*). In the present study, these definitions were seen as synonymous - one of the roles of emotion was as a feedback system in relation to actions, influencing whether or not EER is pursued. Previous negative experiences associated with home improvement appeared to reduce EER motivation, although this was more commonly associated with the dislike of perceived inconvenience. This negative emotion experience supports Vining and Ebreo (2002) who suggest that past emotion experiences will shape behaviour. Even relatively positive experience could result in a reduction in EER motivation where participants felt the project timeframe exceeded their expectations. The achievement of an EER can elicit a positive emotion where this met the personal goals of the participant (Ford, 1992), but this did not appear to alter the motivation (positively or negatively) for further works.

As stated by Reeve (2005) 'motivation cannot be separated from the social world in which it is embedded', with the brain generating "*the motivational and emotional states…to adapt optimally to the physical and social world around us*" (p.65). Yet, it is not particularly incorporated into existing motivation theories. As identified by the previous chapters, the context (external factors) was found in the present study to be particularly relevant to EER motivation, shaping and directing motivation. Therefore they must be considered in conjunction with internal factors in a study and model of EER motivation. Opportunity, in particular, is key to facilitating EER motivation into EER action, and this includes the condition of the physical structure through to financial opportunity.

9.3 Internal Factor Rankings

The order and strength of the internal factors varied between the self-ranking orders (mean and mode) and those identified within the qualitative data. This has been interpreted as participants being not wholly aware or possessing incomplete understanding of the role and strength of the internal factors. This is summarised in Table 9.4.

Based on Table 9.4, the following order has been created (Figure 9.1). This was produced using the greatest consensus regarding the rankings, followed by positioning the factors with moderate similarities in relation to these. The strength of internal factors will change depending on the individual. The order presented here, therefore, is not absolute; rather the provided order is based on the likely order for the study participants.

In addition to those internal factors presented in Table 9.4, self-efficacy, self-interest and moral norms are incorporated into Figure 9.1 based on Table 9.3. Emotion and external factors (context) also presented in Table 9.3 are incorporated into the conceptual model (Figure 9.2).

TABLE 9.4 Internal factors influence strength – qualitative and self-ranking comparison

INFLUENCE	INTERVIEWS	SELF RANKING (MODE)	SELF RANKING (MEAN)	COMMENTS
STRONG	Attitude beliefs and values Priorities Role of home Loss aversion Sense of responsibility	Attitude beliefs and values; Priorities Sense of responsibility Role of home; Expectations; Decisions Self; Locus of control	Sense of responsibility Attitude beliefs and values Priorities	Greatest similarities between the strongest internal factors reported in the interviews and the self-ranked factors include ***attitude, beliefs and values***; ***priorities***; and ***sense of responsibility***. Further similarities were demonstrated for ***role of home***. Differences were demonstrated for *loss aversion*, *expectations*, *decisions*, *self* and *locus of control*
STRONG TO MODERATE			Role of home; expectations	
MODERATE	Locus of control Trust Self and image Expectations Social norms	Trust Loss aversion	Self Decisions	Some similarities between the strongest internal factors reported in the interviews and the self-ranked factors include ***trust*** and ***self.*** *Expectations* had a self-reported rank higher than that observed in the interview, as did *self* and *locus of control* in relation to the self-rank (mode). *Social norms* were identified in the interviews as having more importance than participants believed in the self ranking

INFLUENCE (continued)	INTERVIEWS (continued)	SELF RANKING (MODE) (continued)	SELF RANKING (MEAN) (continued)	COMMENTS (continued)
MODERATE TO WEAK			Locus of control Trust Loss aversion	
WEAK TO NONE	Fashions and trends	Social norms Fashions and trends	Social norms Fashions and trends	***Fashions and trends*** were identified in the interviews and through self ranking as having weak or no influence. However, although social norms were identified by participants through their own ranking as having minimal or no effect, this was demonstrated in interviews as having a moderate influence on motivation. This is interpreted as attributable to participants' incomplete understanding or awareness of this factor.

FIGURE 9.1 Ranking of internal factors based on interviews and participants' self-ranking (based on Table 9.4) including additional internal factors highlighted by the interviews

Figure 9.1 contributes to the internal factors presented in the refined conceptual model (Figure 9.2).

9.4 CONCEPTUAL MODEL REFINEMENT

The conceptual model presented in Chapter three was refined (Figure 9.2) based on the empirical data. It includes a reordering of, and addition to the internal factors, based on Figure 9.1, and therefore based on Table 9.4.

The model is layered to represent the complexity and the inter-related nature of the factors affecting EER motivation – something not previously provided by other

motivation models. Most similar in structure to Maslow's model, but not phased like Maslow's hierarchy due to the fluidity of motivation in relation to EER. This model will be explained in order of layers from the inner most layer outwards.

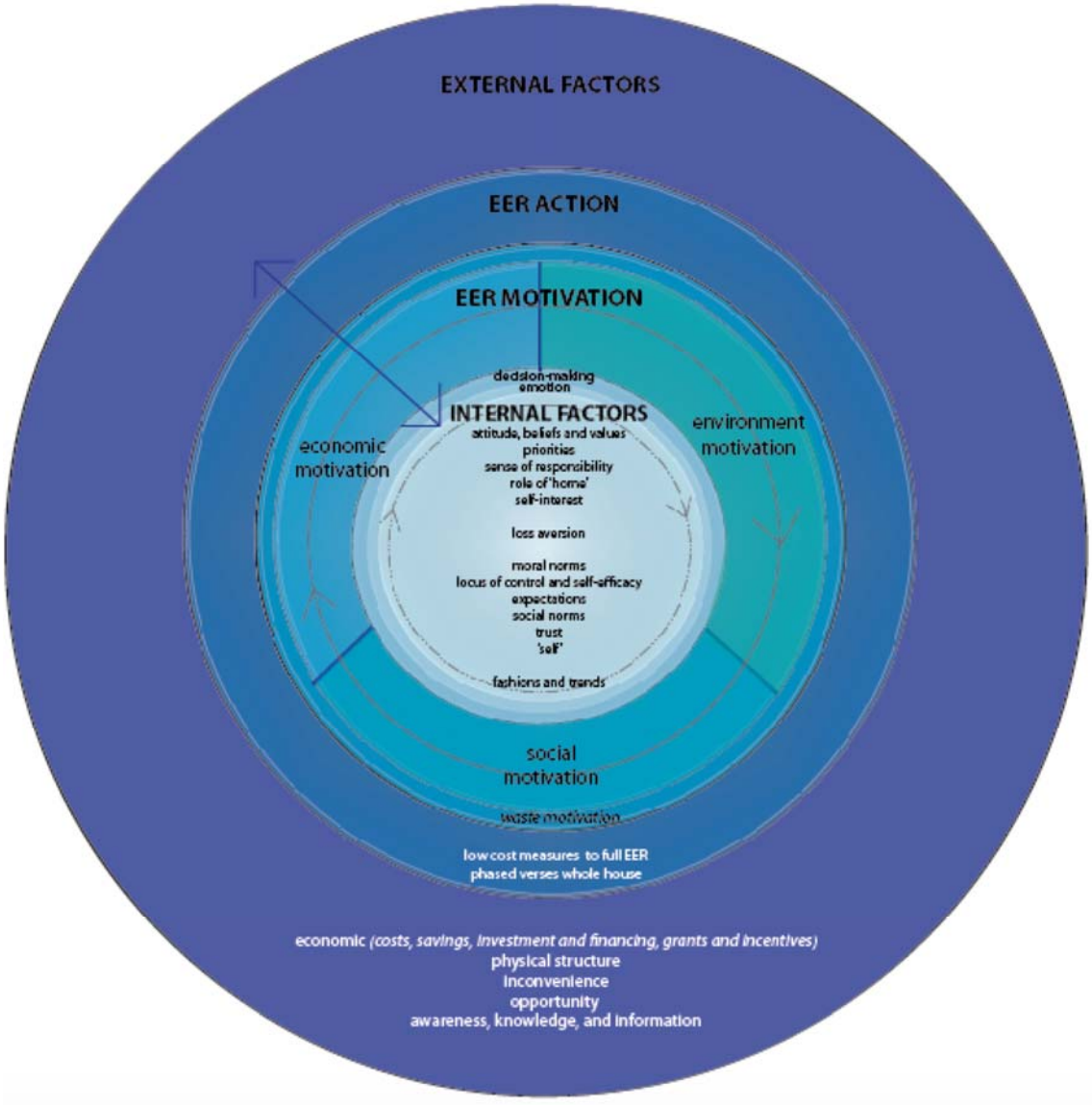

FIGURE 9.2 Refined conceptual model of owner-occupier EER motivation

Owner-occupiers' internal factors are at the core of the model. These can change in strength order as represented by the cyclical arrow within this layer. The order of the

internal factors presented in the model reflect the likely order for the study participants.

Emotion will modify these internal factors (e.g. their strength and order through negative and positive emotions). Emotions are affected by internal factors, particularly attitude, beliefs and values. EER motivation and EER action in relation to emotion is not solely based on dissonance – owner-occupiers can act based on emotional feedback (reinforcement), affected particularly by attitude, beliefs and values; moral norms, and social norms. In turn, emotions will have a particular affect on sense of responsibility, self-interest and 'self', locus of control and self-efficacy, and priorities. However, emotions are likely to have an affect on, and be affected by all the internal factors.

Decision-making is a process. It will modify the internal factors (acting in favour of delivering on other internal factors, and values in particular), motivations and EER action.

EER motivation is divided into four categories, with the waste motivation theme shown to be spread between economic, social and environment motivations. These motivations can alter in influence during a lifetime, and also alter between projects and EER measures. This is represented by the cyclical arrow within this layer. Waste is a particular aspect not included in previous studies as a primary theme, but based on the empirical data of this present study, it is a key motivation theme in EER motivation, applicable to all participants in various forms, regardless of their environmental value levels.

EER action can form different levels of intervention. This will be shaped by the internal factors, owner-occupiers' principal motivations, decision-making (e.g. in preference of meeting different internal factors and motivations over others), and by

external factors. When one action has occurred, the order of internal factors and primary motivation can change.

The external factors must be considered. They can change more frequently than owner-occupiers' internal factors, but they provide the context including the constraints in which the owner-occupiers are situated. This not only can direct the form of EER action, but it will have an affect on motivation, emotions, decision-making and, to some extent on the internal factors. For example, by providing a tariff for electricity-generating technology such as photovoltaic panels results in such technology being favoured over heat-generating technology (decision-making); increasing owner-occupier economic motivation; it can also reduce the overestimation of losses of the internal factor 'loss aversion'. The knowledge of a time limit on such a tariff can alter the internal factor 'priorities', where the owner-occupier has the financing to act (external factor). The arrows between the outer and inner layers represents the interplay between these.

9.5 SUMMARY

This chapter has sought to answer the research questions outlined in Chapter one. Based on the data, although owner-occupiers perform EER for multiple reasons (*research question one*), the works were principally opportunistic to ensure the sufficient functioning of 'the home', as perceived by the participants. The principal motivations for EER (*research question two*) were interpreted as four motivation themes – economic, environmental, social and waste. The social (incorporating comfort for occupants and visitors), economic, and waste motivation themes were reflected across participant socio-demographic and neighbourhood deprivation categories. The 'environment' was highlighted as a strong driver for EER amongst those who attached a greater value to the environment. It could also be a driver for those with lower environmental values through moral norms and emotions as negative reinforcement. The EER motivation theme types did not appear to considerably differ between neighbourhood deprivation or socio-demographic groups within the study, although some observable nuances were detected within these groups. Primary

motivations for each participant generally included between two and four of the EER motivation themes identified. Social, economic and waste motivation themes appeared to be influential regardless of participants' level of environmental motivation.

The drivers which influence EER motivation (*research question three*) are multiple and complex. Drivers were varied, and some (e.g. loss aversion and sense of responsibility) could overlap between motivation themes, implying the inter-related nature of motivation and drivers, and the complexity of EER motivation. They include barriers such as cost and/or financing; inconvenience; time; information (trust, conflicting and mixed messages); and loss aversion – a potential driver and barrier. The data generally suggested factors could be characterised as environmental factors, social factors, and economic factors. Higher neighbourhood deprivation was indicated to have a positive association with EER, interpreted as attributable to a number of the cases within these neighbourhoods having had the opportunity to act (i.e. recent retirement, recent house move, defective building elements). Property characteristics (construction and building types) were also indicated to have an association with EER, but not with neighbourhood deprivation, interpreted as reflecting the applicability, suitability and affordability of measures in relation to construction and building types.

Owner-occupier values (*research question four*) are central to EER motivation. They shape other internal factors, emotions, and the decision-making process. Additionally, they shape the principal EER motivation theme, how this manifests as action, and the type of measures adopted within participants' contexts. Those with higher environmental values were more likely to have undertaken some form of action in relation to improving home energy efficiency performance, and to be more strongly motivated by the environment motivation theme. They appeared to be partially motivated to undertake EER to avoid dissonance with their values. Moral norms appeared to have a greater impact on participants, particularly with those exhibiting higher environmental values, than locus of control. Lower levels of self-efficacy

appeared to have a negative overall affect on EER motivation. Participants' values were strongly associated with their concept of waste, and therefore with the waste motivation theme. This reflected a dislike for waste in all forms, often rooted in childhood and/or life experience, but could also develop through regular interaction with the local environment.

No motivation theory was found to best fit domestic EER (*research question five*). Amongst others, Maslow's hierarchy reflects the functions of a home, and participants needs and priorities; emotions such as guilt and embarrassment reflect Festinger's theory and self-discrepancy theory; loss aversion reflects prospect theory; and locus of control and self-efficacy reflects Vroom's theory and expected-value theory. Ten primary concepts introduced by these theories were outlined in relation to their relevance to EER. Based on this, the conceptual model was refined to incorporate relevant aspects of existing motivation models, and is presented in Section 9.4.

The following chapter will outline the validation methodology and validation of these findings.

CHAPTER TEN: VALIDATION

10.1 INTRODUCTION

This chapter will seek to validate the findings of the research outlined in the proceeding chapters. This meets research Objective six (Section 1.5) – *to validate the findings of motivations for domestic EER, confirming whether the results reflect reality*.

The chapter will explain the background and method to be used for validation, before summarising the findings of the validation interviews, performed with EER experts. It will then provide the new model for EER.

10.2 BACKGROUND

Validity involves establishing the degree to which the researcher's claim about the study findings (knowledge) accurately reflect reality (Cho and Trent, 2006). Validation is a process by which an attempt is made to establish the accuracy of the conceptual model (Hahn, 2013), and over the past few decades has become increasingly an open-ended concept (Secolsky *et al*., 2011). Bryman (2008) identifies four main aspects of validity in social science – construct (measurement) validity; internal validity; external validity; and ecological validity. How this study has met these different validity types are outlined by Table 10.1. Although Hahn (2013) suggests validation should be primarily concerned with internal validity – whether the findings that incorporate a causal relationship between variables is accurate and 'holds water' (Bryman, 2008). This has been 'tested' as Yin (2014) suggests, by seeking to address rival explanations within the data analysis and discussion. Rival explanations are considered "*the core robust analysis in case study research*" whereby an explanation is given which "*competes with the provisionary explanation in its explanatory power*" (Mills *et al.*, 2010, p.833).

Reliability is discussed by Yin (2014) in addition to construct, internal and external validity. This has been achieved through providing clear 'operations' within the

methodology, that is, clear selection protocols and methodology so that this study could be replicated by other researchers in the future.

TABLE 10.1 Types of validation, and where and how these are achieved

VALIDITY TYPE	DESCRIPTION	WHERE MET?	HOW MET?
Construct	Whether the measure of the concept reflects what it is meant to be reflecting.	Methodology chapter.	Review by supervisors of method design. Use of a pilot study.
Internal	Whether the findings that incorporate a causal relationship between variables are accurate and 'hold water'.	Quantitative and qualitative data; discussion chapter.	Rival explanations.
External	Whether the findings are generalisable beyond the context of the study.	Validation chapter. However, it is also recognised that the findings are not statistically generalisable, but can be analytically generalisable.	Expert interviews.
Ecological	Applicability of findings to people's everyday, natural and social settings - does the instrument encapsulate the daily life conditions, opinions, values, and so on, as expressed in their natural setting?	Methodology chapter, qualitative chapter and discussion chapter.	Methodology - data collected in homes - people's natural setting.

Chapter ten will focus on external validity, described by Yin (2014) as "*knowing whether a study's findings are generalisable beyond the immediate study*" (p.48), i.e. beyond the context in which the study is bounded. This relates to analytical and statistical generalisability (*ibid.*). It is recognised in the present study that the case study approach is limited in relation to external validity, and it is not suggested that the findings of this study can be generalised to other cases (Yin, 2003). Rather, the study is considered to be generalisable to theory (i.e. analytical generalisation), and not statistically generalisable (Yin, 1989). The expansion and generalisation of this is based on the identification of the 'deep process' functioning within "*contingent*

conditions via particular mechanisms" (Easton, 2010). Under critical realism invariance is viewed as relating to elements of the constituents of the causal explanation (Easton, 2010).

Although triangulation of methods has been adopted for the study, and has been generally viewed as a vital validation technique in mixed methods research, it has received some criticism (Modell, 2009). This has been regarding the notion of triangulation, i.e. the need for an objective, verifiable reference point, and its inappropriateness for research which is inherently more subjective. It has been described as potentially "*fraught with ambiguities*" resulting in a lack of intersubjectivity (Secolsky *et al*., 2011). Further, where different methods are employed to provide the general background information for the study without greater integration between the different methods, validation through triangulation is not sufficiently met (Modell, 2009). As triangulation in this study has been viewed as contributing to internal validation, external validation still needs to be met (Modell, 2009).

10.3 VALIDATION METHOD

In the present study, it was decided to include a validation phase to strengthen the validity of the research findings, particularly in relation to external validity. Particularly of interest in this phase is *model validation* – the determination of whether the conceptual model corresponds to and explains the EER motivation phenomenon in the real world (Rand and Wilensky, 2006). Qualitative research, for example, can be evaluated for trustworthiness through credibility, transferability, dependability, confirmability and authenticity (Buchbinder, 2011). Validation is recognised by the literature as not a standard procedure, but should not "*be used blindly in every research situation*" (Buchbinder, 2011, p.108). In this study, this is done through expert interviews. The decision was made not to use respondent validation for four principal reasons:

> the time demands placed on the respondents and the potential difficulty in engaging all the original interviewees;

the presence of the validator could influence the validation results (Secolsky *et al*., 2011), telling the interviewer what the interviewee thinks they want to hear;

the account produced by the researcher is designed to produce an overview and identifies underlying concepts in line with the critical realist paradigm, which may be different from individual informants' accounts (Mays and Pope, 2000);

respondent validation is viewed here as being insufficient to contribute to external validity. Rather it would contribute to error reduction (Mays and Pope, 2000).

Telephone elite interviews were performed with six professionals selected from a range of different national organisation types and professions. Handwritten notes during these interviews taken and recordings made. Telephone interviews provide a number of advantages over in person interviews including a reduction in the affect of interviewer characteristics on the respondents' responses and greater ease of performing spatially dispersed interviews, but cannot provide a means of visual observation, and may provide inferior data than in-person interviews (Bryman, 2008). Although Bryman (2008) also suggests that it is not possible to readily use visual aids and that telephone interviews are less likely to extend beyond 20 – 25 minutes. In relation to the former, the refined conceptual model with an explanation was emailed to the elite interviewees in advance. In relation to the latter, due to the use of this method purely for validation purposes, such interviews did not extend beyond 40 minutes.

The experts are identified in Table 10.2. Expert interviewees were selected based on their known experience with EER. They were sent information in advance of the interview, including a summary of the findings, the refined conceptual model (Figure

9.2) and an accompanying explanation of the model. An interview based around the findings was undertaken, using a summary of the findings as a topic guide ('Validation Pack') (Appendix H), to discuss the validity of the model and assess whether further refinement necessary. Informal discussions have also been incorporated in the validation, also outlined in Table 10.2. The notes taken based on the validation interview recordings were sent to the interviewees for review ('member validation' or 'respondent validation') (Torrance, 2012).

TABLE 10.2 Expert interviewees ('Valid') and informal discussions ('Chat')

TYPE	TYPE	ROLE	YEARS OF EXPERIENCE	DESCRIPTION
VALIDATION INTERVIEWEES				
Valid 001	Company (independent EER and home energy analysis)	Energy Analyst	3 years	Provides home energy master plan predominantly for privately owned homes based on individual households and recommendations for feasible, practical retrofit measures. Considers potential financing mechanisms. Nationwide clients but with a southern England bias.
Valid 002	Research organisation.	Director.	8 years	Research based on ecological behaviour including improvement of home energy efficiency and the motivation for performing certain behaviours.
Valid 003	Research organisation.	Director.	Over 10 years	Involved in advising homeowners, communities and government in relation to building energy efficiency. Experience in advising DECC on the original Green Deal.
Valid 004	University Research Centre.	Academic/ Senior Researcher.	Over 10 years	Extensive practice- and research-based experience with EER, increasingly focusing on policy and 'middle actors' (e.g. small builders, insurance industry, property industry professionals). Experience of research on EER achieving 60% or more in carbon reduction through domestic refurbishment. UK and

				international focus.
Valid 005	Government department.	Policymaker (social psychologist).	4 years	Training in experimental psychology and work experience on resource efficiency (including energy and materials) behaviour, interest in behavioural motivations, lifestyles and pro-environmental attitude segmentation model, and water efficiency policy incorporating consumer and householder motivations.
Valid 006	Bristol City Council and Bristol Green Doors.	Retrofit Officer.	5 years	Advisor in the Energy Service Department with focus on private housing. Advisor to policymakers.
INFORMAL DISCUSSIONS				
Chat 001	Company (independent energy efficiency company).	Project Director.	Unknown	National company engaged to help deliver energy efficiency improvements across 30,000 homes in Bristol.
Chat 002	Government.	Minister/ Member of Parliament.	Unknown	Central Government - Environment.

The following section outlines the findings of the validation interviews.

10.4 VALIDATION INTERVIEWS – FINDINGS

The main aspects discussed during the validation interviews and informal discussions are outlined in the following section. These include the internal factors, external factors, EER motivations, and the conceptual model overall. Interviewees suggested that they agreed both with the model and the model explanation as presented to them in the Validation Pack (Appendix H), which was also used to guide the interviews.

10.4.1 Internal Factors

The validation process confirmed that not only is the concept of EER motivation is complex and complicated, but that owner-occupiers perform this type of work for multiple reasons. It was agreed that values are central to EER motivation and that values are important in the shaping of the principal motivation theme. Those with higher environmental values, for example, were considered more likely to have already acted in relation to EER. It was, therefore, suggested that those who had already acted were a minority group of owner-occupiers that were likely to have less impact in relation to the overall carbon emission reductions possible from the housing stock. However, although this may be the case, this does not take into consideration the potential impact of environmental motivation through moral and social norms, and the negative emotions elicited, for those with lower environmental values.

It was agreed that EER is not currently a strong social norm, with a view that this varies across different social groups. The views of the validation interviewees differed over whether or not EER has the propensity to become a social norm – some believed that regulation would be needed in the form of 'consequential improvements', whereas others very much felt that EER could eventually become akin to the double-glazing industry. Consequential improvements are energy efficiency improvements which would be required when, for example, an extension to a property was undertaken. Some local authorities enforce a local version of this, such as Uttlesford District Council in Essex. EER was viewed by some interviewees as having the propensity to become a social norm, particularly where EER achieved a greater scale, extending beyond the 'green minded' owner-occupiers. Rather than be an after-thought, interviewees agreed that energy efficiency works should be performed as the opportunity arises, broadly agreeing with the present study. If the opportunity is missed, there is a real risk that simple energy efficiency measures will not be installed at all, and the energy efficiency of property will be not be improved – particularly when based on the understanding that people move house on average every ten years, kitchens and bathrooms are replaced every fifteen to twenty years and redecoration every five years or more, and therefore the opportunity to undertake energy efficiency works will potentially not occur for another twenty years. Herein lies two associated

issues – owner-occupiers must be aware of the energy efficiency measure available to install alongside existing planned works; and trust of contractors within the home, both issues discussed with validation interviewees. The latter, is less problematic where already undertaking works to the home because contractors already have access to your home, but the former is a significant issue in the context of mixed and conflicting messages, and from media headlines which serve to scaremonger regarding some measures such as solid wall insulation. Validation interviewees suggested that this would deter uptake of EER, but in reality these external factors will shape the EER action – other measures installed rather than solid wall insulation, for example.

There could be a time when the energy efficiency and EER industry become similar to double-glazing, where there are guarantees in place, owner-occupiers are able to engage with companies for quotes on products, and there is more interest in the aesthetic benefits of the products rather than on payback periods (Valid003). Equally, it was suggested that there could come a time when EER and energy efficiency becomes more of a social norm, viewed by the public as akin to recycling (i.e. 'you don't recycle?!' vs. 'you haven't increased your loft insulation!?'). However, because energy efficiency measures, such as loft insulation, are not readily visible in comparison with the highly visible nature of curbside recycling, this is unlikely to be the case, or at least not to the same level. Another aspect of this is potentially the level of skill required for installing energy efficiency measures verses curbside recycling. As highlighted by the validation interviewees, for groups with financial constraints, installing measures themselves might be an important consideration, but will require a particular level of skill. Where contracting others to do the works, owner-occupiers still need to feel sufficiently confident that they are capable of securing the services required.

Owner-occupiers exhibiting higher levels of self-efficacy were confirmed to be those who were more willing to undertake more 'do-it-yourself' projects. Not only do individuals have different motivations to act, but the validation interviewees

confirmed that people also have different capacities to act. However, validation interviewees disagreed about the reasons for this, in that, it was perceived that those in higher deprivation groups would have more time flexibility to undertake such projects, whereas another interpretation was that this socio-demographic group would be financially unable to contract a professional to perform these energy works. Where the time flexibility may be an accurate interpretation for those owner-occupiers who are self-employed across all neighbourhood deprivation groups, the most plausible interpretation based on the empirical data is that those who are unable to financially afford to contract professional services would seek to perform works themselves. This was observed across socio-demographic and neighbourhood deprivation groups, and changed over people's life reflecting the dynamic nature of EER in relation to the external factors. The type of energy efficiency measure installed through a DIY project was dependent on the self-efficacy of the owner-occupier.

An owner-occupier's locus of control could also have an affect on EER motivation. Validation interviewees considered people to generally be less engaged with aspects of energy and energy efficiency in relation to the home as the perception of owner-occupiers was that this is outside their control. Interviewees considered this to be associated with the intangibility of energy in relation to home energy efficiency, and the lack of a clear path to achieve energy efficiency in owner-occupied housing. Although this is partially true, in that people are uncertain about how to achieve energy efficiency in their own home, this is an information issue which is discussed below. In relation to the intangible relationship between efficiency and energy, this certainly varied amongst owner-occupiers in the group. Energy is relatively unseen beyond the output it is used for, exacerbated by direct debits often used to pay for monthly energy bills. Similarly, energy efficiency is usually invisible. However, although this accurately demonstrates that there is difficulty in understanding the actual relationship and the financial ramifications of increased energy use in a home, it is naïve to suggest that this issue acts alone. It acts in parallel with the price for units of energy, which decreases as use increases. This sends mixed messages via owner-occupiers' fuel bills regarding the need to use less energy and therefore provides no incentive to improve home energy efficiency.

The external factor, information, is discussed here due to its close association with the internal factor – trust. These two factors often were perceived to be inherently linked and, therefore, should be considered in parallel. Information and trust were perceived to be key issues amongst the validation interviewees. At the foundation, the view was that owner-occupiers are not typically aware about what an EER entails, the options applicable to their situation and the potential benefits. Although this is an oversimplification of owner-occupiers, as there is a wide range of understanding in terms of these aspects of understandings, this oversimplification did, to some extent, reflect reality. Owner-occupiers are generally unsure of suitable energy efficiency measures until they engage with an improvement project. The risk of this is that this uncertainty means that there could be additional, potentially 'cost-effective' measures that could be applicable that go undetected, thus presenting a missed opportunity to further improve the energy efficiency of a home.

As an external factor, information was cited as a fundamental issue. As discovered in the empirical data, there are a lot of conflicting and mixed messages. This issue was considered to range from the extent and quality of the readily accessible information on the Internet to the messages presented at a Government level. There is a lot of unqualified advice readily available via the Internet, whereas peer-reviewed information is less readily accessible. The mixed messages from Government can be readily seen in the inconsistent, and unpredictably changeable policy and initiatives implemented, something which was reported by owner-occupiers in the present study. This is something validation interviewees agreed deters people from acting. However, beyond this, inherently uncertain schemes such as the Green Deal as originally implemented do nothing to improve this situation, particularly when this scheme was amended to increase uptake by changing it from a loan to a grant. Although validation interviewees considered this to encourage owner-occupiers to wait to see if 'better deals' are implemented – something detected amongst two of the twenty-five original participants, it more importantly fosters owner-occupiers' sense of loss aversion, where owner-occupiers will favour the status quo. Loss aversion was agreed to be

particularly relevant to fuel prices and affordable comfort. According to the validation interviewees, the issue of mixed messages also extends to the messages about the search for cheaper fuel (e.g. fracking), where people anticipate cheaper fuel prices and therefore the urgency of reducing energy usage through improved home energy efficiency wanes. This is a valid point, but one that is not wholly applicable, particularly amongst owner-occupiers in higher deprivation neighbourhoods or with financial difficulties – the search for cheaper energy is a long term prospect, whereas those living on tight budgets are interested in short-term affordability. However, it is accurate to say that such messages regarding potential cheaper fuel sources could delay the social normalisation of EER. In addition, messages broadcast by the media about condensation and damp issues resulting from retrofitting works can scaremonger and lead people to reject the idea of similar works on their own properties.

Generic messages seen so frequently by owner-occupiers are not generally favoured, reported by validation interviewees as a result of people not believing those messages are applicable to their own situation. However, there were a number of participants in the present study who had responded to advertisements and to 'door knocking' council workers offering free or subsidised energy efficiency measures. Information campaigns, it was agreed, often have a number of vested interests, and is not only about raising awareness but also about sales. Owner-occupiers are aware of this and validation interviewees confirmed what was observed from the participants. This highlights the importance of trust of the information source.

Trust was highlighted as an important issue by validation interviewees. It is a factor that was perceived at different levels, including whether people believe they can achieve the savings suggested and whether the calculations used to generate predicted savings are trustworthy and reliable. Systems which are currently in place such as EPCs exacerbate the situation in the sense that they are largely inaccurate and inform people what they know is not a true representation of their home. Where the information comes from a member of a person's social circle, they are more likely to

trust that information. Where a company is known to provide impartial advice, that too is preferable to a source where the interests are unknown. Validation interviewees confirmed that people generally disliked advice perceived to be a sales pitch.

The issue of trust can be extended to those contractors owner-occupiers have in their home to perform the works, particularly where there is a vulnerable resident. This was reported during the validation process as being a preventative reason for undertaking any form of works. Despite this, two validation interviewees suggested that contractors form an important part of the decision-making process and as a source of information. Although this is important for EER action and helps to shape the form that action takes, at a motivation level, interaction with contractors can increase or mitigate EER motivation depending on the emotional experience of the owner-occupier.

10.4.2 EXTERNAL FACTORS

External factors interact with internal factors as well as EER motivation and action. This is a continuous process, which helps to shape, facilitate or even inhibit motivation and action. There was an almost unanimous agreement regarding the interpretation of the association between property characteristics and EER reflecting measure applicability, suitability and affordability. However, a further suggestion proffered was this could reflect the difficulty level of installing certain measures and the cost of these measures; for example, lower cost cavity wall insulation in comparison with more expensive solid wall insulation. In reality, it is likely that the association between EER and property characteristics is a combination of these aspects, although because owner-occupiers would rarely perform solid wall insulation themselves, this is more likely to reflect the complexity of the process rather than level of difficulty of installation (e.g. solid wall insulation require professional installation, can involve significant disruption, and can potentially need planning permission). Further, validation interviewees suggested that people like the aesthetics of their home and are loathed to change this through solid wall insulation, something also observed during some of the interviews with owner-occupiers. The complexity of

the housing stock and the potential of different types of construction (e.g. prefabricated housing and solid wall properties) to utilise similar improvement solutions, means that there is a inherent complexity which needs consideration, something confirmed during the validation process.

Owner-occupiers appear to be more likely to perform EER when the opportunity arose, based on a period of transition (i.e. retirement, redundancy, moving into a new property). This was confirmed in the validation process, with the citing of children leaving for university and the resulting improvement in household disposable income as an example of this. However, beyond this, there was a minor disagreement amongst experts regarding the age groups most likely to undertake works – some considered middle aged groups to be most likely, others 34 – 64 year old groups, and then retired households. The suggested increased likelihood of older groups undertaking EER was justified as due to those groups residing in a property for much longer. Age would not necessarily explain the relationship between higher deprivation neighbourhoods and EER action, but the *intended* length of residence would be more plausible across neighbourhood deprivation groups. Although there was a greater proportion of over 60 year olds in the sample population for the study, there did not appear to be a relationship between EER and age groups, counter to the general perspectives of the validation interviewees. This could be attributed to the predominant age groups engaging with EER changing with location, with those who engage with different companies, groups and organisations, or generally a misconception. It is taken here that the former two interpretations are most likely.

There was a general consensus over those undertaking EER planning on remaining in their home for the foreseeable future. This broadly reflected what was observed in the empirical data, particularly those who were considering moving house expressing that they would only consider energy efficiency measures in their next property.

EER motivations for high and low deprivation households were broadly the same, confirmed by the validation process. Rather, whether EER action occurs reflects more the capacity for households to act (i.e. the constraints for high deprivation

households). The validation process elicited six possible interpretations of the association between EER and neighbourhood deprivation: first, that those households in high deprivation neighbourhoods were probably going through a period of transition or change. This was consistent with the original interpretation of the data.

The second interpretation was that it is the high deprivation neighbourhood households which will be more concerned about how their income is spent, with the aim to have a comfortable life despite a small monthly income. It was also suggested that until energy use sufficiently impacts on their income, people will not act. Although this seems a logical interpretation, it can only be considered partially true: there were a number of households in other types of deprivation neighbourhoods who reported tight constraints on their monthly income and difficulty in affording the desired comfort levels, but were yet to undertake higher levels of EER. Therefore, although the proportion of income spent on energy bills will have an affect, this does not always result in EER action. It may, however, be considered to contribute to overall motivation, resulting in EER action where a period of transition provides the opportunity to act.

The third interpretation was that those in higher deprivation neighbourhoods are those who are more likely to have been targeted in relation to financial assistance. There was no real evidence of this being true based on the empirical data, with households from across neighbourhood deprivation categories reporting having benefited from some form of insulation subsidy, but also lower income groups through to medium and higher income groups reporting earning ‘too much’ to benefit from greater financial assistance in relation to energy efficiency measures.

The fourth suggestion was that residents of higher deprivation neighbourhoods remain in their home for longer because they do not have the opportunity to move and it is therefore in their interest to improve the energy efficiency of their home. Although participants of this group in the study had typically resided in their home for longer,

or intended to reside in their home for many more years, this was not unique to this neighbourhood deprivation category - a third of overall participants having lived in their home for over 20 years, spread between neighbourhood deprivation categories. However, those considering moving within the next few years expressed no intention of improving the energy efficiency of their property. Further, those participants in higher neighbourhood deprivation areas often reported residing there because they belonged to their local community, rather than being financially unable to move house.

The fifth suggestion was that, due to their daily timetable, those in higher deprivation neighbourhoods had greater opportunity and flexibility to undertake energy works in comparison with those in full-time work. This interpretation appears logical, but presents a general naïve perspective grounded in stereotype. Not only did a different validation interviewee suggest that it was those who were self-employed with the greatest flexibility to undertake EER, but also there were a number of participants in the present study across neighbourhood deprivation categories with flexible working hours or who were retired.

A final suggestion was that these neighbourhoods would accept anything which was offered where it was free – something which highlighted a disagreement between validation interviewees. In relation to measures such as free cavity wall or loft insulation, participants across neighbourhood deprivation groups had reported in capitalising from the offer when the opportunity arose, reflecting that this is not a unique trait in high deprivation neighbourhoods. Further, regardless of the need to pay a third of the overall cost for energy efficiency improvements (e.g. solid wall insulation, new boiler) as part of a Bristol-wide, community scheme, it was reported that there was significant interest across all levels of neighbourhood deprivation.

How people finance the upfront cost of EER is a significant issue, emphasised during the validation process. There was agreement during validation that there is public

skepticism in relation to financing models. This skepticism is demonstrated by the low uptake of the Green Deal but the rapid engagement of the public with the Green Deal Home Improvement Fund. Confirmed during validation, people like the idea of accessing a grant rather than committing to finance attached to their property, particularly when there is a significant risk of the financer (e.g. the Green Deal Finance Company) entering into liquidation. This loss aversion of the public, particularly in relation to economics and their home, in the current economic climate can negate EER motivation, and should be an important consideration for EER uptake programmes.

The capital cost of EER is important in relation to the selection of particular measures. The validation process highlighted that, although people understand the concept of payback periods, such calculations did not 'stack up' for larger measures (e.g. solid wall insulation). This was detected in the owner-occupier interviews, where there was recognition that some measures were unlikely to reach payback – highlighting that this is not always essential in motivating EER action, depending on the other benefits (e.g. improved energy security, affordable comfort). Some of the validation interviewees questioned the validity of payback periods, comparing it to whether people use the same assessment process for double glazing, kitchens, holidays and shoes. This was perceived through validation as attributable to the key messages broadcast by government, who have emphasised 'cost effectiveness' of energy efficiency measures by basing it on payback periods.

Cost of measures and financing of the works is one of a number of barriers (economic) identified in the existing literature and in the empirical findings, and confirmed by the validation process. The cost of the measures particularly in relation to technology were described by one validation interviewee as 'prohibitively expensive' for what they save in energy and on utility bills, linking with the issue of basing energy efficiency measures on payback periods, as discussed above. The cost for professional services to reduce the inconvenience barrier (e.g. loft clearing

services) were identified by the validation interviewees as suspiciously high, although a good idea.

All the barriers identified by the research (capital costs, inconvenience, information, product availability and time) were confirmed by the validation interviewees. However, to the barriers identified, the validation interviewees added people's awareness and the salience of the issue as fundamental barriers. This will be further discussed in Section 10.5. Additionally, two other barriers were identified during the validation process: (1) social norms in relation to cultural habitus; and (2) the low market demand for EER resulting in contractors not needing to deviate from their usual approach to works. The information barrier was perceived by the validation interviewees to extend to existing information systems and trust (e.g. EPCs) and the fragmentation of information provision and refurbishment services. The time barrier was perceived to be the limited capacity of the public (e.g. skills, time, confidence) to undertake all or part of EER as 'do-it-yourself' projects. Although this is accurate, skills and confidence relates more to the concept of self-efficacy (internal factor – discussed in Section 10.4.1), and rather than being considered purely as a barrier to EER motivation, the level of an owner-occupier's self-efficacy can facilitate EER motivation and action, or reduce EER motivation. Self-efficacy can also be increased through experience, either through work, or through undertaking necessary improvement works.

10.4.3 Motivation

There was overall agreement during the validation process that the existing motivation theories were broadly relevant, particularly relating to the interpretation of the various concepts. The validation interviewees did, however, view the relevance of these existing motivations slightly differently, as summarised in Table 10.3.

Festinger's Theory and Self-Discrepancy Theory in the form of guilt and embarrassment were confirmed by validation interviewees as being seen amongst

TABLE 10.3 Summary of validation interviewees views on the applicability of existing motivation theories' concepts to EER

VALIDATION INTERVIEWS							
Theory		Festinger's Theory.	Self-Discrepancy Theory.	Prospect Theory.	Vroom's Theory.	Expected Value Theory.	Maslow's Hierarchy.
Concept		Guilt and embarrassment.	Guilt and embarrassment.	Loss aversion.	Locus of control and self-efficacy.	Locus of control and self-efficacy.	Role of home.
Interviewees' views	Valid001	Definitely demonstrated by clients.	Definitely demonstrated by clients.	Definitely demonstrated by clients.	Definitely demonstrated by clients.	Definitely demonstrated by clients.	
	Valid002						Could have a role particularly in relation to self-actualisation and self-esteem.
	Valid003	No direct comments.					
	Valid004	No direct comments.					
	Valid005	Generally yes, although no direct comments.					Particularly in relation to the ultimate aim of creating a warm home in which to perform everyday tasks.
	Valid006	No direct comments.					

owner-occupiers looking to undertake EER. This was reported to be particularly noticeable amongst those owner-occupiers working in the environmental sector. This was also seen amongst the owner-occupiers in the present study, although this not only extended to other sectors closely linked to the environmental sector (e.g. timber industry), these emotions were also be detected amongst some participants who were not, nor had previously been, employed in a similar sector. For those working in the environmental sector and similar, this negative emotional reinforcement could be interpreted as partially attributable to social norms, detected amongst some of the owner-occupier participants.

An additional theory proffered for consideration by one validation interviewee was the 'social practices'. However, within this theory, it focuses on the link between practice and context within social situations. Based on the understanding that the social aspect is only one part of EER and, more generally, the home, and is a social science theory rather than a motivation theory, social practices was not considered for the present study.

The validation process confirmed that owner-occupiers perform EER for multiple reasons and their decisions were influenced by a range of factors. One validation interviewee, however, did suggest that owner-occupiers were not motivated to perform EER and that EER would ultimately need to be regulated (i.e. through 'consequential improvements' where improvement works would be required where home renovations or extensions are being undertaken).

Confirmation was provided that people were motivated by a combination of EER motivations including economic and social (e.g. warmth, aesthetics) themes. It was emphasised during validation that often these motivations are exceedingly close in relation to their strength and primary motivation. One validation interviewee disagreed with the idea of a social motivation for EER, but also suggested that comfort was one of the reasons for undertaking EER, and geographical context can

frame how owner-occupiers view things, certain neighbourhoods fostering more pro-environmental attitudes than others. Rather than a geographical context, this reflects more the idea of a social context in relation to neighbours and social acceptability. This suggests that the idea of a social motivation for EER is not always easy to interpret. EER is not purely motivated by the economic motivation theme, and the concept that people are economically rational was considered to be inaccurate, people being influenced by multiple, sometimes conflicting factors. Equally EER is not purely motivated by the environmental motivation theme. As a motivation theme for EER, the validation process confirmed waste as a motivation theme although some interviewees admitted that it had not previously been considered as a motivation theme, and therefore contributes to knowledge. One validation interviewee suggested that those with a pro-environmental attitude would inherently dislike the idea of waste, although this motivation theme was detected across households with different levels of environmental values.

During validation, EER motivations were suggested to significantly differ depending on the level of EER being considered, from loft insulation to a whole house refurbishment to achieve carbon neutrality. Rather than reflecting different motivations for different EER levels, EER motivation is fluid as reflected in the conceptual model, and the strength of motivations and the influencing factors can fluctuate depending on the type and nature of the work being undertaken, the measures being selected, the desired outcomes and the priorities of the owner-occupiers at the time.

The validation process also revealed the debates amongst those whom had already performed EER and were participating in Open Doors events to inform and motivate others considering engaging in the same type of refurbishment. These hosting homeowners were reported to have disagreed regarding the best way to frame their introductory talks with visitors to best motivate them, regardless of how they themselves had been motivated. This highlights the complexity of EER motivation and how it can differ between people as well as over time. The reasons given by

validation interviewees for owner-occupiers pursuing EER related to the motivation themes identified by the study, particularly economic and social. Environmental motivation was highlighted during the validation phases as not solely relating to carbon emission reduction but also environmental impact, with different owner-occupiers typically focusing on one over the other. In relation to the implications of this, it may affect how we frame information for environmental motivation to encourage greater uptake of EER.

The waste motivation theme caused some discussion during the validation process and generally needed further explanation. Although it was not considered a surprising finding and was potentially more difficult to understand, it was confirmed to be fundamental for motivating sustainable-related behaviours such as recycling and energy use. As a motivation this was considered particularly applicable to 'useful heat' and cost of fuel, but also could be associated with embodied energy and the environment. However, in relation to embodied energy not all validation interviewees were certain that this was a particularly tangible concept for owner-occupiers. Although it is true that not all owner-occupiers will fully comprehend embodied energy, it is an oversimplification of owner-occupiers to suggest that the concept is too difficult to understand or intangible to contribute to the waste motivation. Where owner-occupiers did have an interest in embodied energy and avoiding unnecessary waste, it was reported by one validation interviewee that this could result in inhibiting the potential energy savings through EER. Rather than reflecting just the potential loss of opportunity in relation to potential savings through EER, this reflects the different internal factors influencing owner-occupiers' EER motivation and action, and their decision-making process. There was a general agreement that this motivation theme was formed in childhood and growing up.

Generally, it was agreed that those with higher environmental values were more likely to act, but one validation interviewee emphasised that this depended on a person's economic situation – where they have economic constraints with higher priorities (e.g. paying gas bills, buying children's shoes) they may have environmental values, but

these are not reflected in that person's daily life. Although this was detected during the owner-occupier interviews, particularly amongst those who had younger children, it not only highlights the internal factor of 'priorities', and potentially demonstrates how EER motivation can be suspended by those priorities, but also reflects Maslow's hierarchy of needs. For those with higher environmental values with the capacity to act, it was reported that such individuals were more likely to have undertaken some form of EER and were less likely to be the group with greatest impact.

Validation interviewees agreed Maslow was considered applicable in various forms: there is a desire for a warm (i.e. affordable comfort), functional home at the foundation of the hierarchy. At higher levels of Maslow's model, self-esteem and self-actualisation appear pertinent to EER motivation, confirmed by the validation process. Those owner-occupiers experiencing the higher levels of Maslow's hierarchy could be argued to be those experiencing the environmental theme as their principal motivation.

10.5 NEW ASPECTS ELICITED FROM VALIDATION INTERVIEWS

There were three new principal aspects elicited from the validation interviews: the impact of 'green taxes' relative to the cost barrier for performing works; the frequency of moving housing in the UK as a barrier to performing EER, incorporating low interest from estate agents in promoting energy efficiency; and awareness and salience of energy and energy efficiency.

First, green taxes are those charges imposed on certain companies such as energy companies by the Government. These were reported during the validation interviews as becoming additional charges on consumers' bills, thereby adversely affecting those who are unable to afford their own energy. Energy supply programmes aim to save carbon but also generate profit. An example of this is the increased cost of boilers (reported around £300), which is similar to the amount a household would save on their energy bills through improved energy efficiency. Although this was perceived as

an external factor and part of economics/costs, it was not included in the model. The justification for excluding this is that, although it will affect the cost of certain services and measures – already considered as an external factor in the conceptual model, it was not a factor directly observed by the owner-occupiers within the study. The lack of this observation has been interpreted as the added cost of the 'green tax' being incorporated within the overall cost of a product of service and therefore is not generally perceived by owner-occupiers. What should be considered is how to reduce the cost of measures and services – including whether to restrict the amount companies can add to these items for such taxes.

The second new factor raised during validation was the frequency owner-occupiers move house. Although the reported figures varied between validation interviewees from six to twelve years, currently the DCLG suggest that 54.7% and 61% of owner-occupiers reported by the DCLG to have resided in their home for ten or more years (2010 and 2014a, respectively). The frequency of moving house was suggested as resulting in the reduced likelihood that owner-occupiers will want to attach a 25-year loan such as the Green Deal (in its original form) to their property or to undertake a large-scale refurbishment due to the associated disruption. Rather, owner-occupiers who had become aware of the energy inefficiency of their property and the higher cost of operating their home were more likely to search for a more efficient property when they next move. This was perceived as an external factor and will be included in the model.

The third new aspect raised was that, the external factor 'awareness', was highlighted as an issue in relation to energy and energy efficiency, including the available options and potential benefits. Energy is made tangible through items such as utility bills. In contrast, energy efficiency is more intangible and was suggested during validation as not being 'at the top of people's minds'. Further, generally people have a narrow understanding of energy efficiency and a poor understanding of the link between energy efficiency and their energy bills. Although they have an 'emotive relationship' with their energy bills, people were reported to be disengaged in relation to energy

efficiency. For example, where people are provided with the choice between a new kitchen or improved home energy efficiency (intangible), they are more likely to select the new kitchen (tangible). This was perceived as encapsulated under the external factor 'awareness, knowledge and information' in the existing refined model, but to this 'salience' will be added.

10.6 REFINED CONCEPTUAL MODEL

Validation interviewees all confirmed that EER motivation was a complex subject. This complexity is a reflection not only of the heterogeneous housing stock, but also of owner-occupiers' differing internal processes and contexts. As suggested in an informal discussion with a Government minister, the diverse tastes and preferences in relation to the aesthetics of a home was an essential part of the complexity of the EER challenge.

The general consensus during validation was that the conceptual model was useful, and 'fitted together well'. The usefulness of the model was attributed to the potential for stimulating debate, and in the non-linear depiction of EER motivation. It was recognised that the non-linear nature meant that the model was potentially more challenging to understand and that a linear model is what would be more widely accepted. However, it was also recognised that the concept of EER motivation is not itself a linear one and therefore the conceptual model presented was deemed to be a valuable approach in enhancing wider understanding of EER motivation. A number of specific comments were also made regarding the conceptual model during the validation process.

The experts liked the multiple motivations depicted and the interaction between the external and internal factors. There was an agreement that the waste motivation theme should be graphically shown as associated with the other three motivation themes. The interaction between internal and external factors were confirmed, validation interviewees liking how external factors can change more rapidly than internal

factors, something reported as observed in private practice. The factors presented were confirmed as all those observed or reported by owner-occupiers to professionals practicing in the area of EER. The validation process confirmed that, although external factors might affect the bigger or overall decision regarding EER, the internal factors might affect the exact energy efficiency measures that are selected, but also any decisions originally based on internal factors will be affected by external factors such as property characteristics and financing. This reflects the fluidity and continuous interaction between internal and external factors. Some interviewees needed clarification regarding the relationship between external and internal factors, and consequently it was decided to amend the arrows between the internal and external factors to graphically clarify this process further.

The only aspect directly recommended for refinement in relation to the refined conceptual model was the possibility of relocating the internal factors 'fashions and trends' and 'social norms' to external factors. Although there is some overlap between these factors in relation to their position as external or internal factors, the decision was made to retain their internal position. This is justified as, although these are influenced by external factors, they are predominantly based on the perceptions of the individual and are more akin to their values which could include the culture in which they have grown up and/or are positioned. They have been, therefore, interpreted as internally grounded factors.

There was an additional suggestion that some clarification would be beneficial regarding the role of emotions and decision-making in relation to their mechanistic role on the internal factors. This was, therefore, incorporated into the final description of the model.

The validation process has helped to confirm and refine the conceptual model. Based on the validation process, the conceptual model was further refined to clarify the interaction between the internal and external factors, and to add 'salience' to the

external factor of 'awareness, knowledge and information'. The refined conceptual model presented below (Figure 10.1) provides a new way of thinking about owner-occupiers in relation to EER, and also includes a refined description of the model. An accompanying description is presented in Section 10.8.

10.7 THE MODEL FOR OWNER-OCCUPIER MOTIVATION FOR EER

The model presented below (Figure 10.1) is the final model for EER as a result of the validation process.

10.8 MODEL DESCRIPTION

Owner-occupiers' internal factors are at the core of the model. These can change in strength order as represented by the cyclical arrow within this layer. The order of the internal factors presented in the model reflects the likely order for the study participants and are hierarchical. Emotions and decision-making have a mechanistic role on the internal factors and are temporal in the sense the they will change over time and, therefore, affect the internal factors differently over time. Emotion will modify these internal factors (e.g. their strength and order through negative and positive emotions). Emotions are affected by internal factors, particularly attitude, beliefs and values. EER motivation and EER action in relation to emotion is not solely based on dissonance – owner-occupiers can act based on emotional feedback, affected particularly by attitude, beliefs and values; moral norms, and social norms. In turn, emotions will have a particular affect on sense of responsibility, self-interest and 'self', locus of control and self-efficacy, and priorities. However, emotions are likely to have an affect on, and be affected by all the internal factors. Decision-making is a process. It will modify the internal factors (acting in favour of delivering on other internal factors, and values in particular), motivations and EER action.

EER motivation is divided into four categories, with the waste motivation theme evenly spread between economic, social and environment motivations. These motivations can alter in influence during a lifetime, and also alter between projects and EER measures. This is represented by the cyclical arrow within this layer.

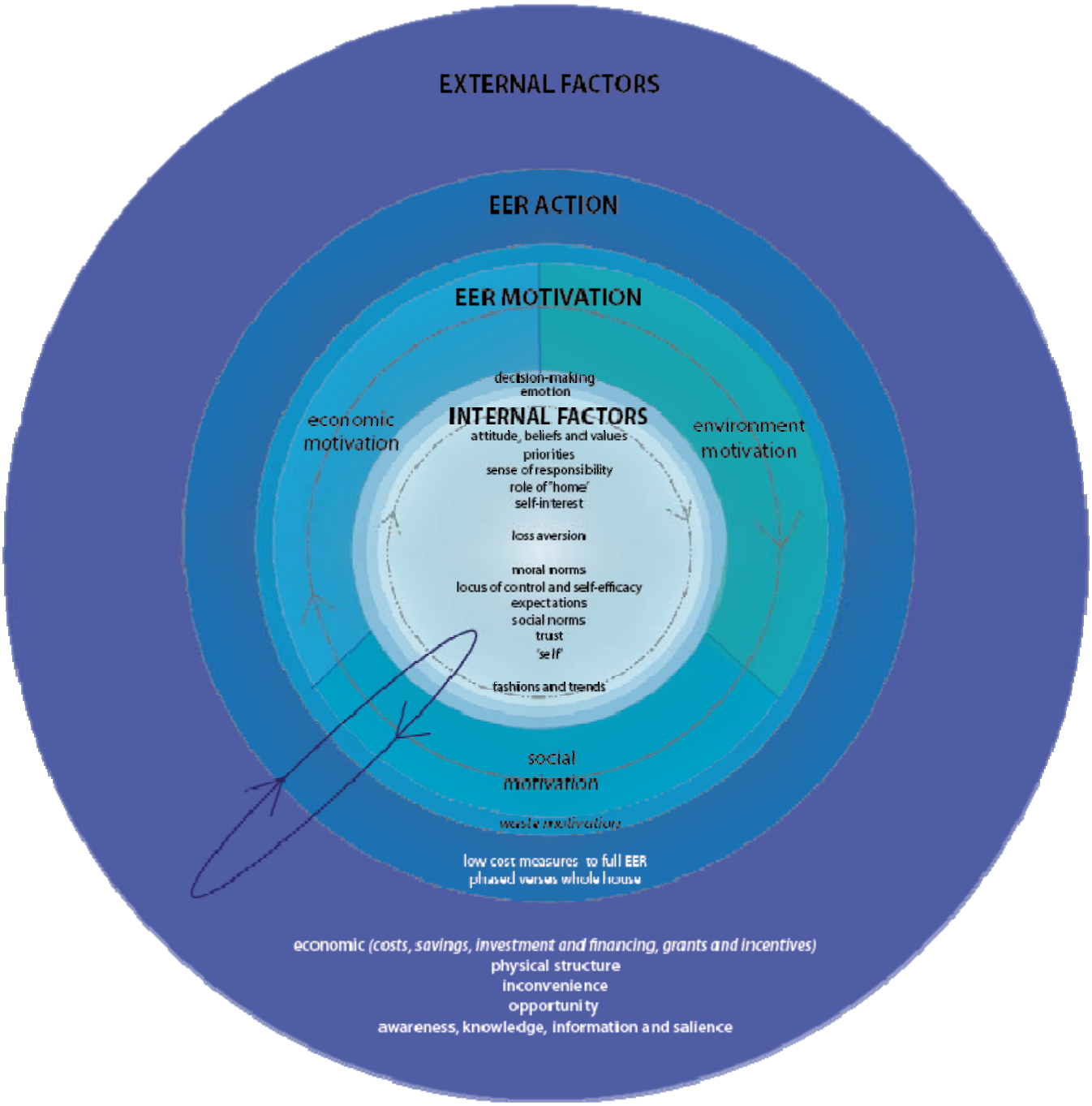

FIGURE 10.1 Final model of the internal and external factors affecting owner-occupier motivation for EER

EER action is located between EER motivation and external factors as it is not purely in external context, and flows directly from EER motivation. It can form different levels of intervention. This will be shaped by the internal factors, owner-occupiers' principal motivations, decision-making (e.g. in preference of meeting different internal factors and motivations over others), and by external factors. When one action has occurred, the order of internal factors and primary motivation can change.

The external factors must be considered. They can change more frequently than owner-occupiers' internal factors, but they provide the context including the constraints in which the owner-occupiers are situated. This not only can direct the form of EER action, but it will have an affect on motivation, emotions, decision-making and, to some extent on the internal factors. For example, by providing a tariff for electricity-generating technology such as photovoltaic panels results in such technology being favoured over heat-generating technology (decision-making); increasing owner-occupier economic motivation; it can also reduce the overestimation of losses of the internal factor 'loss aversion'. The knowledge of a time limit on such a tariff can alter the internal factor 'priorities', where the owner-occupier has the financing to act (external factor). The cyclical arrow between the outer and inner layers represents the interplay between each layer, particularly between the internal and external factors. It is cyclical to demonstrate the continuous flow between the layers.

10.9 SUMMARY

The present chapter has sought to validate the research findings, thus meeting Objective six (Section 1.5). Based on interviews and informal discussions with experts from a range of backgrounds, this chapter has discussed some of the key aspects of the conceptual model and study findings, resulting in some minor refinement of the conceptual model. This refinement was in the form of graphically altering the arrow representing the relationship between the external and internal factors for greater clarity, and including 'salience' in the external factors.

The following chapter provides a conclusion to the study.

CHAPTER ELEVEN: CONCLUSION AND RECOMMENDATIONS

11.1 INTRODUCTION

This chapter seeks to draw conclusions based on the research findings and validation provided in the proceeding chapters. By doing so, it meets Objective seven (Section 1.5) presented in Chapter one. In Chapter nine, a discussion of the findings in relation to the key research questions (Section 9.2) was presented. This chapter summarises the findings in relation to the key research questions, the research objectives, and how this delivers the research aim. It presents the model refined in light of the empirical data presented in Chapters seven and eight, and the validation data presented in Chapter ten.

11.2 SUMMARY

Table 11.1 outlines the research aim, proposition, objectives, and questions and which chapters have sought to meet the objectives and questions. The present chapter seeks to draw conclusions about the present study, including recommendations for policy and practice, and for future research.

Chapter two contributed primarily to Objective one and partially to Objective two, providing an exploration of motivation theory and the application of this to EER. It identified seven principal motivation theories which appeared to be broadly applicable to EER motivation amongst owner-occupiers. This included Maslow's hierarchy, Vroom's expectancy theory, Festinger's cognitive dissonance theory, expected-value theory, prospect theory, and self-discrepancy theory. Based on the literature, this chapter also identified a number of potential factors affecting decision-making in the home and the actors considered most likely to contribute to EER.

Objective two was met through Chapter three, which provided a review of the existing literature on the incentives and barriers to owner-occupied EER. The drivers for energy efficiency improvements in the existing housing stock were identified, as

were the debates revolving around what improvement levels can be achieved and by which means.

TABLE 11.1 Overview of research aim, proposition, objectives and questions

OVERVIEW		
AIM		
To develop a new model of motivation for owner-occupier motivation for 'energy efficiency refurbishment' (EER).		
PROPOSITION		
Owner-occupier motivation for EER can be categorised as predominantly economic, social or environmental. The predominance of this will be governed by internal and external factors.		
OBJECTIVE		**CHAPTER(S)**
1	To explore motivation theory and its application to domestic EER.	2
2	To acquire insight into the motivation for owner-occupied domestic EER through an extensive literature review of home improvements, energy efficiency, drivers for pro-environmental behaviour, home decision-making and motivation theory in the built environment.	2 - 3
3	To create a new model of motivations for owner-occupied domestic EER based on the literature review.	4
4	To develop and deploy a suitable methodology for primary data collection on owner-occupier motivation for EER.	5
5	To analyse and appraise the relationship between owner-occupiers' motivation for EER and the motivation themes in relation to the conceptual model.	6 - 9
6	To validate the findings of motivations for domestic EER, confirming whether the results reflect reality.	10
7	To draw conclusions about the motivation of owner-occupiers and develop recommendations for policy and professional practice, and for future research.	11

RESEARCH QUESTIONS		
1	Why do owner-occupiers perform domestic EERs?	9
2	What are the principal motivations for EER in the owner-occupied housing stock?	9
3	What are the drivers influencing owner-occupiers' motivations for EER?	9
4	To what extent do owner-occupiers' values influence their motivation for EER?	9
5	Which motivational theory or hybrid of theories 'best fits' domestic EER?	9

The literature review presented in Chapter four contributed to the development of the conceptual model, thus delivering Objective three. It identified the distinction between intrinsic and extrinsic motivation, adopted as 'internal' and 'external' factors in the model, associating the external factors with owner-occupiers' context, and internal factors with aspects such as personal values, sense of responsibility and moral norms. As highlighted in both the literature and in the study, external and internal factors are not necessarily complimentary, and tensions can exist. This chapter identified three of the four final motivation themes – environmental, social and economic. Based on these, motivation drivers were developed. Based on the literature review, a process of model development was undertaken creating a broad model representing the groupings and interrelationships of the factors associated with EER motivation. This was focused into the initial conceptual model.

The research methodology was provided in Chapter five, meeting the fourth objective. The critical realist paradigm was adopted, and the multiple case study was considered to compliment this and the nature of the study. The research design incorporated a mixed methods approach, with emphasis on the qualitative methods. A short building survey combined with general observations and qualitative interviews were implemented across twenty-five owner-occupied houses in low-, medium- and high-deprivation neighbourhoods across Bristol. A short questionnaire to capture socio-demographic and lifestyle data was used, and documentary evidence was used where

available. The in-depth, semi-structured interviews enabled exploration of the key factors relating to the study of EER across households which had performed EER to differing levels, and elicited aspects not previously identified by the existing literature. Although it is acknowledged that the data produced by the study is not statistically generalisable due to the size of the population, the results presented are analytically generalisable.

The analysis of the data met Objective five, aiming to identify owner-occupier EER motivation and the motivation themes in relation to the conceptual model. There were three chapters contributing to Objective five – Chapters six to eight. In Chapter six, the quantitative data produced based on the questionnaire and property survey was analysed using descriptive and non-parametric tests utilising the software programme SPSS. Although the quantitative data did not produce statistically generalisable results due to the size of the sample population, it provided an overview of the characteristics of the study population and the associations identified within the study. Based on participant rankings of internal factors, an overall internal factor ranking was produced indicating the strength of the influence of these internal factors.

Chapter seven presented the qualitative data analysis, based on thematic coding and the identification of underlying themes and mechanisms in line with the overarching critical realist paradigm. This identified the participants' EER motivation themes, incorporating the waste motivation theme – not previously identified by the existing literature. This chapter identified the functions of the home as perceived by the participants, the barriers and drivers for EER, and the presence and strength of their internal factors. Not only did this chapter identify participants to be generally loss averse in relation to financing works for their home improvements, but it also identified EER works to be opportunistic.

The influence of external factors in relation to EER motivation (Objective five) were discussed in Chapter eight based on the qualitative data. The interaction between the

situational (external) factors and internal factors shape EER motivation. External factors which appeared to shape participant motivation and EER action included the physical structure of a property, opportunity, economic factors, inconvenience, information, availability of appropriate measures, and time as a resource. Importantly, economic factors included financing of works, and this had a close association with loss aversion - overall loans such as the original structure of the Green Deal were not viewed favourably by participants, particularly when attached to their home.

Based on the data analysis presented in Chapters six to eight, Chapter nine provided a discussion of the findings and model refinement, contributing to Objective five, but also to Objective six in attempting to ensure the conceptual model reflects reality. Chapter nine also presented a discussion of the findings in relation to the key research questions.

Chapter ten presents the validation of the findings based on interviews and informal discussions with experts. The result of these interviews was the refinement and confirmation of the conceptual model in the context of EER, and the attainment of Objective six. The present chapter meets the final objective of the present study - Objective seven. The research aim presented in Chapter one was to develop a new model of motivation for owner-occupier motivations for EER. The refined conceptual model presented in Chapter ten, based on the existing literature, the empirical data and the validation meets this overarching research aim.

Based on the research findings, the research proposition (Section 1.7) was found to be partially accurate. The empirical data has found that there is a need to add the waste motivation theme to the economic, social and environmental motivation themes presented by the original proposition. In addition to the internal and external factors, emotion and the process, ‘decision-making’ have been added as these have a role in shaping EER motivation and EER action.

11.3 CONCLUSIONS

For the UK government to meet its climate change and carbon reduction targets, it is imperative that policymakers, practitioners and academics understand EER motivation in the owner-occupied housing stock. In the absence of regulation, there is a need to understand motivations to be able to facilitate EER action effectively. Beyond carbon reductions, improvements in the energy performance of the existing housing stock will facilitate a reduction in fuel poverty, and occupant health and wellbeing benefits.

There are four primary findings based on the present study. These are the role of values in EER motivation; the types of motivation themes for EER and how these translate across owner-occupier groups; property and deprivation characteristics which have a role in EER action and potentially in motivation; and the conceptual model generated. This section outlines these findings.

11.3.1 The Central Role Values Have in EER Motivation

The present study has identified that owner-occupier values are central to EER motivations. The attitude, beliefs and values of the owner-occupiers shape the other internal factors, owner-occupier motivations, and their emotion and decision-making processes. Feedback from the emotions owner-occupiers experience are affected by values, and provide positive or negative reinforcement depending on the type of emotions experienced. Negative reinforcement can provide either an incentive or disincentive to act.

Values shape the principal motivation theme and how this motivation manifests in action – i.e. the type of measures adopted within the context in which the owner-occupier is situated. These values will also be associated with owner-occupiers' concepts of waste and, therefore, their waste motivation theme. Such values, particularly in relation to waste and the environment, was often observed in the study to be founded in childhood and/or life experience, but could also be developed through regular interaction of the owner-occupier with the local environment. An

owner-occupier's values will not solely shape the principal motivations experienced, but will also shape the type of energy efficiency improvement measures selected within a given context.

The importance of owner-occupier values cannot be underestimated. Depending on the strength of an individual's values, they can result in the suspension or termination of motivation for EER in favour of other 'products' such as holidays. It is therefore imperative that policy, incentives and schemes, research and refurbishment projects take owner-occupiers into account to better understand not only what motivates owner-occupiers, but also how to maintain their engagement.

11.3.2 There are Four EER Motivation Themes

Owner-occupiers perform EER for multiple reasons. Importantly, there are four motivation themes in the context of EER – environmental, social (e.g. comfort, social interaction), economic (e.g. utility bill savings), and waste (e.g. materials, energy, time). Owner-occupiers are typically motivated by two or more of these themes. Any of these themes can differ in strength between projects and within a project over time, not just between owner-occupiers. This reflects the complexity and the fluidity of EER motivation in owner-occupied housing, and particularly the complexity of individuals.

The motivation themes did not significantly differ between neighbourhood deprivation of socio-demographic categories, although nuances within groups were detected. This has implications for policy and government research, which has often adopted the socio-demographic profiles of participants as a way of initially categorising them. The EER motivation themes and EER action, where it occurs, are affected by both internal and external factors. Owner-occupiers will perform EER for multiple reasons, influenced by their internal and external factors. Works were observed to be principally opportunistic to ensure a sufficiently functional home depending on how a home's 'function' was perceived to be by the owner-occupier.

For example, energy efficiency works were typically performed as a result of malfunctioning technology, building defects, or the condition of the property. The function of a home was generally observed to be the same for owner-occupiers, and broadly reflected Maslow's hierarchy of needs.

The social, economic and waste motivation themes were reflected across owner-occupier socio-demographic and neighbourhood deprivation categories within the study, regardless of environmental motivation. Those owner-occupiers with higher environmental values also reflected stronger environmental motivation for EER. It was those owner-occupiers with higher environmental values who were most likely to have already undertaken some form of action in relation to improving the energy efficiency of their home. However, the environment dimension could also drive EER action amongst those with lower environmental values through moral norms and emotions such as guilt and embarrassment. Although it would be easy to associate this with social comparison with owner-occupiers' social circles and, therefore, with social norms, this could be an internal dissonance created by the gap between the ideal and actual self and/or moral norms, based on the values of the individual. Certainly those exhibiting higher environmental values were perceived to be more strongly motivated by the environmental motivation theme to avoid a dissonance with their environmental values. Therefore it could be interpreted that the environmental motivation theme can be used for both those with higher and those with lower environmental values by framing information slightly differently.

The four motivation themes were also used to categorise the principal drivers for EER action. These drivers were varied but contributed to overall motivation. The drivers could be categorised under different motivation themes demonstrating the potential for overlap between motivation themes. Motivation themes and motivation drivers are inter-related. Not only does this emphasise the complexity of EER motivation, but also the potential resulting simplification this entails; that is, due to such overlaps, there is a possibility that information and policy can be structured to appeal to more than one motivation theme and thus target more than one group of owner-occupier.

The factors which influence EER motivation include the barriers, which can potentially inhibit, attenuate or terminate EER motivation. Such barriers include economic aspects such as cost of the works and/or financing; inconvenience; time limitations; information such as trust of the information source, conflicting and mixed messages, which can incorporate the messages broadcast by changing policy; and loss aversion. People are loss averse, favouring the status quo over the overestimated potential losses. However, where the affordability of comfort is threatened within their home and therefore threatening one key function of their home, owner-occupiers will also be driven to act through this 'loss aversion' factor. Where an owner-occupier has a lower level of self-efficacy, this appeared to have a negative affect on EER motivation. Although owner-occupiers had mixed views regarding their locus of control, it was broadly agreed that collective action could potentially have some impact. This could imply the potential for neighbourhood EER schemes where neighbourhoods undertake action to improve the energy efficiency of their homes simultaneously facilitated by the local authority. Examples of such are those seen in the recently launched Warm Up Bristol scheme (launched October 2014), which could also potentially reduce the affect of self-efficacy on EER. Beyond the barriers, internal factors potentially affecting EER motivation in owner-occupied housing include priorities, sense of responsibility, moral norms, and the role of 'home'. The most significant external factors affecting EER is opportunity, but also includes awareness and availability of grants.

11.3.3 The Property and Neighbourhood Deprivation Characteristics are Important

Property characteristics such as the construction type (e.g. solid wall) and building form (e.g. terrace) were identified as having an association with EER, but not with neighbourhood deprivation. This association between EER and these external factors were interpreted as a reflection of energy efficiency measure applicability, suitability and affordability, something the validation interviewees agreed with. This is relevant to EER motivation as it directly relates to barriers such as cost, inconvenience, time, and loss aversion. Another dimension of the physical property is the condition a home and its services are in: as works were typically opportunistic, i.e. performed when a

need to ensure the sufficient functioning of the home, it should be considered how EER can be encouraged amongst those owner-occupiers requiring such improvement works. Consideration should be given to presenting owner-occupiers with clearly structured, trustworthy information which outlines the suitable, applicable measures for owner-occupiers against the cost, based on their property and construction type. Although there is existing information available on such aspects, such as through the Energy Saving Trust website, the present study emphasises the importance of this in relation to other information provision. Such information also needs to be readily available at the time when owner-occupiers are faced with needing to perform improvement works to maintain a functional home, but also owner-occupiers need to be aware of these possibilities, i.e. before visiting websites such as the Energy Saving Trust.

The principal motivations were broadly the same across all deprivation and socio-demographic categories, particularly in relation to the economic, social and waste motivation themes. Higher neighbourhood deprivation appeared to have a positive relationship with EER. Although on the surface this appears counterintuitive, there are a number of possible explanations. These explanations range from the owner-occupiers of these neighbourhoods having a different daily timetable to owner-occupiers in other neighbourhoods, to those in higher deprivation neighbourhoods in this study going through a time of transition. The notion of affordability of comfort in the form of warmth and overall cost of utility bills in parallel with a period of transition is the most plausible interpretation based on the data elicited from the interviews. It was not, however, found that higher EER levels in high deprivation levels was attributable to those participants residing in these neighbourhoods benefiting from a greater number of government grants.

11.3.4 The Model of EER Motivation

For EER action to occur, EER motivation must exist. The study found that no existing motivation theory wholly applied to EER motivation in owner-occupied housing. However, the existing theories investigated contributed concepts to the construction

of a new EER motivation model. The model was refined based on the empirical data and then following the validation process. The validation process confirmed the appropriateness and applicability of the model in the context of EER motivation. This new way of considering EER motivation is the most significant finding aspect generated by the present study. It has moved away from a linear process with start and end points, and attempts to reflect the complex but dynamic, ongoing process of EER motivation in a useful way.

The presented model incorporates both internal and external factors. There is interaction not only between internal factors, but also between internal and external factors. They cannot be viewed as separate from one another. Emotion and decision-making are mechanistic and will contribute to shaping not only the internal factors, but also EER motivation and EER action. There are four principal motivation themes, and these have been depicted in the model with the waste motivation encompassing the three other themes (economic, environmental and social) as waste motivation overlaps these other three themes. The arrows within the model demonstrate the various interaction within the model, and within and between the layers, but also represents the dynamic nature of EER motivation overall. It is not a start-end process, but an ongoing process which will change over time.

11.4 RECOMMENDATIONS FOR THEORY, POLICY AND PRACTICE

As part of the present research, Objective seven (Section 1.5) required that recommendations for theory, policy and professional practice be provided. The study provides findings relevant to theory in contributing to new knowledge to a rarely explored field. EER motivation cannot be explained by a single existing motivation theory, although concepts from existing theories are applicable. The findings emphasise that a linear approach is an inaccurate depiction of owner-occupier motivation, as is the depiction of a static process. EER motivation in owner-occupied housing is a dynamic process and this should be taken into consideration in further academic research.

Based on the findings of this study, policy needs to take a view of EER motivations which extends beyond the economic theme. This is a complex area, particularly because external and internal factors vary between people, houses, and geographic locations. However, this complexity is partially reduced due to the overlaps in drivers and motivation themes, potentially enabling owner-occupiers to be motivated by similar drivers, but for different motivations, and therefore reducing the number of different messages needed to foster and stimulate owner-occupier EER motivation amongst different segments of the owner-occupier population.

Policy needs to recognise that owner-occupiers are potentially motivated by two or more of the four motivation themes to encourage greater uptake of EER in the context of no regulation. Barriers also need to be taken into consideration, as these can attenuate or even terminate EER motivation and action. Reducing barriers such as upfront cost by providing secured debt, attached to a home, for EER is unlikely to appeal to the wider owner-occupier population, particularly in times of economic austerity and where the Government amends its policies relating to energy efficiency and 'renewable' schemes at short notice.

The conceptual model can be used not only to shape policy, but also as a framework to inform information campaigns. In practice, practitioners can use the findings and the model to better understand the motivations of their clients, not only better understanding how best to tailor their services for the desired outcomes, but also how best to persuade greater uptake of EER action depending on the principal EER motivations.

11.5 IMPLICATIONS

Previous research has insufficiently taken into consideration the role of owner-occupier motivation for EER. This is despite it becoming increasingly evident that deep carbon reductions from the existing housing stock will be necessary to contribute to the Government's legally binding carbon reduction targets without

regulating for such home improvements. Therefore, an awareness of owner-occupier motivations for EER is essential for policy-makers, practitioners and academics. However, existing theories of motivation do not wholly explain owner-occupier motivations for EER.

The present study advances a new way of thinking in relation to EER motivation, particularly in terms of the types of motivations for EER. Based on motivation as a precursor to action, the need to better understand EER motivation is necessary to increase EER action uptake amongst the owner-occupied housing stock. This has implications for policy, practice and research in the area of EER in relation to how EER motivation is fostered and encouraged, but also to initiate a new approach in thinking about how owner-occupiers could be categorised beyond their neighbourhood deprivation or socio-demographic profile.

The findings can be used by policy-makers to shape local and national policy, and initiatives to better engage the owner-occupier population. Application of the findings will be most effective where the local context such as the constraints and opportunities are taken into consideration. The wider uptake of EER amongst owner-occupiers should be facilitated through policies and initiatives, which are informed by the findings rather than conforming to the traditional assumption of the rational, economically motivated individual.

The findings can be utilized by practitioners from a wide range of backgrounds including advisors, surveyors and contractors to better assess the needs and motivations of owner-occupiers. By doing so, not only will this potentially enable professional services to be better tailored to owner-occupiers, but more importantly also facilitate the better engagement with clients who may have otherwise terminated contact with a company after their initial enquiry.

11.6 FURTHER RESEARCH

In addition to recommendations for policy and professional practice Objective seven (Section 1.5) required that recommendations for future research be provided. Based on the present study, recommendations for further research include:

a. Testing the model elsewhere in the UK, internationally, and on different segment groups (e.g. early adopters of EER or Green Open Door participants). This could include a comparison between cities, countries or groups.

b. Investigate the interaction between internal and external factors, and identification of which internal and external factors are the most important and attempt to identify whether a set of factors will be more likely to result in increased EER action.

c. A study into whether different message constructs based on the refined EER motivation model results in increased uptake.

d. To investigate whether it is possible to categorise owner-occupiers in relation to EER motivation in such a way that cuts across socio-demographic groups.

11.7 REFLECTIONS ON A JOURNEY

The preceding thesis is a culmination of four and a half years of part-time study. During this time, not only have I experienced a significant shift in my understanding of the topic but, perhaps more importantly, in my research and general skills. Having previously been involved in research at the University, I had some experience of focus groups and interviews, as well as literature reviews. However, my understanding of research design and methods, as well as the underlying framework and the challenges have evolved over the course of my postgraduate studies. The following pages outline my reflections on my PhD journey.

11.7.1 The journey – some general reflections

From the academic and personal development perspectives, my PhD journey has resulted in the development of a wide range of skills. These have included organisation, project management, research design, research methods, analysis and interpretation as well as communication, both written and oral.

During the four and a half years, I have had three different Director of Studies, and two Second Supervisors, all with different worldviews, skills and understanding of the overall research. Each have had their own method of working and interacting, and I have benefitted from experiencing their different approaches. The constancy of my main supervisory team, particularly my Second Supervisor, even following their departure from the University during the writing up phase meant that much of the uncertainty which could have been caused during the later phases of the PhD were minimised.

There were a number of valuable lessons during the journey. At the start of the thesis, based on my reading of the literature, I made the decision to pursue motivation as my main focus. Being more led by my original Director of Studies I was persuaded to change this focus to behaviour despite the wide range of existing and on-going research already on this topic. When I changed the topic back to motivation after my Director of Studies was replaced, I learned my first valuable lesson – to listen to advice from these experts, but to be confident in my own knowledge, interpretations and choices.

The second lesson was in relation to how to receive constructive criticism and criticism in general. During the viva for the first milestone, rather than learning from the key components necessary to advance the research, I took all criticism to heart, failing to distinguish between general criticism and constructive criticism.

In retrospect, rather than the milestones, the viva or the use of a different research approach, the most challenging parts of the process were: identifying and engaging participants; transcriptions; getting to grips with software; coping with hardware failures; and trying to find a work-study-life balance:

1. *Identifying and engaging participants* – as a hidden population, in research owner-occupiers are notoriously difficult to identify. I started with flyer drops, which generated no interest. I spoke with 'Ward Coordinators' who helped me to spread the word of my research through communities. Initial engagement was slow, and resulted in my initial timetable for the research to fall behind. In the end, I found the best way to engage with prospective participants was to take a multiple approach as outlined in Figure 5.1. There was also difficulty in some gatekeepers not being able or willing to help. Some explained this was due to the Data Protection Act 1998. I had a good response to my blog, but also through community newsletters. Recruitment of participants took additional time, which I needed to factor into my timetable, but also resulted in a lack of data being present in my initial milestone reports.

2. *Transcriptions* – I had been advised not to complete full transcriptions by seasoned academics. However, thinking that not only would I be judged negatively for not doing so, but also that my typing skills were up to the challenge I proceeded with full transcripts. It transpired that transcribing twenty-five 1 – 2 hour interviews was no mean feat, with a host of varying dialects and, where there was more than one participant in the interview, talking over one another. A great number of hours were spent on transcriptions, and the laborious nature of doing so meant that it was hard to maintain motivation, with some irony considering the topic of the thesis.

3. *Software and hardware* – in some instances in my thesis, software eased the research process. In others, it resulted in a distraction. It can, in the

hands of a novice, prove 'clunky'. The main issue I had with software was its lack of compatibility with Macintosh in 2013. With reports of compatible versions of SPSS and NVivo being imminently launched, only to be pushed back this resulted in initial delays in data analysis followed by me in needing to borrow a Windows laptop from a friend. Software wasn't the only difficulty – in October and November 2014 whilst writing the final components of the thesis I discovered that my Mac had not in fact been saving my work for weeks due to a full hard drive. Desperation and desolation are perhaps the closest descriptions to this. The lesson was to double check saved files and back them up more regularly. In December 2014, in trying to produce a complete thesis document my Mac burnt out. This time I had copies saved on mobile external hard drives.

4. *Finding a work-study-life balance* – perhaps the most challenging of all, I struggled to find a balance between work, study and life. With demands at home, and the need to earn enough to support family, tensions formed between these aspects. During this time, I have had job changes as well as personal life changes. The interesting thing about the PhD period is that I have learnt that there isn't always a balance to be struck – like any project, it is more to do with meeting various needs and sometimes compromising by giving up a few weekends and evenings, and foregoing an event. Sometimes it is about knowing when to put down work or study.

11.7.2 Doing things differently

The challenge of looking retrospectively is knowing whether you would or could have done anything differently during the research. It would be easy for me to say I would not have done anything differently, having taken valuable lessons from the process. However, there are three aspects I would have altered:

1. Flyers

   The flyers were used in the early stages to help recruit participants. These were posted through letterboxes in different neighbourhoods. This was time consuming and did not generate *any* interest. Perhaps this is due to the amount of 'junk mail' received by homeowners, or perhaps due to the lack of an advertised incentive. For future research, I am consequently more likely to explore alternative recruitment methods rather than using flyers.

2. Vouchers

   Although a number of owner-occupiers had signed up to participate in the study prior to a voucher (honorarium) being advertised, the response rate improved following the announcement of a voucher. Although providing an interesting comparison between those participants who engaged before and after the offer of a voucher (intrinsic and extrinsic motivation), I would now prefer to advertise a voucher at the start of the recruitment.

3. Transcripts

   The full transcripts were useful in getting to know the data. However, they were exceedingly time-consuming and some parts of the interview were not relevant to the study. Despite this, transcriptions enabled me to become immersed in the data, although had I only transcribed the points pertinent to the study I could have saved both time and energy. During later studies unrelated to the PhD, it was just as effective to transcribe data pertinent to the topic. I would seek to build in transcription services into any future funding bids.

11.7.3 Limitations of the work

There are a number of limitations presented by this research. These include the location of the case study; the decision not to employ a coding frame for data analysis; not explicitly investigating whether any of the case houses were mortgaged;

and the likelihood that the model will be of more interest for policymakers rather than industry or homeowners. I will proceed to summarise these:

1. Location

The biggest is perhaps the location. As discussed in section 5.3.1, although Bristol is a 'core city' in England, it is well-known for its 'green credentials' as recognised by being the first UK city to be awarded European Green Capital (2015). This means that, without further testing of the model in other cities and towns, I have made no claims about it being statistically generalizable. The model is analytically generalizable, but although the city has a diverse population, with Bristol's overall environmental standpoint, the case study cannot be considered 'typical'.

2. No coding framework

The qualitative data was coded in NVivo guided by the key research questions. Beyond this, no coding framework was specifically used. The decision not to use a predetermined coding frame was to avoid what some authors have described as producing data based on the 'tail wagging the dog' (Barbour, 2001). Rather than 'word crunching' using computer software, which can 'miss' or oversimplify important aspect, I sought to identify the meanings of the participants through manually analysing the data.

3. Mortgages

Participants were not directly asked if they had a mortgage attached to their home. In a number of the cases including Cases 007, 008 and 014 this information naturally evolved during the interview. However, whether the presence of a mortgage had a direct influence on the type of EER motivation or on the level of EER undertaken was not investigated.

4. Policymakers, industry and homeowners

Although the model developed during the study could be of use by policymakers and industry professionals, it is more likely to be of greatest interest and use to policymakers. It is likely to be of limited use by homeowners themselves.

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APPENDICIES

APPENDIX A – Copy of questionnaire, interview topics and questions

Owner-occupier motivations for energy efficiency improvements

Questionnaire

Age

- □ 18 – 25 years
- □ 26 – 35 years
- □ 36 – 45 years
- □ 46 – 55 years
- □ 56 – 60 years
- □ 61 – 70 years
- □ Over 70 years

Gender

- □ Male
- □ Female
- □ Prefer not to say

Ethnicity (*please specify*)

Country of birth (*please specify*)

Country of residence for past 10 years (*please specify*)

Education

- □ GCSEs
- □ A-levels
- □ HND
- □ Undergraduate degree
- □ Masters
- □ Postgraduate
- □ Other (please specify) _____

Income

- □ Less than £12,000

□ £13,000 – £19,000
□ £20,000 - £29,000
□ £30,000 - £39,000
□ £40,000 – £49,000
□ over £49,000

Household

Family Structure

□ Single
□ Live with partner
□ Live with partner and children/dependents
□ Live with children/dependents
□ Other (*please specify*) _____

Children

□ None
□ 1
□ 2
□ 3
□ 4
□ More than 4

Children ages *(select multiple where appropriate)*

□ Less than 1 year
□ 1 – 2 years
□ 3 – 5 years
□ 6 – 10 years
□ 11 – 15 years
□ 16 – 18 years
□ Over 18 years

Length of residence

□ Less than a year
□ 1 – 3 years
□ 4 – 8 years
□ 9 – 15 years
□ 16 – 20 years
□ Over 20 years

Profession (*please specify*)

Profession of partner (where applicable) (*please specify*)

Are you involved or do you participate in any local groups or networks (such as local community groups, eco or environmental groups, Green Doors events, and so on)? (*please specify*)

Do you perform any other environmental activities (recycling, growing own food, cycling to work, other)?

- □ Recycling
- □ Grow own food
- □ Cycle to work
- □ Shop locally
- □ Shop fairtrade
- □ Buy organic
- □ Other (*please specify*) _____

Do you perform any of the following energy saving behaviour?

- □ Turn down the thermostat
- □ Adjust the thermostatic radiator valves
- □ Boil only as much water as I need
- □ Switching off appliances when not in use
- □ Switching off appliances at the wall/socket
- □ Washing clothes at 30°C
- □ Other (*please specify*) _____

	INTERVIEW TOPIC	EER	NON-EER	PROMPTS	RESEARCH QUESTIONS MET
1	Attitudes, values and beliefs	Do you consider yourself 'motivated' to undertake EER? Why?	Do you consider yourself 'motivated' to undertake EER? Why?	- An EER is a substantial renovation deliberately incorporating works to improve the energy efficiency performance of the building.	
		What does the term 'home' mean to you?	What does the term 'home' mean to you?	- What makes a 'house' a 'home'?	
		What should a 'home' deliver for its occupants?	What should a 'home' deliver for its occupants?	- What functions are important for a 'home' to fulfill?	
		What does the environment mean to you and your family? Does it feature in your day-to-day life?	What does the environment mean to you and your family? Does it feature in your day-to-day life?	- In terms of the local and wider environment. This could include the weather, green space, pollution, etc. -Cycling to work, growing your own, walking rather then driving, recycling, etc	
		How do you think this feed in to the image you and your family present to society? Is it acceptable?	How do you think this feed in to the image you and your family present to society? Is it acceptable?	- Do you wish to portray yourself as 'green' or 'environmentally responsible'? -How long have you been doing these behaviours (first of acquaintences or were you inspired by others?)	
		Do you feel you can make an impact for yourself, your family, your community and wider society?	Do you feel you can make an impact for yourself, your family, your community and wider society?	- In terms of the environment, do you feel you can act to improve and/or protect the local and wider environment?	
2	Motivation for installing energy efficiency measures	Could you tell me a little about the refurbishment and the process you went through?	Have any energy saving measures such as draughtproofing, top up insulation and energy saving light bulbs been installed in your property? Why?	-What was installed, did this change from the original choices made (why), were there any difficulties; when was it undertaken (how long resident) - Why have energy saving measures installed? Grants/subsidies/comfort/encouragement from friends and family/other?	Research Questions 2 and 4
		What motivated you to undertake an EER rather than not undertaking a refurbishment or meeting the minimum standards?	Would you perform an EER or energy efficiency works to your property if you had the option? Why/Why not?		
		What were your main reasons for undertaking an EER?			
		Was this affected by your idea of 'home' and 'environment'?	Was this affected by your idea of 'home' and 'environment'?		
		What were the key factors which affected your motivation to act?	Have you considered undertaking energy efficiency improvement works previously? Why? Was this just a consideration or did you take it further?		
		How long did you consider undertaking such a project?	Would funding/low-interest loans such as the Green Deal provide you with greater incentive to install energy efficiency measures? Why/Why not?		
		What were the main aims of the refurbishment?	Are there any other incentives other than money which might motivate you to undertake works?	- Updating existing house; improving energy efficiency (why?); reducing environmental impact (why?); improved comfort (why?); to make it a 'home'; others	
3	The factors which affected their original motivation	Before undertaking the refurbishment, in terms of your motivation, were there any factors which affected your motivation? Order of strength/priority?	Are there factors which have affected your motivation not to undertake an energy efficiency refurbishment?	- External factors such as subsidies and grants, conservation or planning restrictions, financing, value added; internal factors such as image, social image, expectations of outcomes	Research Questions 3 and 4
		Would you say any of the following list <***show list***> had any affect? Order of strength/priority?	Would you say any of the following list <***show list***> had any affect? Order of strength/priority?		
4	The factors affecting their decisions	What were the factors affecting the decisions which were actually taken?	What were the factors affecting your decision not to install energy efficiency measures?	- Available financial support including subsidies and grants; family structure/members in the household; ideal lifestyle; costs and savings; housing market; property characteristics, etc.	Research Questions 1, 3 and 4
		Why did you choose the measures you did?	If you were to install some measures, what would you choose? Why? What wouldn't you choose? Why?		
		Did these differ from those you were originally considering and why?			

APPENDIX B – Information sheet, consent form and flyer

INFORMATION SHEET

My name is **Samantha Organ** and the purpose of this information sheet form is to outline the study procedures, inform you of your rights as a participant and the data being collected on you in this study.

If you wish to confirm that I am a research student at **The University of the West of England** in the Faculty of Environment and Technology, please contact my supervisor on 0117 32 83562 or at David.Proverbs@uwe.ac.uk.

Please carefully read the following.

Purpose of the Study:
The purpose of the study is to investigate the motivations of owner-occupiers for performing (or not performing) energy efficiency refurbishments; that is, why people improve the energy efficiency of their home.

Procedures:
Once you have read the information about the study and where you choose to accept this consent form, you will be asked to complete a short questionnaire whilst I perform a basic visual survey of your property. The visual survey may include photographs, unless otherwise requested. Where possible I will need access to the attic, each room, and any external grounds. This should take around 20 minutes. This is a research survey and it is not possible to provide professional advice based on this.

Following the survey, a semi-structured interview will be performed with yourself in your home. Unless otherwise indicated, the interview will be recorded (audio). It is suggested that you leave between 1 hour and 1.5 hours for this interview.

Where possible, copies of documents about any works you might have undertaken would be useful. This could include schedule of works, professional surveys or energy assessments, drawings, product information, building control approval, and warranties. The purpose of these documents would be to confirm or support information given or observations regarding any works performed to your property. Where provided, photographs will be taken of the documents. These will be anonymised.

Voluntary Participation:
Participation in this study is purely voluntary. You can decline to answer any questions, and you are free to terminate the investigation at any time. There is no penalty if you decide not to answer particular questions or end your participation.

Should you wish to leave the study, any data collected on you and your property will be removed and destroyed.

Right to Ask Questions:

You are welcome to ask questions or concerns about this research by contacting Samantha Organ at Samantha2.Organ@uwe.ac.uk or on 07969 638 590.

Use of Data:

The data produced as a result of the investigation will be used for a PhD study on owner-occupier motivations for energy efficiency refurbishment. It is also likely that it will be contribute to other academic publications.

Confidentiality and Anonymity:

Your participation and data is confidential. Unless otherwise requested by you, you will be assigned an identification code, your real identification retained in a lockable safe only for the duration of the study and not retained electronically. Audio recordings will be placed on a USB stick and this will also be stored in the safe for the duration of the study. This information will be destroyed after the completion of the study. No information will be passed on to anyone connected with you.

You must be 18 years or above and own your home to be eligible to participate in this study.

CONSENT FORM

My name is **Samantha Organ** and the purpose of this consent form is to outline the study procedures, inform you of your rights as a participant and the data being collected on you in this study.

If you wish to confirm that I am a research student at **The University of the West of England** in the Faculty of Environment and Technology, please contact my supervisor on 0117 32 83562 or at David.Proverbs@uwe.ac.uk.

Please indicate whether you give consent for any of the following:

1. I am happy for the interview to be recorded (audio)

   Yes

   No

2. I am happy for photographs to be taken of my property which may be of benefit to the study

   Yes

   No

3. I am happy for documentary evidence to be used (anonymised), where of benefit, for the study.

   Yes

   No

4. The written transcripts and other data may be kept in an archive for future use (anonymised).

   Yes

   No

5. The anonymised records may be used to show other researchers and/or to students in classrooms

   Yes

   No

6. I would like to opt out of anonymity and my true identity used.

No

You will be provided with a copy of this consent form for your records.

Signed [participant]

Printed name [participant]

Date

Signature of researcher _____

Flyer

Can you help with my PhD on…

YOU, YOUR HOME AND ENERGY

Help by talking and receive vouchers

Calling all homeowners. Can **you** help? I'm a PhD student looking for homeowners in Henleaze, Bedminster and Whitchurch Park to give me **only around an hour** of their time to talk to me. You could make a BIG difference to my study. Participants will receive **£10 in Marks and Spencer's vouchers** to be posted to you as a thank you for taking part.

The study looks at motivations to perform energy efficiency home improvements such as adding insulation and low energy lighting through to larger refurbishment projects incorporating multiple energy efficiency measures. But you don't need to have installed any measures – I'd still like to hear from you even if you haven't installed any energy efficiency measures! The study relies on the kindness and cooperation of homeowners in volunteering a little time to talk to me. Participation is confidential and the data generated will be anonymous.

To find out more or to volunteer, you can email me at samanthaorgan@hotmail.com or visit http://seorgan.wordpress.com/ (or Google 'seorgan wordpress')

Alternatively, call or text me on 07969 638 590.

I will also be in the areas on the following dates, so feel free to text or call me with your address for me to pop over:

Henleaze: Monday 19th August 2013, 4 – 7pm

Bedminster: Tuesday 27th August, 4 - 7pm

Whitchurch Park: Monday 2nd September, 4 – 6pm

Vouchers will not be carried on these dates or during the interviews. Vouchers will be posted to you.

UWE BRISTOL University of the West of England

Coldharbour Lane, Bristol, BS16 1QY

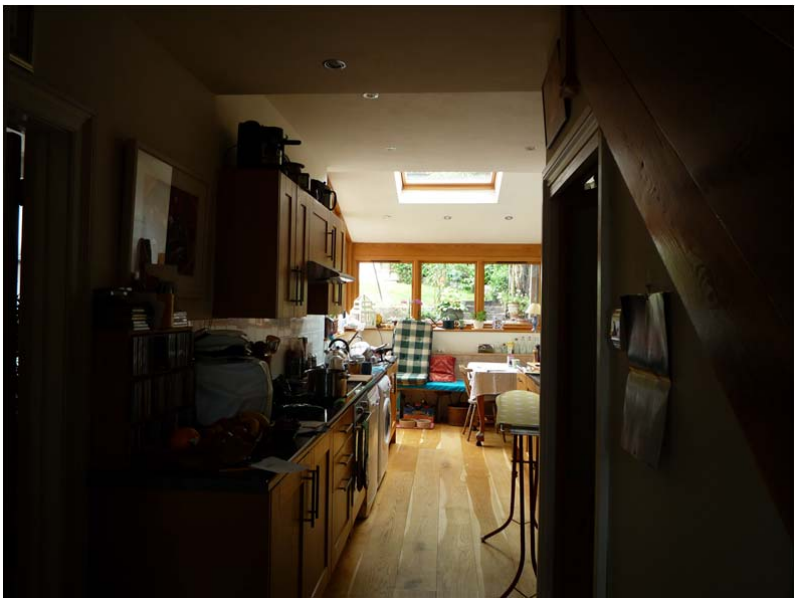
APPENDIX C – Physical survey framework

BASIC PHYSICAL SURVEY	
Date (DD/MM/YYYY)	
Weather	
Address	
Location (Urban, Suburban, Rural)	
Orientation	
Property age (approx.)	
Construction type	
Building type (e.g. detached)	
Neighbouring buildings	
Rooms	
Doors	
Glazing	
Wall insulation (type, material, thickness)	
Roof insulation (type, material, thickness)	
Floor insulation (type, material, thickness)	
Draught proofing	
Energy efficient light bulbs (and %)	
Energy efficient appliances	
Boiler/Heating system	
Secondary heating source	
Heating distribution	
Heating controls	
Materials (eco/conventional)	
Low carbon technology	
Water (recycling/technology)	
Airtightness	
Ventilation	
Finishes	
Curtilage	
Other (notes)	

APPENDIX D – Photographs and documentary evidence

Case001

Case001 front elevation



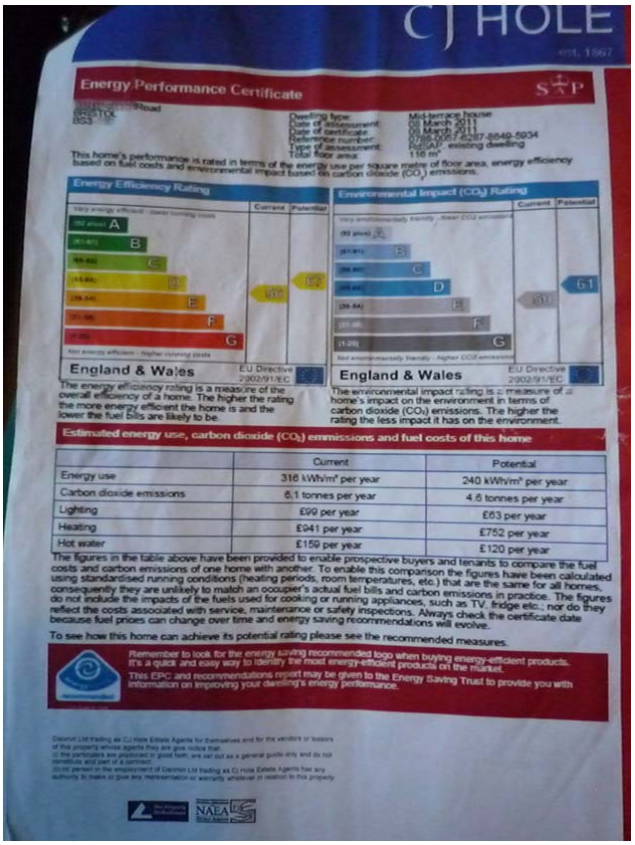
Case001 single storey extension (modern) – opportunity to improve property energy efficiency (extension includes K-glass double glazing)

Case002

Case002 front elevation

Case002 double glazing

Case002 woodburning stove (kitchen-dining area)



CJ HOLE

est. 1867

Energy Performance Certificate

S P

Dwelling type: Mid-terrace house
Date of assessment: 08 March 2011
Date of certificate: 08 March 2011
Reference number: 0788-0067-6287-8649-5934
Type of assessment: RdSAP, existing dwelling
Total floor area: 116 m²

This home's performance is rated in terms of the energy use per square metre of floor area, energy efficiency based on fuel costs and environmental impact based on carbon dioxide (CO_2) emissions.

Energy Efficiency Rating

	Current	Potential
(92 plus) A		
(81-91) B		
(69-80) C		
(55-68) D		
(39-54) E		
(21-38) F		
(1-20) G		
Not energy efficient - higher running costs		
England & Wales	EU Directive 2002/91/EC	

The energy efficiency rating is a measure of the overall efficiency of a home. The higher the rating the more energy efficient the home is and the lower the fuel bills are likely to be.

Environmental Impact (CO_2) Rating

	Current	Potential
(92 plus) A		
(81-91) B		
(69-80) C		
(55-68) D		
(39-54) E		
(21-38) F		
(1-20) G		
Not environmentally friendly - higher CO2 emissions		
England & Wales	EU Directive 2002/91/EC	

The environmental impact rating is a measure of a home's impact on the environment in terms of carbon dioxide (CO_2) emissions. The higher the rating the less impact it has on the environment.

Estimated energy use, carbon dioxide (CO_2) emmissions and fuel costs of this home

	Current	Potential
Energy use	316 kWh/m² per year	240 kWh/m² per year
Carbon dioxide emissions	6.1 tonnes per year	4.6 tonnes per year
Lighting	£99 per year	£63 per year
Heating	£941 per year	£752 per year
Hot water	£159 per year	£120 per year

The figures in the table above have been provided to enable prospective buyers and tenants to compare the fuel costs and carbon emissions of one home with another. To enable this comparison the figures have been calculated using standardised running conditions (heating periods, room temperatures, etc.) that are the same for all homes, consequently they are unlikely to match an occupier's actual fuel bills and carbon emissions in practice. The figures do not include the impacts of the fuels used for cooking or running appliances, such as TV, fridge etc.; nor do they reflect the costs associated with service, maintenance or safety inspections. Always check the certificate date because fuel prices can change over time and energy saving recommendations will evolve.

To see how this home can achieve its potential rating please see the recommended measures.

Remember to look for the energy saving recommended logo when buying energy-efficient products. It's a quick and easy way to identify the most energy-efficient products on the market.

This EPC and recommendations report may be given to the Energy Saving Trust to provide you with information on improving your dwelling's energy performance.

NAEA

Case002 Energy Performance Certificate

Case003

Case003 front elevation

Case003 garden and rear single storey extension. Garden includes ‘growing their own’

Case003 loft and insulation

Case003 basement room including a World War 2 bomb shelter

Case004

Case004 front elevation

Case004 photovoltaic panels to the rear of the property

Case004 original leaded stained glass window (single glazed) – potential compromise between energy efficiency and period features

Case004 lack of loft insulation

Case005

Case005 front elevation with photovoltaic panels

Case0005 photovoltaic inverter

Case005 loft space with rafter- (old) and joist- (new) level insulation

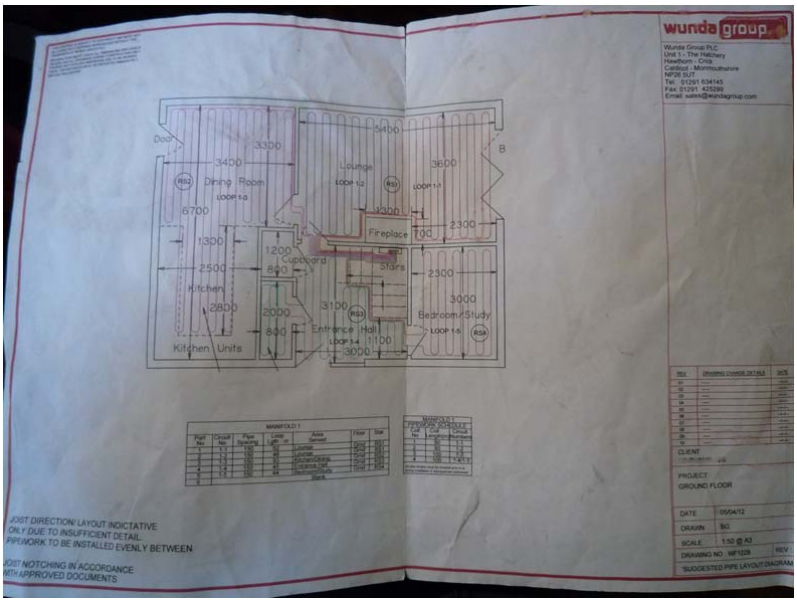
Case005 rear elevation with photovoltaic panels

Case006

Case006 external view of property

Case006 participant photo of work progression – process of insulating the floors

Case006 participant photo of work progression – process of insulating the floors



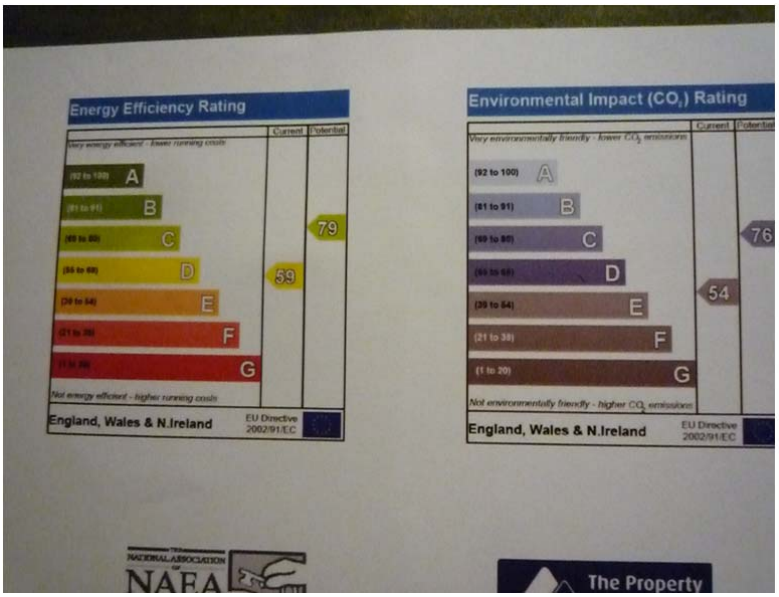
Case006 plan for underfloor heating layout

Case006 participant photo of work progression – process laying underfloor heating

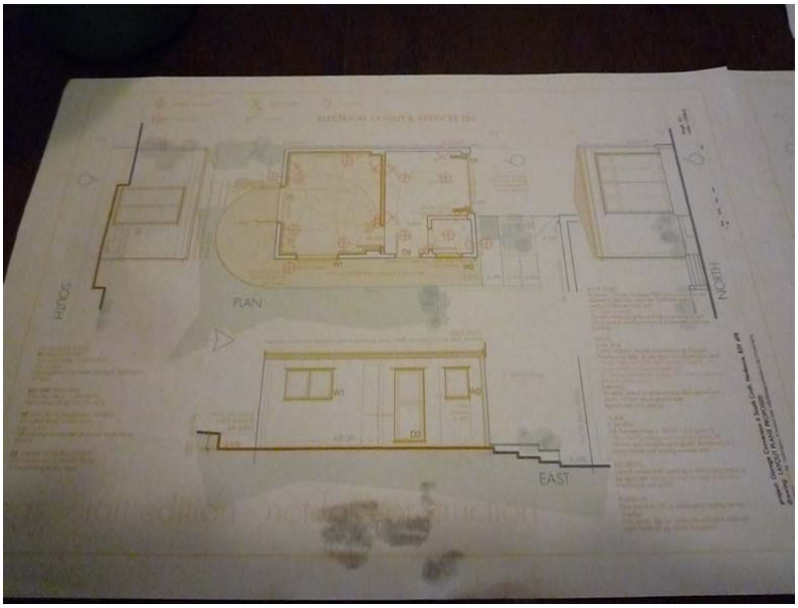
Case006 participant photo of work progression – process of insulating the ceiling/upper floor

Case007

Case007 front elevation



Case007 Energy Performance Certificate



Case007 plan for low-energy extension/garage conversion

Case007 garage conversion floor insulation

Case007 garage conversion wall insulation

Case007 installation of the green roof

Case007 fully installed green roof

Case008

Case008 front elevation

Case008 lounge showing open fire, single glazed sash windows and internal finishes

Case008 regular condensing boiler

Case008 double panel radiator

Case008 ongoing, gradual works demonstrated by partially plastered landing

Case009

Case009 front of property facing park

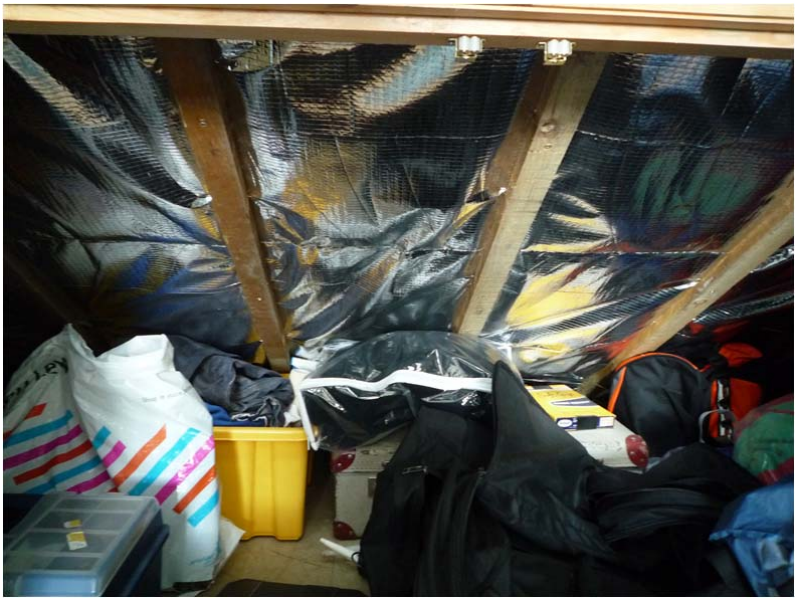
Case009 loft insulation at rafter-level

Case009 combination boiler

Case009 photovoltaic inverter

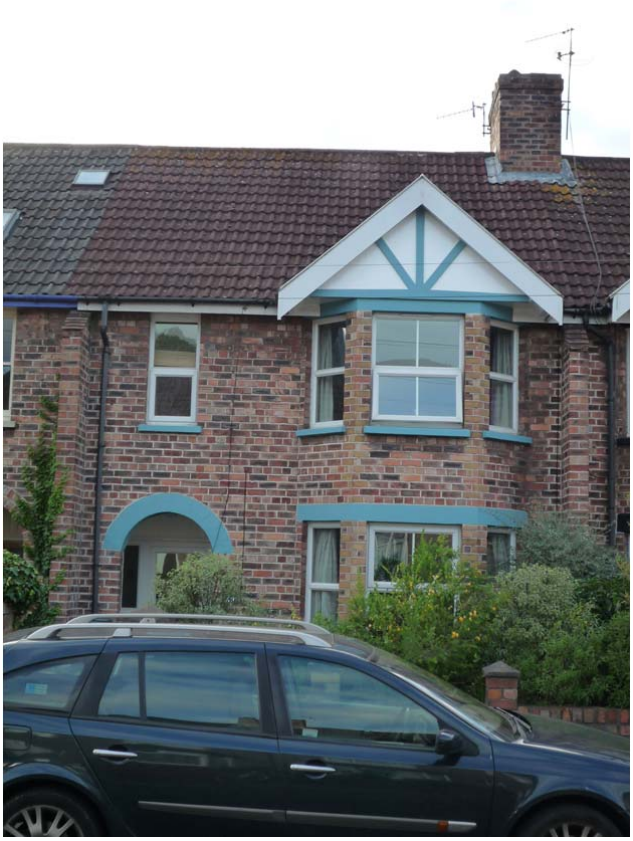
Case010

Case010 front elevation



Case010 loft space

Case011

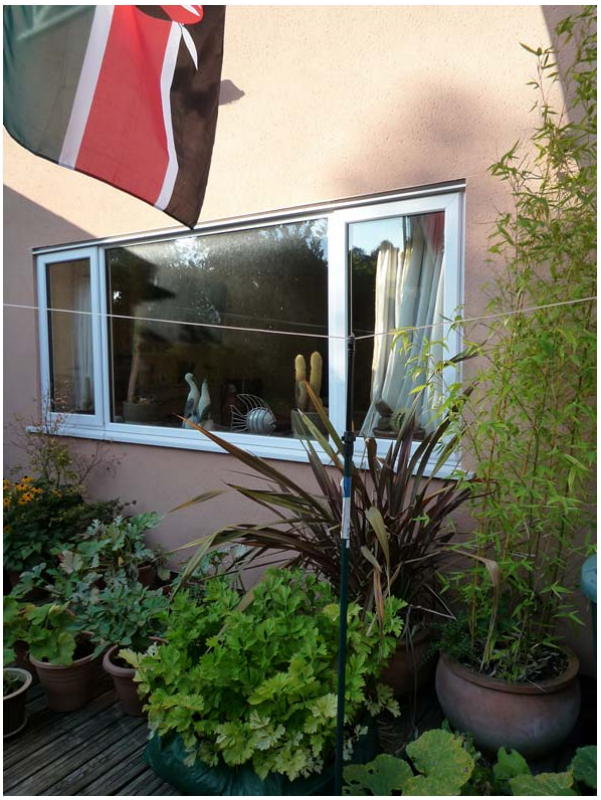


Case011 front elevation

Case011 loft insulation

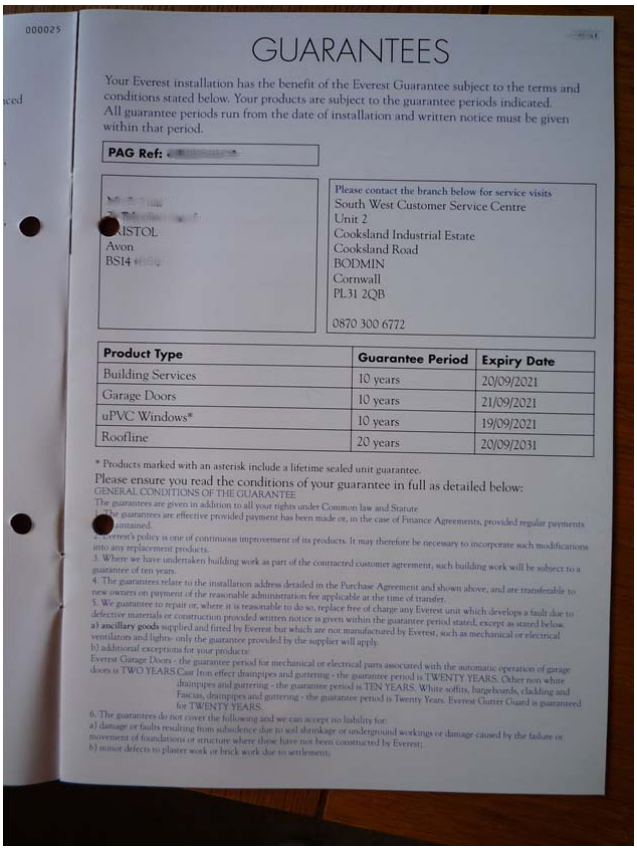
Case012

Case012 front elevation including single glazing



Case012 rear of property with double glazing and new render

Case012 double glazing



000025

GUARANTEES

Your Everest installation has the benefit of the Everest Guarantee subject to the terms and conditions stated below. Your products are subject to the guarantee periods indicated. All guarantee periods run from the date of installation and written notice must be given within that period.

PAG Ref: [redacted]

[redacted]
BRISTOL
Avon
BS14 [redacted]

Please contact the branch below for service visits
South West Customer Service Centre
Unit 2
Cooksland Industrial Estate
Cooksland Road
BODMIN
Cornwall
PL31 2QB

0870 300 6772

Product Type	Guarantee Period	Expiry Date
Building Services	10 years	20/09/2021
Garage Doors	10 years	21/09/2021
uPVC Windows*	10 years	19/09/2021
Roofline	20 years	20/09/2031

* Products marked with an asterisk include a lifetime sealed unit guarantee.

Please ensure you read the conditions of your guarantee in full as detailed below:

GENERAL CONDITIONS OF THE GUARANTEE

The guarantees are given in addition to all your rights under Common law and Statute

1. The guarantees are effective provided payment has been made or, in the case of Finance Agreements, provided regular payments are maintained.

2. Everest's policy is one of continuous improvement of its products. It may therefore be necessary to incorporate such modifications into any replacement products.

3. Where we have undertaken building work as part of the contracted customer agreement, such building work will be subject to a guarantee of ten years.

4. The guarantees relate to the installation address detailed in the Purchase Agreement and shown above, and are transferable to new owners on payment of the reasonable administration fee applicable at the time of transfer.

5. We guarantee to repair or, where it is reasonable to do so, replace free of charge any Everest unit which develops a fault due to defective materials or construction provided written notice is given within the guarantee period stated, except as stated below.

a) **ancillary goods** supplied and fitted by Everest but which are not manufactured by Everest, such as mechanical or electrical ventilators and lights- only the guarantee provided by the supplier will apply.

b) additional exceptions for your products:

Everest Garage Doors - the guarantee period for mechanical or electrical parts associated with the automatic operation of garage doors is TWO YEARS.Cast Iron effect drainpipes and guttering - the guarantee period is TWENTY YEARS. Other non white drainpipes and guttering - the guarantee period is TEN YEARS. White soffits, bargeboards, cladding and Fascias, drainpipes and guttering - the guarantee period is Twenty Years. Everest Gutter Guard is guaranteed for TWENTY YEARS.

6. The guarantees do not cover the following and we can accept no liability for:

a) damage or faults resulting from subsidence due to soil shrinkage or underground workings or damage caused by the failure or movement of foundations or structure where these have not been constructed by Everest;

b) minor defects to plaster work or brick work due to settlement;

Case012 participant documentation – double glazing guarantee

Case012 combination boiler

WORCESTER
Bosch Group

Dedicated to heating comfort

Certificate of
Registration

This is to certify that the
GREENSTAR 28I JUNIOR FSN-GB NG COMBI
7369

Installed by
Dynamic Heating Services
77-79, Stokes Croft
Bristol
BS1 3RD

At the following property
[redacted] Road
Bristol
BS14 [redacted]

is covered under the
manufacturers guarantee until
26.06.2017

Signed on behalf of Worcester, Bosch Group

Steve Lister
Director of Sales

Ian Cockett
Director of Service Operations

0231

Case012 participant documentation – certificate of registration for combination boiler

Case012 loft space

CAVITY INSULATION GUARANTEE AGENCY

25 Year Guarantee Certificate

Installed Date: 18/01/2005

Guarantee: [redacted]

BRISTOL
AVON

BS14

Installer: DOMESTIC & GENERAL INS SERVICE
Address: UNIT C
MAGNIS WORKS
ROMAN ROAD
HEREFORD

HR4 9QR
Phone: 01432 270650

The Guarantee

Period of Guarantee - 25 years from date of installation

The Cavity Insulation Guarantee Agency (CIGA) hereby guarantees that any defect in materials or workmanship in connection with the installation by the Installer of the cavity wall insulation in the above property shall be rectified without charge subject to compliance with the terms and conditions set out below.

Your Route to Total Satisfaction

In the event that you have a problem that you believe to be caused by a defect in materials or workmanship relating to the Cavity Wall Insulation installed by the installer referred to above:-

1. Please check (as far as is practical) that there is no obvious cause for the problem, eg blocked gutters, blocked vents, cracked masonry.
2. **If this check does not resolve the problem, contact the Installer who performed the installation who will, where possible, rectify the defect.**
3. If the problem still remains unresolved, contact CIGA in writing at the address given below.
4. Following this contact, CIGA will arrange for the manufacturer or system designer to investigate the matter and where required instigate any necessary remedial work free of charge.

Conditions

1. **All defects must be reported in writing to the installer as soon as practicable and CIGA must be informed if the matter is not resolved satisfactorily within two months of reporting to the installer.**
2. The guarantee is not valid if the installation has been altered or disturbed after the installation was completed.
3. Your statutory rights are not affected by this guarantee.
4. The guarantee remains valid for subsequent owners of the property and/or, where the present occupant is only the lawful tenant of the property, for the benefit of the Landlord and the Superior Landlord of the property and their respective successors as well as the lawful successors of the said tenant.
5. Any claim under the guarantee must be notified to CIGA within twenty-five years of the Installation date.
6. The value of rectification work carried out by CIGA under this guarantee shall in no event exceed £10,000.
7. In the event of a dispute that cannot be settled by negotiation the matter shall be referred at the instigation of either party to an arbitrator appointed in the absence of agreement between the parties by the Chairman for the time being of the British Board of Agrément whose decision shall be final and binding.

CIGA

CIGA House, 3 Vimy Court, Vimy Road, Leighton Buzzard, Beds. LU7 1FG

InstaFibre FILLING THE GAP

In partnership with energy saving trust

IMPORTANT DOCUMENT – KEEP THIS CERTIFICATE WITH THE DEEDS TO THE HOUSE

Case012 participant documentation – retrofitted cavity wall insulation certification

Case013

Case013 front elevation

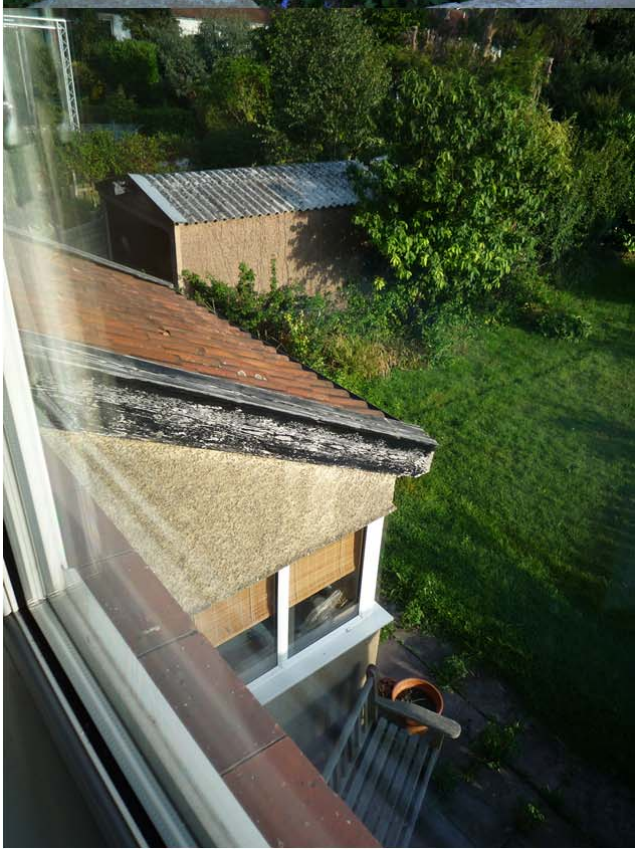
Case013 participant photograph of front elevation during refurbishment

Case013 participant photograph of front window during refurbishment

Case013 participant photograph of cross wall - timber frame with ‘stramit’ exposed during refurbishment

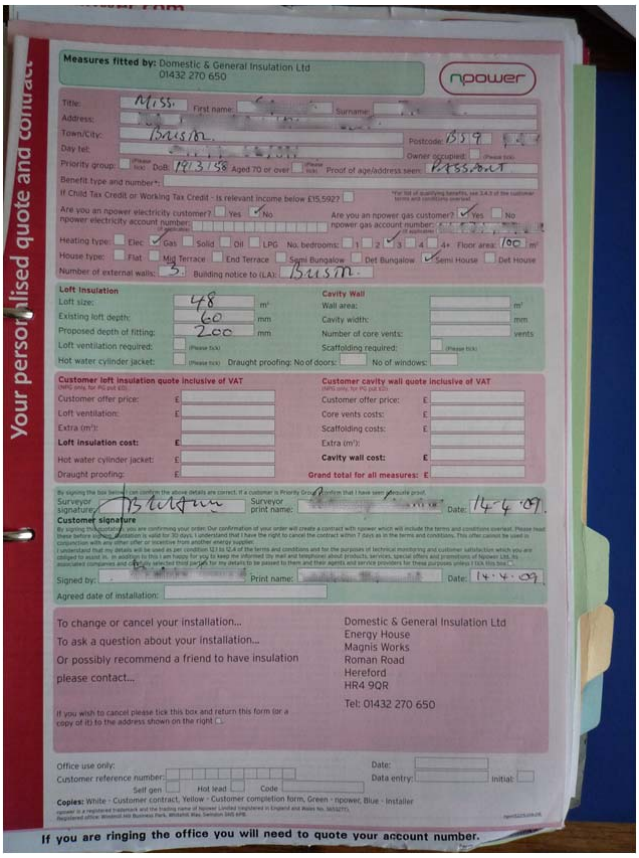
Case014

Case014 front elevation



Case014 single storey lean-to extension

Case014 double glazing - deterioration



Your personalised quote and contract

Measures fitted by: Domestic & General Insulation Ltd
01432 270 650

npower

Title: Miss. First name: [redacted] Surname: [redacted]
Address: [redacted]
Town/City: Brism. Postcode: BS9 [redacted]
Day tel: [redacted] Owner occupied:
Priority group: DoB: 14.3.58 Aged 70 or over Proof of age/address seen: Passport
Benefit type and number*:
If Child Tax Credit or Working Tax Credit - Is relevant income below £15,592?
Are you an npower electricity customer? Yes No
npower electricity account number:
Are you an npower gas customer? Yes No
npower gas account number:
Heating type: Elec Gas Solid Oil LPG No. bedrooms: 1 2 3 4 4+ Floor area: 100 m²
House type: Flat Mid Terrace End Terrace Semi Bungalow Det Bungalow Semi House Det House
Number of external walls: 3 Building notice to (LA): Brism.

Loft Insulation
Loft size: 48 m²
Existing loft depth: 60 mm
Proposed depth of fitting: 200 mm
Loft ventilation required:
Hot water cylinder jacket: Draught proofing: No of doors: No of windows:

Cavity Wall
Wall area: m²
Cavity width: mm
Number of core vents: vents
Scaffolding required:

Customer loft insulation quote inclusive of VAT
Customer offer price: £
Loft ventilation: £
Extra (m²):
Loft insulation cost: £
Hot water cylinder jacket: £
Draught proofing: £

Customer cavity wall quote inclusive of VAT
Customer offer price: £
Core vents costs: £
Scaffolding costs: £
Extra (m²):
Cavity wall cost: £
Grand total for all measures: £

Surveyor signature: Surveyor print name: Date: 14.4.09
Customer signature
Signed by: Print name: Date: 14.4.09
Agreed date of installation:

To change or cancel your installation...
To ask a question about your installation...
Or possibly recommend a friend to have insulation
please contact...

Domestic & General Insulation Ltd
Energy House
Magnis Works
Roman Road
Hereford
HR4 9QR
Tel: 01432 270 650

If you wish to cancel please tick this box and return this form (or a copy of it) to the address shown on the right

Office use only: Date:
Customer reference number: Data entry: Initial:
Self gen Hot lead Code

Copies: White - Customer contract, Yellow - Customer completion form, Green - npower, Blue - Installer

If you are ringing the office you will need to quote your account number.

Case014 loft insulation documentation

Case015

Case015 front elevation

Case015 rear elevation including single storey extension and photovoltaic panels on the roof

Case015 kitchen-dining area showing finishes, double panel radiator and single glazed timber French door leading to garden

Case016

Case016 front elevation including scaffolding for replacement roofing works

Case016 roofing works

Case016 rear elevation including single storey extension

Case017

Case017 front elevation

Case017 internal finishes (lounge leading to kitchen)

Case017 wood burning stove (lounge)

Case017 condensing regular boiler

Case018

Case018 front elevation

Case018 rear elevation

Case018 ‘do-it-yourself’ magnetic, removable secondary glazing

Case018 magnetic, removable secondary glazing (defective)

Case019

Case019 front elevation including photovoltaic panels

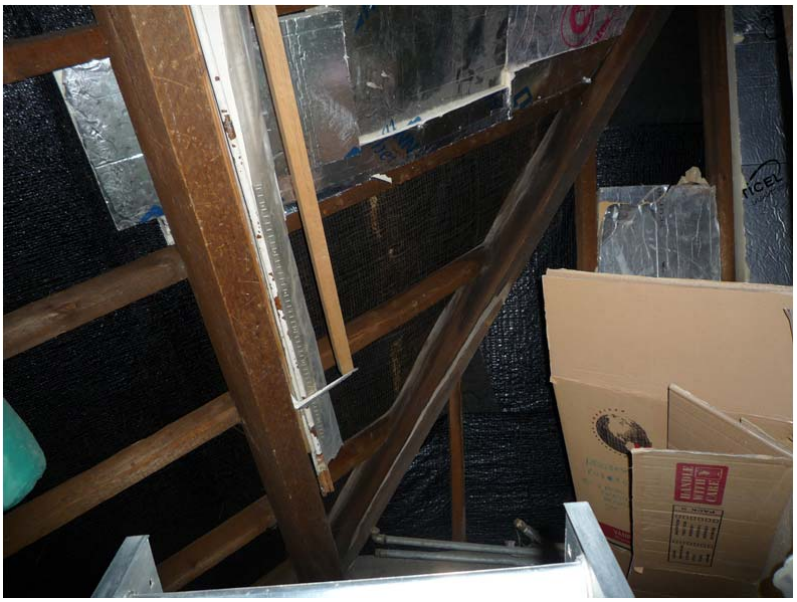
Case020

Case020 front elevation

Case021

Case021 front elevation

Case021 insulated loft hatch



Case021 loft space with partial insulation (rigid) at rafter level

Case021 rainwater recycling system

Case021 rainwater recycling system – pump and power

Case022

Case022 front elevation

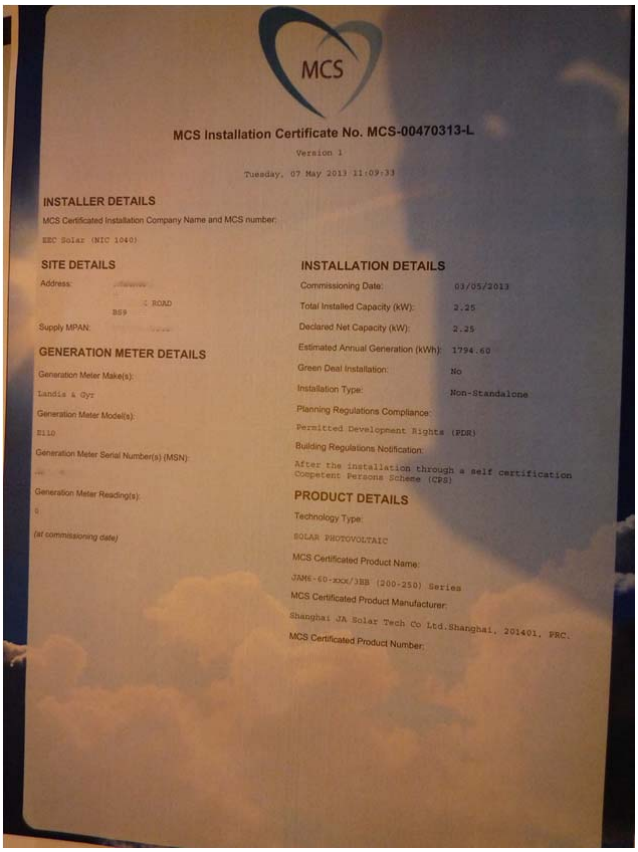
Case022rear elevation including photovoltaic panels

Case022 bathroom requiring redecoration – potential opportunity for energy efficiency considerations

Case023

Case023 front elevation

Case023 rear elevation including photovoltaic panels



MCS

MCS Installation Certificate No. MCS-00470313-L

Version 1

Tuesday, 07 May 2013 11:09:33

INSTALLER DETAILS

MCS Certificated Installation Company Name and MCS number:

EEC Solar (NIC 1040)

SITE DETAILS

Address:

[redacted] ROAD

BS9

Supply MPAN:

GENERATION METER DETAILS

Generation Meter Make(s):

Landis & Gyr

Generation Meter Model(s):

E110

Generation Meter Serial Number(s) (MSN):

Generation Meter Reading(s):

(At commissioning date)

INSTALLATION DETAILS

Commissioning Date:	03/05/2013
Total Installed Capacity (kW):	2.25
Declared Net Capacity (kW):	2.25
Estimated Annual Generation (kWh):	1794.60
Green Deal Installation:	No
Installation Type:	Non-Standalone
Planning Regulations Compliance:	Permitted Development Rights (PDR)
Building Regulations Notification:	After the installation through a self certification Competent Persons Scheme (CPS)

PRODUCT DETAILS

Technology Type:

SOLAR PHOTOVOLTAIC

MCS Certificated Product Name:

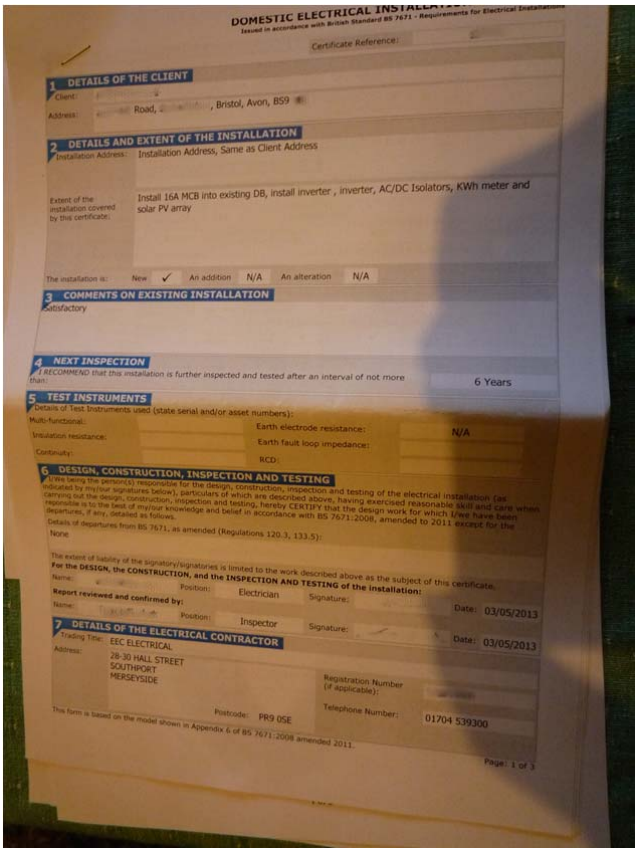
JAM6-60-XXX/3BB (200-250) Series

MCS Certificated Product Manufacturer:

Shanghai JA Solar Tech Co Ltd.Shanghai, 201401, PRC.

MCS Certificated Product Number:

Case023 microgeneration certification scheme (MCS) documentation (for photovoltaic panel installation required for the Feed-in Tariff



DOMESTIC ELECTRICAL INSTALLATION

Certificate Reference:

1 DETAILS OF THE CLIENT

Client:

Address: Road, , Bristol, Avon, BS9

2 DETAILS AND EXTENT OF THE INSTALLATION

Installation Address: Installation Address, Same as Client Address

Extent of the installation covered by this certificate: Install 16A MCB into existing DB, install inverter , inverter, AC/DC Isolators, KWh meter and solar PV array

The installation is: New ✓ An addition N/A An alteration N/A

3 COMMENTS ON EXISTING INSTALLATION

Satisfactory

4 NEXT INSPECTION

I RECOMMEND that this installation is further inspected and tested after an interval of not more than: 6 Years

5 TEST INSTRUMENTS

Details of Test Instruments used (state serial and/or asset numbers):

Multi-functional:

Insulation resistance:

Continuity:

Earth electrode resistance: N/A

Earth fault loop impedance:

RCD:

6 DESIGN, CONSTRUCTION, INSPECTION AND TESTING

I/We being the person(s) responsible for the design, construction, inspection and testing of the electrical installation (as indicated by my/our signatures below), particulars of which are described above, having exercised reasonable skill and care when carrying out the design, construction, inspection and testing, hereby CERTIFY that the design work for which I/we have been responsible is to the best of my/our knowledge and belief in accordance with BS 7671:2008, amended to 2011 except for the departures, if any, detailed as follows.

Details of departures from BS 7671, as amended (Regulations 120.3, 133.5):

None

The extent of liability of the signatory/signatories is limited to the work described above as the subject of this certificate.

For the DESIGN, the CONSTRUCTION, and the INSPECTION AND TESTING of the installation:

Name: Position: Electrician Signature: Date: 03/05/2013

Report reviewed and confirmed by:

Name: Position: Inspector Signature: Date: 03/05/2013

7 DETAILS OF THE ELECTRICAL CONTRACTOR

Trading Title: EEC ELECTRICAL

Address: 28-30 HALL STREET
SOUTHPORT
MERSEYSIDE

Registration Number (if applicable):

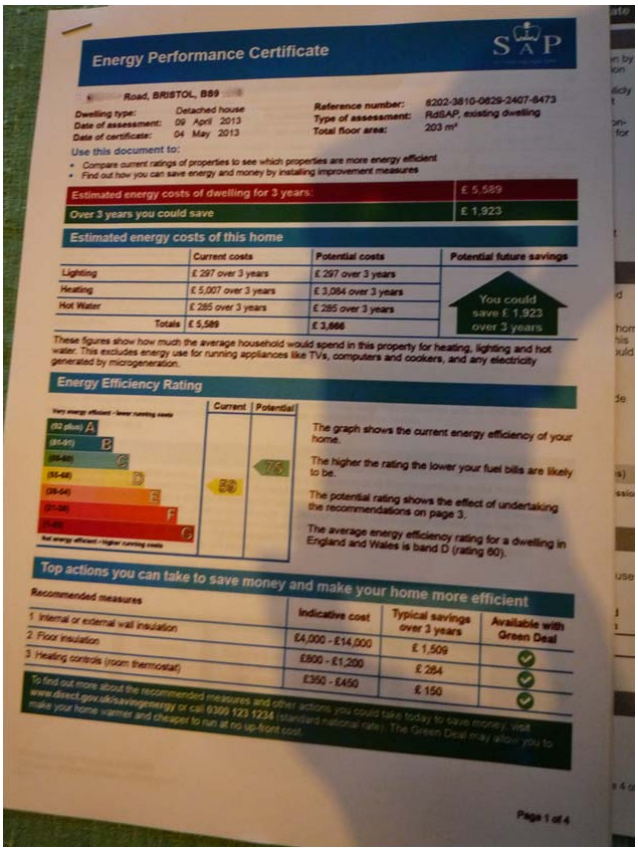
Telephone Number: 01704 539300

Postcode: PR9 0SE

This form is based on the model shown in Appendix 6 of BS 7671:2008 amended 2011.

Page: 1 of 3

Case023 documentation on photovoltaic panel installation



Energy Performance Certificate

SAP

Road, BRISTOL, BS9

Dwelling type: Detached house
Date of assessment: 09 April 2013
Date of certificate: 04 May 2013

Reference number: 8202-3810-0629-2407-8473
Type of assessment: RdSAP, existing dwelling
Total floor area: 203 m²

Use this document to:

- Compare current ratings of properties to see which properties are more energy efficient
- Find out how you can save energy and money by installing improvement measures

Estimated energy costs of dwelling for 3 years:	£ 5,589
Over 3 years you could save	£ 1,923

Estimated energy costs of this home

	Current costs	Potential costs	Potential future savings
Lighting	£ 297 over 3 years	£ 297 over 3 years	You could save £ 1,923 over 3 years
Heating	£ 5,007 over 3 years	£ 3,084 over 3 years	
Hot Water	£ 285 over 3 years	£ 285 over 3 years	
Totals	£ 5,589	£ 3,666	

These figures show how much the average household would spend in this property for heating, lighting and hot water. This excludes energy use for running appliances like TVs, computers and cookers, and any electricity generated by microgeneration.

Energy Efficiency Rating

	Current	Potential
Very energy efficient - lower running costs		
(92 plus) A		
(81-91) B		
(69-80) C		72 C
(55-68) D	58 D	
(39-54) E		
(21-38) F		
(1-20) G		
Not energy efficient - higher running costs		

The graph shows the current energy efficiency of your home.

The higher the rating the lower your fuel bills are likely to be.

The potential rating shows the effect of undertaking the recommendations on page 3.

The average energy efficiency rating for a dwelling in England and Wales is band D (rating 60).

Top actions you can take to save money and make your home more efficient

Recommended measures	Indicative cost	Typical savings over 3 years	Available with Green Deal
1 Internal or external wall insulation	£4,000 - £14,000	£ 1,509	✓
2 Floor insulation	£800 - £1,200	£ 264	✓
3 Heating controls (room thermostat)	£350 - £450	£ 150	✓

To find out more about the recommended measures and other actions you could take today to save money, visit www.direct.gov.uk/savingenergy or call 0300 123 1234 (standard national rate). The Green Deal may allow you to make your home warmer and cheaper to run at no up-front cost.

Page 1 of 4

Case023 Energy Performance Certificate

Case024

Case024 front elevation

Case025

Case025 front elevation

Case025 gas fire (lounge)

Case025 anthrocite stove (dining room)

Case025 loft space (‘do-it-yourself’ conversion without Building Regulations)

Case025 loft space

Case025 documentation – condensing boiler

APPENDIX E – Observation notes

CASE001 OBSERVATIONS

Good atmosphere.
Interviewee at home with a broken hip.
Nice home, comfortable. Tidy.
Interviewee appeared relatively relaxed.
Bicycles under the stairs.
A large colander of blackberries in the sink.
Get Well Soon cards on the mantle.
Lots of family photographs.
Knitting on the sofa.

Mentioned from a family of 7 children and taught not to **waste** anything.
Vegetarian since her teens and her husband has been a vegetarian since his 20s.
13 year old border collie (poor back legs and hearing)
Eldest son completed a Masters in Sustainable Building

She said she would have participated without the incentive.

CASE002 OBSERVATIONS

Difficult to find.
Nice property. Tidy.
Scaffolding outside (front elevation) for minor works.
Rendered to rear of the property. Timber sash windows throughout except for bay windows (PVC double glazed).
High technology – TV and sound system.
Some empty rooms awaiting decoration.
Some photographs (wedding photos) in lounge.

Relaxed participant in simple, casual clothing – a lightweight striped hoodie, jeans, hair tied back.
Relaxed seated position in lounge. Open body language and good eye contact.
Participant quite articulate but could be vague in places.

Said most of her friends rent

CASE003 OBSERVATIONS

Participant seemed fairly relaxed.
Dressed casually.
Open body language but not a relaxed atmosphere. Choses to sit on the other, perpendicular sofa.

Participant needed more probing than some other participants.
Not sure of the sort of responses 'I was looking for' in places.
Did not portray someone with a high eco attitude but not a very low eco attitude.

Father of 4 year old and 1 year old and recent 4th birthday party.
House full of toys and toy storage, most surfaces cluttered but not unclean.
Various artwork on walls.
Bomb shelter in 2nd basement room.
Damp in basement and first floor.

Stated that he forgot about the voucher and seemed pleased about the voucher.

CASE004 OBSERVATIONS

Relaxed, but chose to sit opposite me across a large dining table. Fairly open body language but not wholly relaxed atmosphere.
Clean, very tidy house. Recent decoration throughout. No clutter anywhere!
Just returned from work, dressed in a summery maternity dress (due early Oct 2013).
Owns a rescue cat.

Scottish and emphasized/played on the stereotype of Scots being careful with money, but a clear interest in doing activities for ethical reasons but within an economic limit.
Unsure of how to respond in places and sometimes looking for clarification, sometimes even approval of responses.

Voucher expected.

CASE005 OBSERVATIONS

Difficult to find.
Relaxed participant, casually dressed in shorts and a shirt.
House run down internally (dated and worn decoration and fittings), furnishings old and worn, and strong smell throughout. Overall property in a good condition.
Growing own in back garden, but overgrown (commented about current weather vs. lack of time recently and the need to involve lodgers in gardening rota).

Participant articulate.
Edirol cut out a **lot**.
Clear eco interests expressed but a lack of attachment to 'home' and the environment.
Degree and postgraduate degree in science – the latter focusing on energy technology.

CASE006 OBSERVATIONS

Arrived late (telephoned ahead). Difficult to find. Participants welcoming. Owner (female) dressed smartly, partner dressed very casually.

House towards the end of a large refurbishment.

Owner lives at home with 2 old cats (>15 years old) and her two adult sons.

Participant (owner) had her partner of 5 years in attendance. She wasn't really sure how to answer most of the questions and often looked to him or myself for reassurance.
Clear power (dominance) relationship between the couple. Although partner did most of the work it was unclear who took ownership of the motivation – the partner often commented that he knew how to improve certain elements, project managed and did the research into the products, and had made strong suggestions to the owner. He paid out for certain components so he made the decision about those components.

Owner left towards the end to collect son and the partner (doesn't live with her) became slightly disengaged with interview. Although he was overly willing to talk, he didn't want to fully commit to answers 'because it wasn't his property', and because of this, it made some of the interview questions irrelevant.

CASE007 OBSERVATIONS

Nice home. Fairly new, light coloured finishes (from previous owners).
Lots of builders' tools in kitchen-diner area (currently having the garage converted into an office and workshop space with green roof) and materials in garden.

Relaxed couple, having lunch when I arrived, both dressed casually.

A balanced, supportive relationship (balance of power) between the couple.

High quality finishes in existing house – unlikely scope for internal insulation.

Completive of questions.

CASE008 OBSERVATIONS

Nice, relaxed, comfortable couple with a 7-month old baby. Woman taking the lead.
A cat.

Nice property, a work in progress but clean and tidy – most of the rooms have been refurbished but hall and landing, and bathroom, kitchen and dining room are yet to be refurbished. Mostly in very good condition.

Woman comfortable and easy to chat to. Started in dining room across table until the need to feed the baby, and then moved to the front room.

Looked for sale particulars relating to current property but found the particulars from their previous property (not in Bristol) (cottage).

CASE009 OBSERVATIONS

Tidy house but a little outdated and run down in places.

Not a very relaxed atmosphere, and half the interview the interviewee spent with moderately closed body language, although she started mirroring some of my body language in the latter part of the interview. However, interviewee remained slightly closed for the whole visit. However, managed to elicit some laughter.

Poor eye contact and sat across the table.

Participant wore casual clothing.

CASE010 OBSERVATIONS

A nice house although some damp coming through the wall to the rear room (lounge/dining room) causing the plaster to come away/disintegrate.

Participant was welcoming and casually dressed in shorts and t-shirt.

Participant had open body language and good eye contact.

A tendency to go off on tangents and trail off.

CASE011 OBSERVATIONS

Arrived early and telephoned ahead.

Welcoming and accommodating.

Large, rescue dog.

Clean, contemporary and nice home. Nice and relaxed atmosphere.

Open and relaxed body language with good eye contact.

Nicely presented (re. clothing) but casually and comfortably dressed (slogan t-shirt and cardigan).
CASE012 OBSERVATIONS

Couple were incredibly welcoming and friendly even though I was late (got lost) (I emailed them when I was trying to find them).

Both casually dressed (man in Bristol t-shirt and shorts) and both had open body language.

Although husband dominated the conversation he gave his wife time and space to contribute. No displayed power/dominance.

Clearly very community- and social well-being-active and very pro-active.

Atmosphere felt empowering and inspired.

CASE013 OBSERVATIONS

Couple were welcoming and engaging despite me having arrived late because I got lost en route to case012 and then case012 overran.

Presentable house, clean and comfortable but still undergoing some aesthetic works (e.g. hallway). Felt very aware of the mantle place ornaments, photographs and furniture (not least of all because they made reference to such items).

Husband and wife both supported and contributed to interview although husband dominated in places, but no ‘power domination’ detected. Both had relaxed and open body language and good eye contact.

Throw on sofa and a ‘mish-mash’ of furniture – sentimental value, gained over time or second-hand things?

Sat in lounge which was quite dark, partly because it was getting late (6.30pm start) but partly because it was a large room with only one source of direct daylight (but also glazed doors to other light rooms).

Not as well-built or as substantially refurbished as the previous property (round the corner) (case012).

Clearly numerous issues and challenges requiring immediate attention upon moving in (insulation, electrics, etc.)

CASE014 OBSERVATIONS

Welcoming individual.

Clean and comfortable house, fairly well maintained.

Dressed in ‘casual office’ clothes and relaxed, open body language with good eye contact.

Chose to sit at the table in the dining room (front room) because it was a hot day and this was the coolest room.

Interviewee seemed to want time to contemplate, and go back and add to earlier answers.

Lots which could be done to the house in terms of better double glazing, solid wall insulation, water butt, low carbon technology, etc. but it hasn't been done. Money/capital mentioned as a factor.

Clear tension between retaining the aesthetics of the building, money (capital) and the environment.

CASE015 OBSERVATIONS

Entered into a very dark hallway and went into a bright and airy kitchen-diner where we sat perpendicular across the table.

Lots of art work in different styles on walls throughout the property.

Interviewee had open body language with good eye contact, but crossed hands in lap.

House in good state of repair albeit slightly dated in places.

Interviewee often avoided answering the questions directly (although I'm unsure whether this was intentional), but frequently answered them elsewhere in the interview indirectly.

Plants inside the kitchen and garden incorporated raised beds and bee/butterfly-friendly plants such as achillia.

CASE016 OBSERVATIONS

Sat to table in the kitchen extension – lots of daylight due to lots of glazing. Warm welcome from one of interviewee's daughters, and a nice atmosphere. Interviewee was moderately relaxed but had a weary atmosphere.

Two young dogs (terriers), excited early on during interview.

House in fairly good repair and in the process of having the roof replaced. However, window fit on first floor reported to be poor and an issue during the winter.

Interviewee was careful to choose his answers and without prompting took the interview away from the direction he *thought* the questions were taking him.

Renting rooms to lodgers.

Wife had been a chiropractor and died a year ago. Younger daughter has had M.E. for 6 years (since she was 13 years old).

Apparently took their chimney down to accommodate neighbour's PV panels (overshadowing).

Garden basic, small and a little untidy, but made a comment about preferring the space and 'aesthetics' of their garden to the raised beds next door. No flowers. Mentioned lack of time to maintain garden.

CASE017 OBSERVATIONS

Interviewee kindly saw me earlier than originally arranged. Welcoming but not entirely relaxed at first. She provided gluten-free biscuits.

Interviewee was still in work/cycle clothes (casual but a work polo shirt).

House very cluttered in parts and outdated in terms of decoration and fittings. Most of the furniture didn't match, suggesting inherited, second-hand or accumulated over a long period of time. No throws to help make the furniture appear to match. However, it generally seemed to match with her attitude regarding recycling and using items as much as possible.

She mentioned that she has never bought wood for her woodburning stove in the lounge, but takes it all from skips.

A lot of books, old style (1960s/70s) ornaments and trinkets, and old photographs on the wall. A boomerang on the wall with the photographs.

The fact that she wasn't always environmental in her attitude and has a reality check when she visited a landfill site when she worked for the BBC was interesting and generally in contrast to the more gradual awareness and experiences of the other cases to date.

Draught excluders everywhere and quite a few rugs on top of carpets.

Not even the internal doors matched each other- there were 3 or 4 different types of doors.

Unexpected voucher and she was thrilled to receive it.

CASE018 OBSERVATIONS

Nice house. Felt relaxed and smelt of incense (yoga feel'). Mainly good finishes, but some aesthetic damage from previous damp issues (bedroom and dining room).

Participant was very concise and felt slightly closed. Could be difficult to talk to and bond with. Tried to bond/make a connection through yoga, alternative therapy and dogs.

Previous issues of damp and resultant loss of plaster etc. (removed by a professional to aid in the drying process) in the dining room and front bedroom. Waiting for the 'all clear' before redecoration and for the neighbours to repair their roof/guttering prior to redecorating the front bedroom.

Lots of yoga type posters and artwork everywhere.

A thai-yoga massage-like room

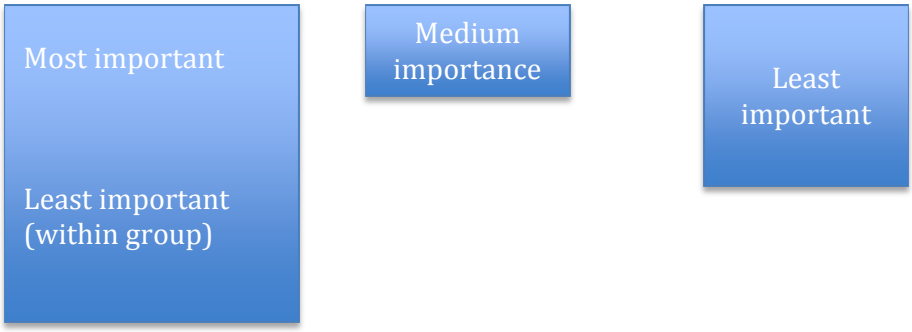
Vegetarian (sometimes vegan)

10 year old whippet (dog)

Split with long-term partner 5 years before.

Sometimes the interviewee acted as if the answers were obvious and therefore a waste of time. She didn't think long about her answers.

Photo of factors:



CASE019 OBSERVATIONS

Welcoming interviewee

Owns a rescue border collie

Has a neurological disease making it hard for her to get around (she used crutches and mobility aids)

Clear general awareness for the environment and influenced by her youth in West Indies.

House a little cluttered in places – mostly toys. She's having new carpets throughout downstairs (currently rugs and stained carpet which are a trip hazard)

Comfortable atmosphere.

Quite dark inside despite being 2pm

Interviewee didn't always directly respond to questions, going off on tangents.

Helps at a local children's group on Friday evenings ('The Ark' – possibly Noah's Ark).

Odd situation – she had to take her neighbour to the doctor around the corner to have stitched removed (from an operation). She said she'd be 10 minutes and left me in the house with my bicycle locked in the garage and her border collie left with me. She called the house phone, which I didn't answer but I text her and once she confirmed she was calling her house phone, I answered her phone. She explained the neighbour still hadn't been seen. She returned after 70 minutes to finish the interview but on her return she asked had we finished even though I'd only managed to ask her one question. She then wanted to finish the interview whilst she prepared her husband's dinner, washed up and cleaned the kitchen, using mobility aids for some of this.

She felt guilty about making me very late for the second interview so she drove me around to case020 – it turned out they knew each other.

CASE020 OBSERVATIONS

Welcoming even though I was 90 minutes late due to previous interviewee challenged. I had managed to email ahead to explain I was running late. Interviewee said she knew case019 and 'knew what she was like' and to come in the house whilst her husband helped case019 with the car bike rack.

Owns a nervous whippet dog.

Tidy, very clean house verging on sparse in places. Former council property with a

converted attic (into an office).

Couple, although friendly, seemed slightly on edge.

Didn't show any particular interest or awareness in energy efficiency but had some basic interest in the 'environment'.

Decoration very outdated but some had been 'freshened up', and was clean and in good condition.

Attending her first Bristol Green Doors tomorrow with her friend who is interested in external wall insulation – some of her answers might have been different if the interview was done after this..?

CASE021 OBSERVATIONS

Very warm and welcoming interviewees (retired couple).

Had bought Danish pastries to share with drinks.

Interviewees both relaxed and open body language with good eye contact.

Nice house – front and back garden included areas of food producing plants

Victorian property with modern extension built a few years ago by Footprint Building.

Property in good condition throughout, although a variety of internal cracking across ceiling plasterwork in a number of places. A little outdated in parts.

Finished basement rented to university students.

Concise answers.

No power relationship between the couple detected – the husband allowing his wife to take the lead (she had arranged the interview) and stepping in when she looked for a second opinion or support for her answer.

After the interview we discussed how my PhD had so far influenced my opinions and attitude towards the environment, prejudices and opinions of friends, and how they have never purchased wood to burn in the wood burners – friends call them if there is a public tree or one of their own being felled. The couple also rummage through skips for timber.

Talked about their barge in France – includes an A+++ fridge, solar panels and water efficiency products.

CASE022 OBSERVATIONS

Newspaper up at windows (husband took down curtains so temporarily put newspaper up).

Welcoming interviewee although she seemed a little apprehensive.

Decoration a little outdated and worn in places, but in an ok condition.

Quite tidy and clean although 2 year old was distributing toys and bread around.

Bathroom has had some tiles removed.

Open body language and managed her 2-year old toddler very well so she could engage with the interview.

Very much concerned with community and working to preserve the community and surrounding green areas.

CASE023 OBSERVATIONS

Dated furnishings (VERY patterned carpets) but clean, welcoming and in fairly good overall condition.

Interviewee had a hearing aid and sometimes had trouble hearing me. He seemed relaxed, but facetious. Sometimes joked, giving me the opposite answer to his view but then providing me with his actual answer.

He definitely was trying to control/form a power relationship.

Interviewee was pleasant with open body language but didn't always answer questions or answer directly, despite sometimes asking the same question multiple times.

Relaxed atmosphere. Interviewee ate dinner during the interview. Sometimes felt as if he was being intentionally 'different' with his responses.

Before interview we chatted about his garden (grows herbs) and gluten-free diet.

CASE024 OBSERVATIONS

Warm welcome. Directed me round to the rear of the house and guided me through the back alley and into the garden.

Lots of recycling and children's bikes in the lean-to/utility area.

House in good condition with good finishes. Very tidy and clean. A few small toys in places. Modern and stylish.

Young children being put to bed (father reading them Enid Blighton's Secret Seven upstairs) when I arrived. Calm atmosphere in the house, lights dimmed.

Temperature inside the house was cold.

Open body language from both interviewees. Sat around dining table, with female choosing to sit at the head of the table next to me, then the male sitting to her left (opposite the table from me). Good support and interaction between couple, working together and taking it in turns to answer questions. No obvious 'power' relationship detected. Neither one dominated the entire interview overall. Sometimes one would give a more in-depth answer than the other, but this changed from question to question.

Lots of photographs (wedding and children) and artwork everywhere.

CASE025 OBSERVATIONS

Nice home. Relaxed, comfortable atmosphere. Welcoming. Hustle and bustle of female and the calmness of the male.

Interviewee had forgotten I was visiting.

Good, themed (Mackintosh and Bloomsbury) decoration throughout although some cracking to the ceiling and walls downstairs. Upstairs some staining to the second bedroom where there had been a water leak in the attic last year.

Mackintosh theme had been carried to the original doors.

Artwork on walls – lots of architectural themed art. Also some interesting choices in fittings (e.g. the anthracite stove)

Lots of books!! Books on lots of different subjects. Many travel books.

Home looks 'lived in' and comfortable – papers and utensils; clothes and unmade beds but clean and nice.

Open body language and good eye contact.

Electric Brompton charging in the hallway. Brought my bike into the house. Was told I didn't need to take my shoes off.

Attic space very cold!!

At the end of the interview (after switching off the recording) the interviewee mentioned that the front downstairs windows had also become a security risk (on top of the difficulty in maintaining them and the leaks), as it would have been possible to easily take them out between two men to enter the house.

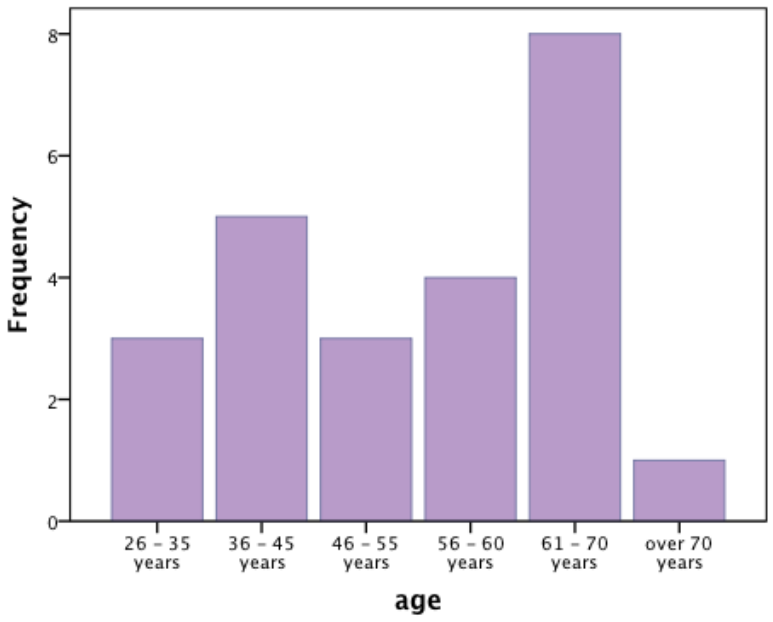
APPENDIX F – Quantitative data: graphs and tables

DESCRIPTIVE ANALYSIS
1. SOCIO-DEMOGRAPHICS

Ages

age

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	2 26 - 35 years	**3**	**11.1**	**12.5**	**12.5**
	3 36 - 45 years	**5**	**18.5**	**20.8**	**33.3**
	4 46 - 55 years	**3**	**11.1**	**12.5**	**45.8**
	5 56 - 60 years	**4**	**14.8**	**16.7**	**62.5**
	6 61 - 70 years	**8**	**29.6**	**33.3**	**95.8**
	7 over 70 years	**1**	**3.7**	**4.2**	**100.0**
	Total	**24**	**88.9**	**100.0**	
Missing	999 missing	**1**	**3.7**		
	System	**2**	**7.4**		
	Total	**3**	**11.1**		
Total		**27**	**100.0**		



Gender

gender

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1 male	**8**	**29.6**	**32.0**	**32.0**
	2 female	**15**	**55.6**	**60.0**	**92.0**
	3 both present	**2**	**7.4**	**8.0**	**100.0**
	Total	**25**	**92.6**	**100.0**	
Missing	System	**2**	**7.4**		
Total		**27**	**100.0**		

Country of birth

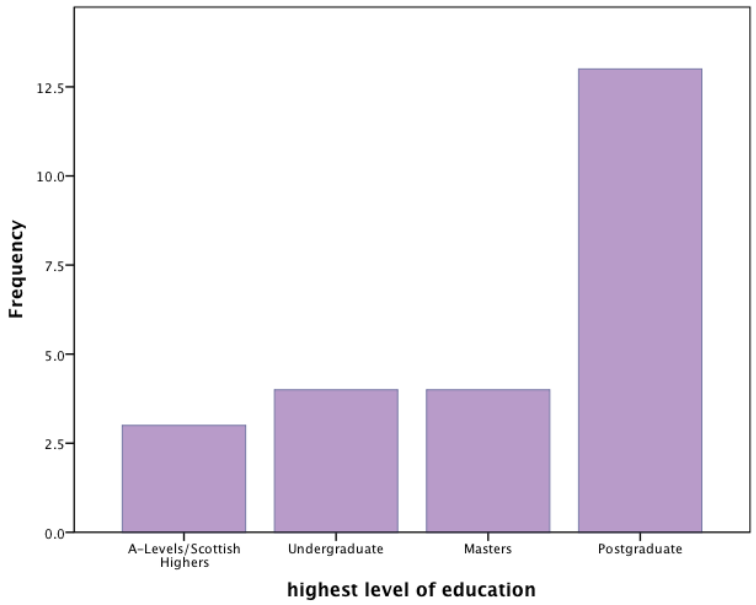
country of birth

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1 UK	**22**	**81.5**	**91.7**	**91.7**
	3 South Africa	**1**	**3.7**	**4.2**	**95.8**
	4 West Indies	**1**	**3.7**	**4.2**	**100.0**
	Total	**24**	**88.9**	**100.0**	
Missing	999 Missing	**1**	**3.7**		
	System	**2**	**7.4**		
	Total	**3**	**11.1**		
Total		**27**	**100.0**		

Education

highest level of education

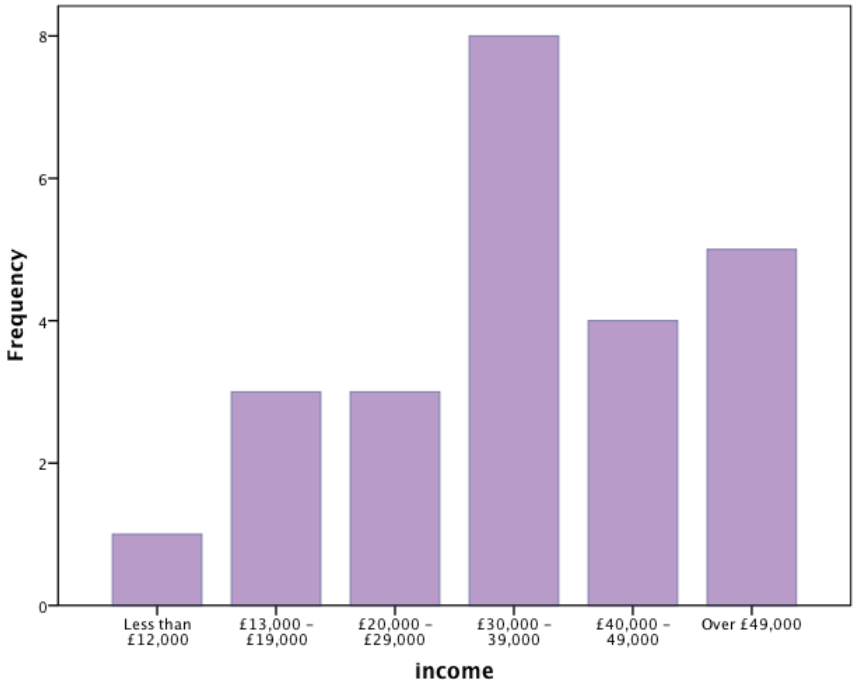
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	2 A-Levels/Scottish Highers	**3**	**11.1**	**12.5**	**12.5**
	4 Undergraduate	**4**	**14.8**	**16.7**	**29.2**
	5 Masters	**4**	**14.8**	**16.7**	**45.8**
	6 Postgraduate	**13**	**48.1**	**54.2**	**100.0**
	Total	**24**	**88.9**	**100.0**	
Missing	999 Missing	**1**	**3.7**		
	System	**2**	**7.4**		
	Total	**3**	**11.1**		
Total		**27**	**100.0**		



Income

income

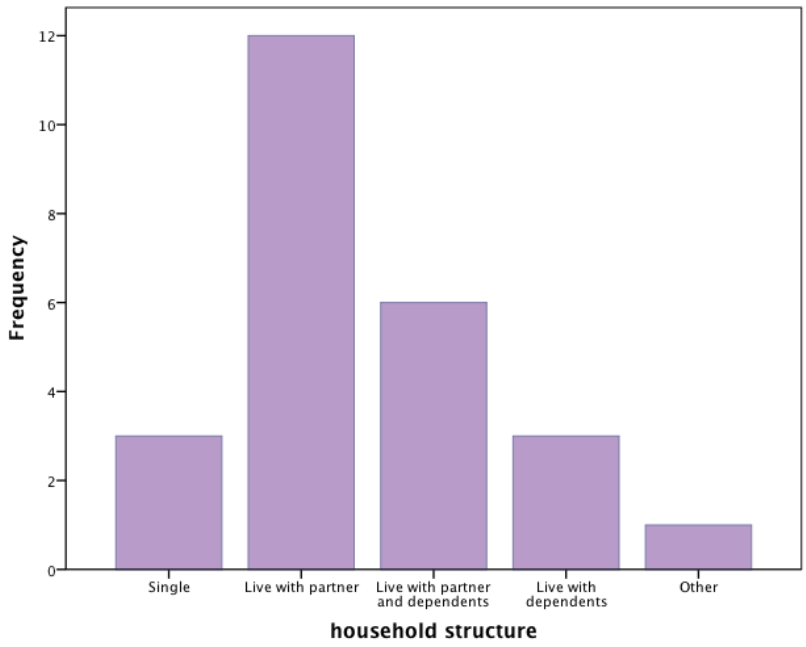
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1 Less than £12,000	**1**	**3.7**	**4.2**	**4.2**
	2 £13,000 - £19,000	**3**	**11.1**	**12.5**	**16.7**
	3 £20,000 - £29,000	**3**	**11.1**	**12.5**	**29.2**
	4 £30,000 - 39,000	**8**	**29.6**	**33.3**	**62.5**
	5 £40,000 - 49,000	**4**	**14.8**	**16.7**	**79.2**
	6 Over £49,000	**5**	**18.5**	**20.8**	**100.0**
	Total	**24**	**88.9**	**100.0**	
Missing	999 Missing	**1**	**3.7**		
	System	**2**	**7.4**		
	Total	**3**	**11.1**		
Total		**27**	**100.0**		



Household structure

household structure

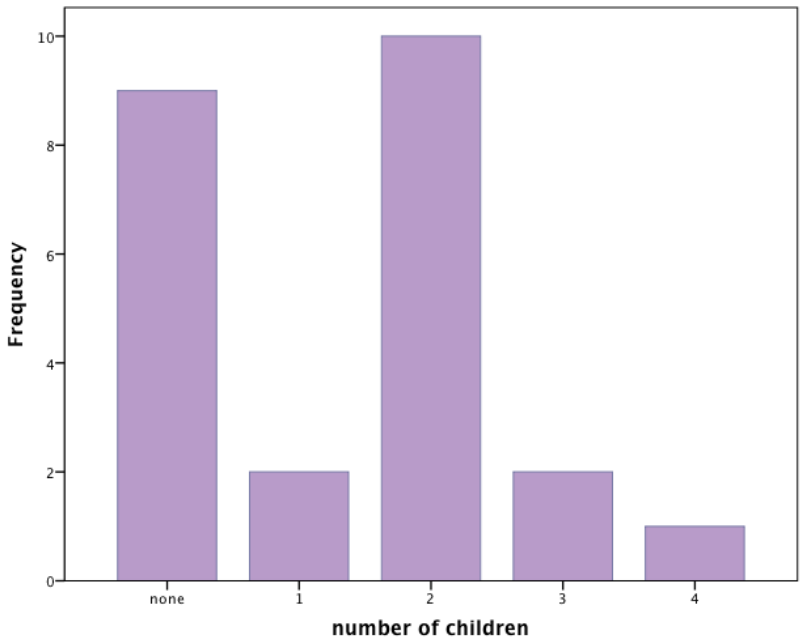
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1 Single	**3**	**11.1**	**12.0**	**12.0**
	2 Live with partner	**12**	**44.4**	**48.0**	**60.0**
	3 Live with partner and dependents	**6**	**22.2**	**24.0**	**84.0**
	4 Live with dependents	**3**	**11.1**	**12.0**	**96.0**
	99 Other	**1**	**3.7**	**4.0**	**100.0**
	Total	**25**	**92.6**	**100.0**	
Missing	System	**2**	**7.4**		
Total		**27**	**100.0**		



Children

number of children

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1 none	**9**	**33.3**	**37.5**	**37.5**
	2 1	**2**	**7.4**	**8.3**	**45.8**
	3 2	**10**	**37.0**	**41.7**	**87.5**
	4 3	**2**	**7.4**	**8.3**	**95.8**
	5 4	**1**	**3.7**	**4.2**	**100.0**
	Total	**24**	**88.9**	**100.0**	
Missing	999 missing	**1**	**3.7**		
	System	**2**	**7.4**		
	Total	**3**	**11.1**		
Total		**27**	**100.0**		

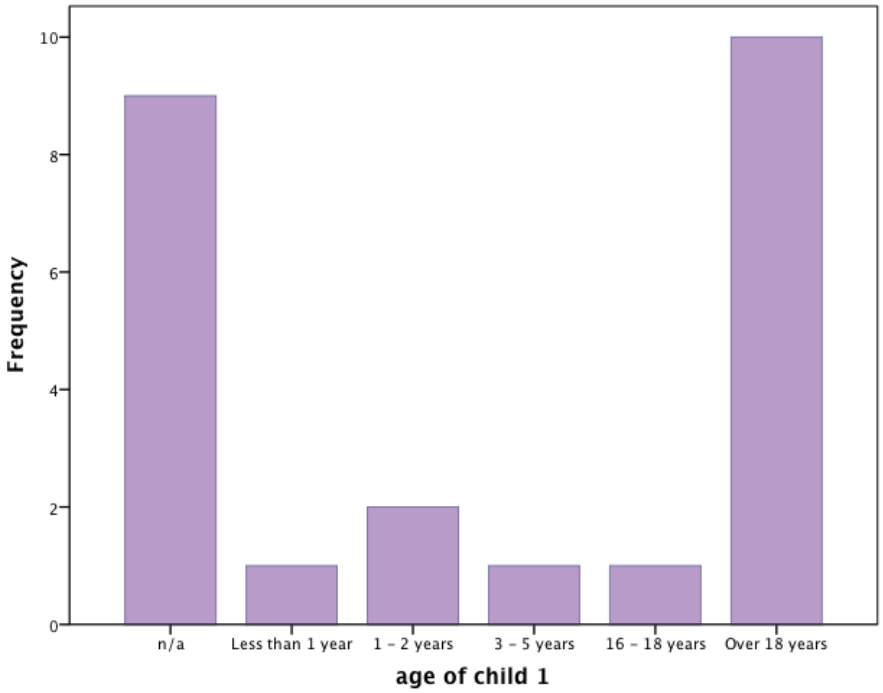


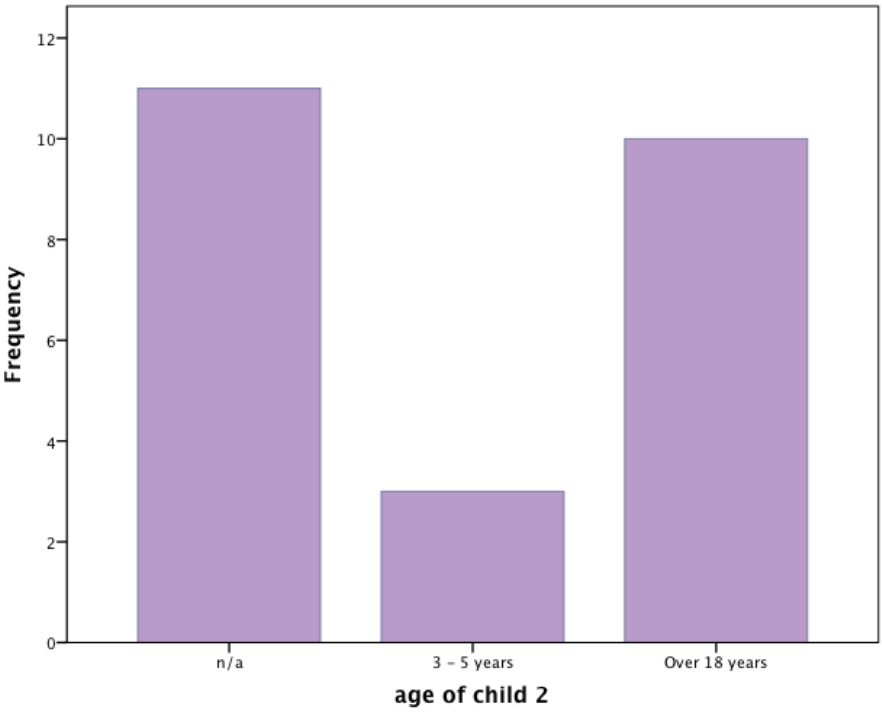
age of child 1

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	0 n/a	9	33.3	37.5	37.5
	1 Less than 1 year	1	3.7	4.2	41.7
	2 1 - 2 years	2	7.4	8.3	50.0
	3 3 - 5 years	1	3.7	4.2	54.2
	6 16 - 18 years	1	3.7	4.2	58.3
	7 Over 18 years	10	37.0	41.7	100.0
	Total	24	88.9	100.0	
Missing	999 missing	1	3.7		
	System	2	7.4		
	Total	3	11.1		
Total		27	100.0		

age of child 2

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	0 n/a	11	40.7	45.8	45.8
	3 3 - 5 years	3	11.1	12.5	58.3
	7 Over 18 years	10	37.0	41.7	100.0
	Total	24	88.9	100.0	
Missing	999 missing	1	3.7		
	System	2	7.4		
	Total	3	11.1		
Total		27	100.0		

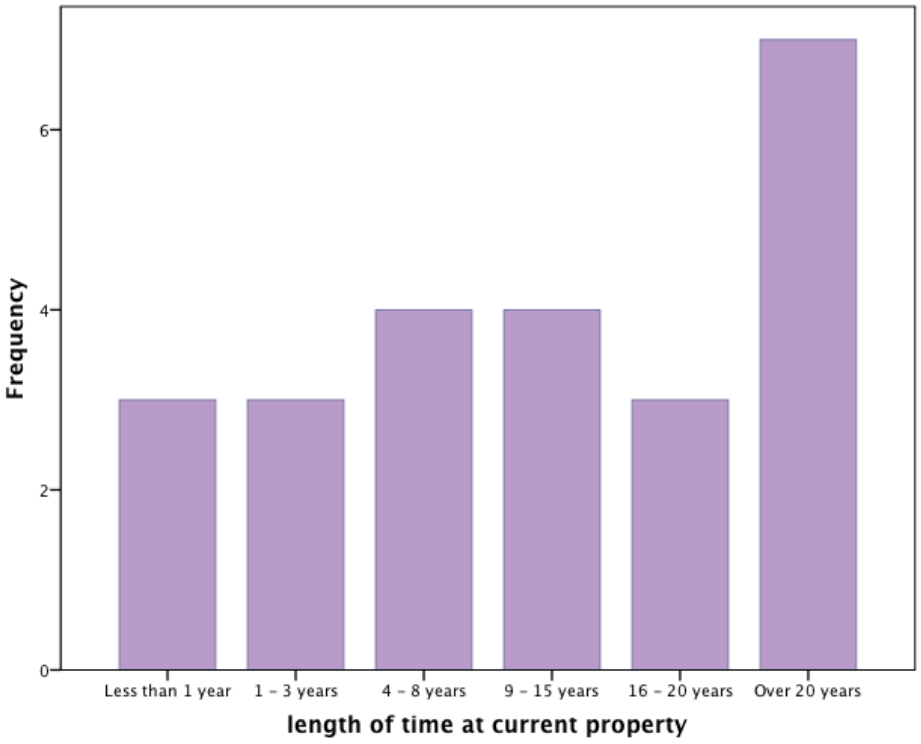

Frequency
10
8
6
4
2
0
n/a
Less than 1 year
1 – 2 years
3 – 5 years
16 – 18 years
Over 18 years
age of child 1


Frequency
12
10
8
6
4
2
0
n/a
3 – 5 years
Over 18 years
age of child 2

Length of residence

length of time at current property

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1 Less than 1 year	**3**	**11.1**	**12.5**	**12.5**
	2 1 - 3 years	**3**	**11.1**	**12.5**	**25.0**
	3 4 - 8 years	**4**	**14.8**	**16.7**	**41.7**
	4 9 - 15 years	**4**	**14.8**	**16.7**	**58.3**
	5 16 - 20 years	**3**	**11.1**	**12.5**	**70.8**
	6 Over 20 years	**7**	**25.9**	**29.2**	**100.0**
	Total	**24**	**88.9**	**100.0**	
Missing	999 missing	**1**	**3.7**		
	System	**2**	**7.4**		
	Total	**3**	**11.1**		
Total		**27**	**100.0**		



Profession

profession

	Value	Count	Percent
Standard Attributes	**<none>**		
Valid Values	**higher or further education**	**5**	**18.5%**
	secondary education/teacher /trainer	**1**	**3.7%**
	research	**3**	**11.1%**
	management	**2**	**7.4%**
	administration	**3**	**11.1%**
	IT (developer, engineer)	**0**	**0.0%**
	creative (graphic designer, designer, or photographer)	**0**	**0.0%**
	finances	**1**	**3.7%**
	health	**1**	**3.7%**
	legal	**1**	**3.7%**
	engineer	**0**	**0.0%**
	retired	**7**	**25.9%**
	other	**1**	**3.7%**
Missing Values	**missing**	**0**	**0.0%**

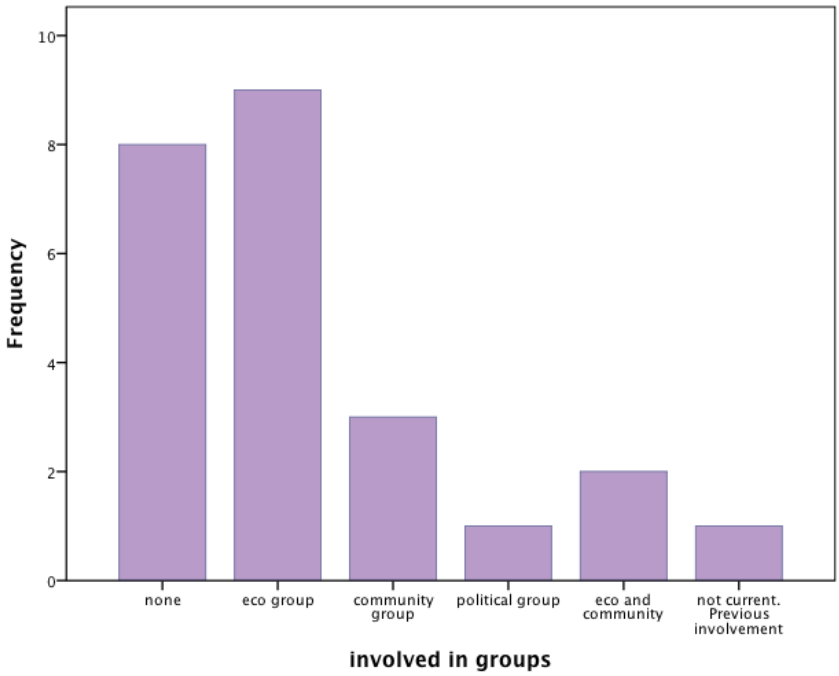
partner's profession

	Value	Count	Percent
Standard Attributes	**<none>**		
	higher or further education	**1**	**3.7%**
	secondary education/teacher /trainer	**1**	**3.7%**
	research	**0**	**0.0%**
	management	**1**	**3.7%**
	administration	**0**	**0.0%**
	IT (developer, engineer)	**2**	**7.4%**
Valid Values	**creative (graphic designer, designer, or photographer)**	**2**	**7.4%**
	finances	**2**	**7.4%**
	health	**0**	**0.0%**
	legal	**2**	**7.4%**
	engineer	**1**	**3.7%**
	retired	**4**	**14.8%**
	other	**1**	**3.7%**
	n/a	**7**	**25.9%**
Missing Values	**missing**	**1**	**3.7%**

Participation in groups

involved with groups

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	0 none	**8**	**29.6**	**33.3**	**33.3**
	1 eco group	**9**	**33.3**	**37.5**	**70.8**
	2 community group	**3**	**11.1**	**12.5**	**83.3**
	3 political group	**1**	**3.7**	**4.2**	**87.5**
	4 eco and community	**2**	**7.4**	**8.3**	**95.8**
	5 not current. Previous involvement	**1**	**3.7**	**4.2**	**100.0**
	Total	**24**	**88.9**	**100.0**	
Missing	999 missing	**1**	**3.7**		
	System	**2**	**7.4**		
	Total	**3**	**11.1**		
Total		**27**	**100.0**		

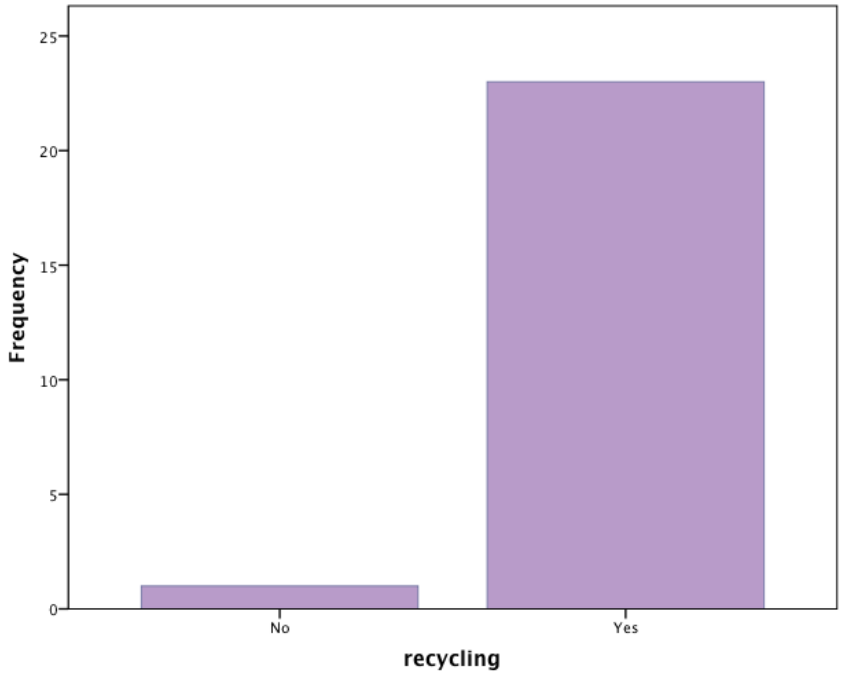

Frequency
10
8
6
4
2
0
none
eco group
community group
political group
eco and community
not current. Previous involvement
involved in groups

2. ENVIRONMENTAL ACTIVITIES

Recycling

recycling

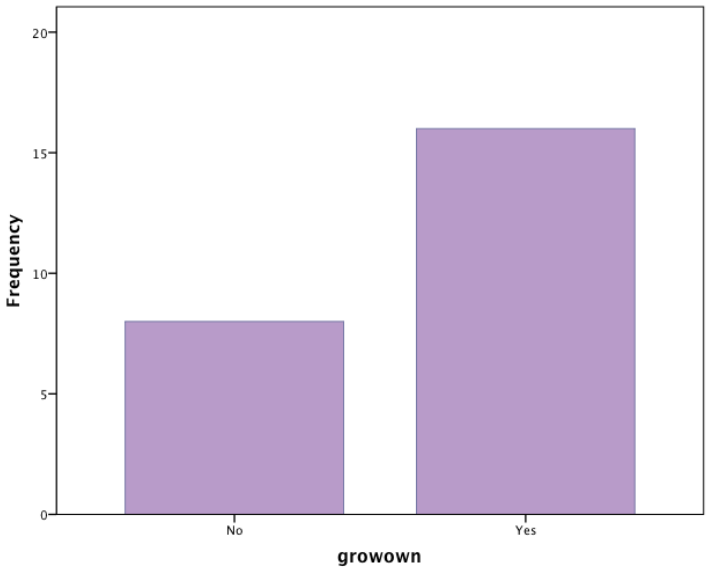
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	0 No	**1**	**3.7**	**4.2**	**4.2**
	1 Yes	**23**	**85.2**	**95.8**	**100.0**
	Total	**24**	**88.9**	**100.0**	
Missing	999 missing	**1**	**3.7**		
	System	**2**	**7.4**		
	Total	**3**	**11.1**		
Total		**27**	**100.0**		



Growing own

growing own food

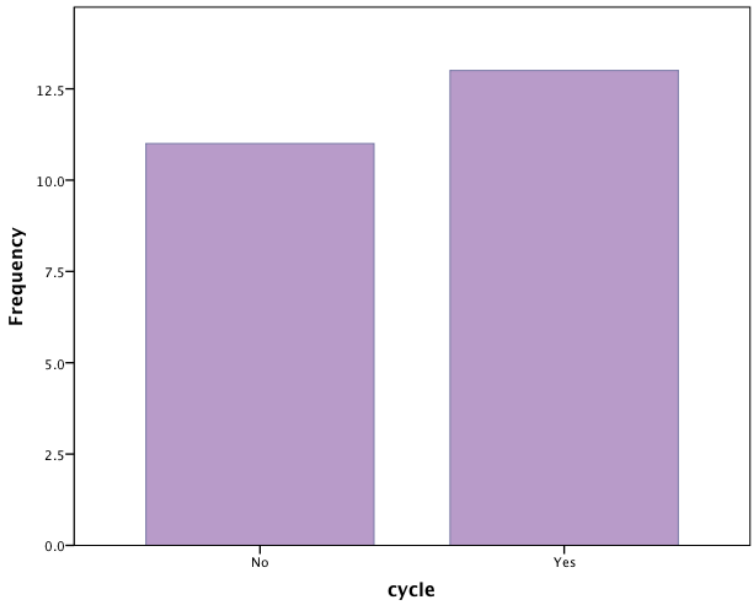
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	0 No	**8**	**29.6**	**33.3**	**33.3**
	1 Yes	**16**	**59.3**	**66.7**	**100.0**
	Total	**24**	**88.9**	**100.0**	
Missing	999 missing	**1**	**3.7**		
	System	**2**	**7.4**		
	Total	**3**	**11.1**		
Total		**27**	**100.0**		



Cycle to work

cycle to work

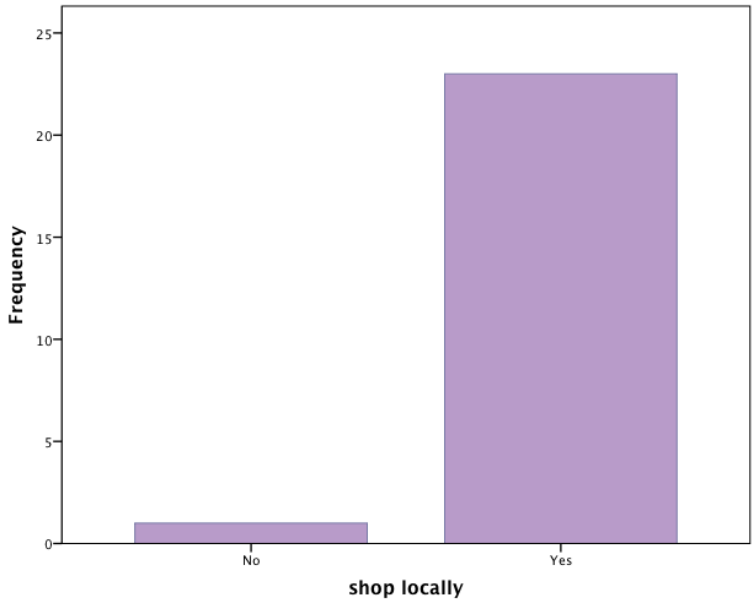
		Frequency	Percent	Valid Percent	Cumulative Percent
	0 No	**11**	**40.7**	**45.8**	**45.8**
Valid	1 Yes	**13**	**48.1**	**54.2**	**100.0**
	Total	**24**	**88.9**	**100.0**	
	999 missing	**1**	**3.7**		
Missing	System	**2**	**7.4**		
	Total	**3**	**11.1**		
Total		**27**	**100.0**		



Shopping

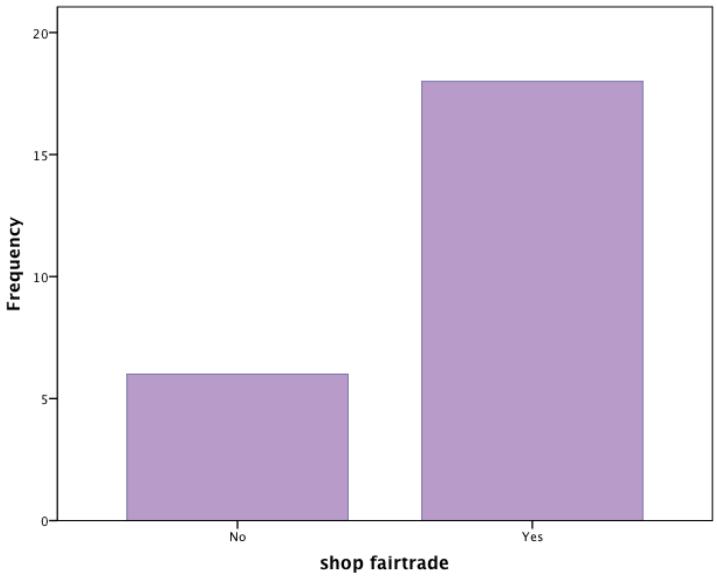
shop locally

		Frequency	Percent	Valid Percent	Cumulative Percent
	0 No	**1**	**3.7**	**4.2**	**4.2**
Valid	1 Yes	**23**	**85.2**	**95.8**	**100.0**
	Total	**24**	**88.9**	**100.0**	
	999 missing	**1**	**3.7**		
Missing	System	**2**	**7.4**		
	Total	**3**	**11.1**		
Total		**27**	**100.0**		



shop fairtrade

		Frequency	Percent	Valid Percent	Cumulative Percent
	0 No	**6**	**22.2**	**25.0**	**25.0**
Valid	1 Yes	**18**	**66.7**	**75.0**	**100.0**
	Total	**24**	**88.9**	**100.0**	
	999 missing	**1**	**3.7**		
Missing	System	**2**	**7.4**		
	Total	**3**	**11.1**		
Total		**27**	**100.0**		



neighbourhood deprivation * shop fairtrade Crosstabulation

Count

		shop fairtrade		Total
		0 No	1 Yes	
neighbourhood deprivation	1 Low	**1**	**6**	**7**
	2 Medium - Low	**1**	**3**	**4**
	3 Medium	**2**	**6**	**8**
	4 High - Medium	**1**	**0**	**1**
	5 High	**1**	**3**	**4**
Total		**6**	**18**	**24**

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)	Point Probability
Pearson Chi-Square	**3.429**[a]	**4**	**.489**	**.540**		
Likelihood Ratio	**3.256**	**4**	**.516**	**.720**		
Fisher's Exact Test	**3.243**			**.540**		
Linear-by-Linear Association	**.567**[b]	**1**	**.451**	**.513**	**.279**	**.097**
N of Valid Cases	**24**					

a. 8 cells (80.0%) have expected count less than 5. The minimum expected count is .25.

b. The standardized statistic is -.753.

income * shop fairtrade Crosstabulation

Count

		shop fairtrade		Total
		0 No	1 Yes	
income	1 Less than £12,000	**0**	**1**	**1**
	2 £13,000 - £19,000	**1**	**2**	**3**
	3 £20,000 - £29,000	**1**	**2**	**3**
	4 £30,000 - 39,000	**2**	**6**	**8**
	5 £40,000 - 49,000	**1**	**3**	**4**
	6 Over £49,000	**1**	**4**	**5**
Total		**6**	**18**	**24**

Chi-Square Tests

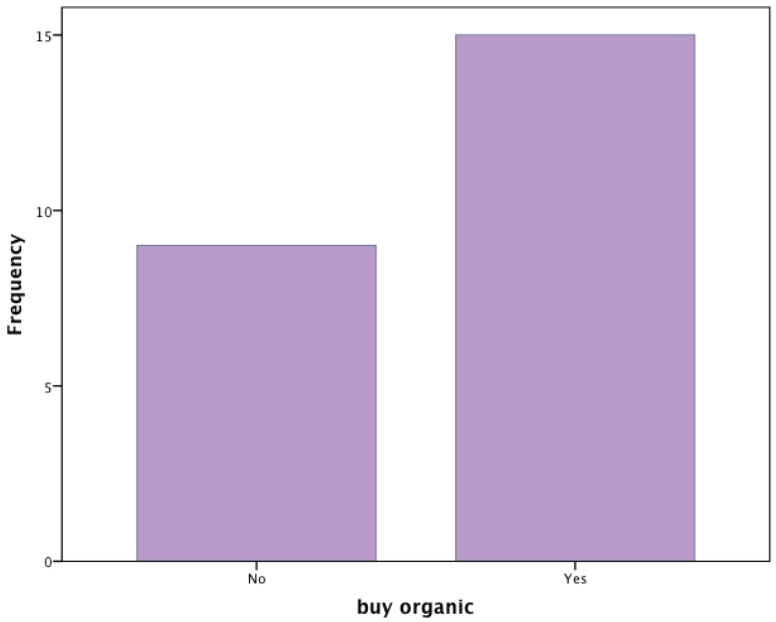
	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)	Point Probability
Pearson Chi-Square	**.622**[a]	**5**	**.987**	**1.000**		
Likelihood Ratio	**.854**	**5**	**.973**	**1.000**		
Fisher's Exact Test	**1.656**			**1.000**		
Linear-by-Linear Association	**.027**[b]	**1**	**.870**	**1.000**	**.494**	**.124**
N of Valid Cases	**24**					

a. 11 cells (91.7%) have expected count less than 5. The minimum expected count is .25.

b. The standardized statistic is .163.

buy organic

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	0 No	**9**	**33.3**	**37.5**	**37.5**
	1 Yes	**15**	**55.6**	**62.5**	**100.0**
	Total	**24**	**88.9**	**100.0**	
Missing	999 missing	**1**	**3.7**		
	System	**2**	**7.4**		
	Total	**3**	**11.1**		
Total		**27**	**100.0**		



neighbourhood deprivation * buy organic Crosstabulation

Count

		buy organic		Total
		0 No	1 Yes	
neighbourhood deprivation	1 Low	**3**	**4**	**7**
	2 Medium - Low	**2**	**2**	**4**
	3 Medium	**2**	**6**	**8**
	4 High - Medium	**1**	**0**	**1**
	5 High	**1**	**3**	**4**
Total		**9**	**15**	**24**

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)	Point Probability
Pearson Chi-Square	**2.819**[a]	**4**	**.589**	**.694**		
Likelihood Ratio	**3.153**	**4**	**.533**	**.694**		
Fisher's Exact Test	**2.868**			**.694**		
Linear-by-Linear Association	**.237**[b]	**1**	**.627**	**.662**	**.373**	**.106**
N of Valid Cases	**24**					

a. 9 cells (90.0%) have expected count less than 5. The minimum expected count is .38.

b. The standardized statistic is .486.

income * buy organic Crosstabulation

Count

		buy organic		Total
		0 No	1 Yes	
income	1 Less than £12,000	**0**	**1**	**1**
	2 £13,000 - £19,000	**1**	**2**	**3**
	3 £20,000 - £29,000	**2**	**1**	**3**
	4 £30,000 - 39,000	**2**	**6**	**8**
	5 £40,000 - 49,000	**1**	**3**	**4**
	6 Over £49,000	**3**	**2**	**5**
Total		**9**	**15**	**24**

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)	Point Probability
Pearson Chi-Square	**3.591**[a]	**5**	**.610**	**.752**		
Likelihood Ratio	**3.891**	**5**	**.565**	**.772**		
Fisher's Exact Test	**3.701**			**.752**		
Linear-by-Linear Association	**.433**[b]	**1**	**.511**	**.568**	**.310**	**.095**
N of Valid Cases	**24**					

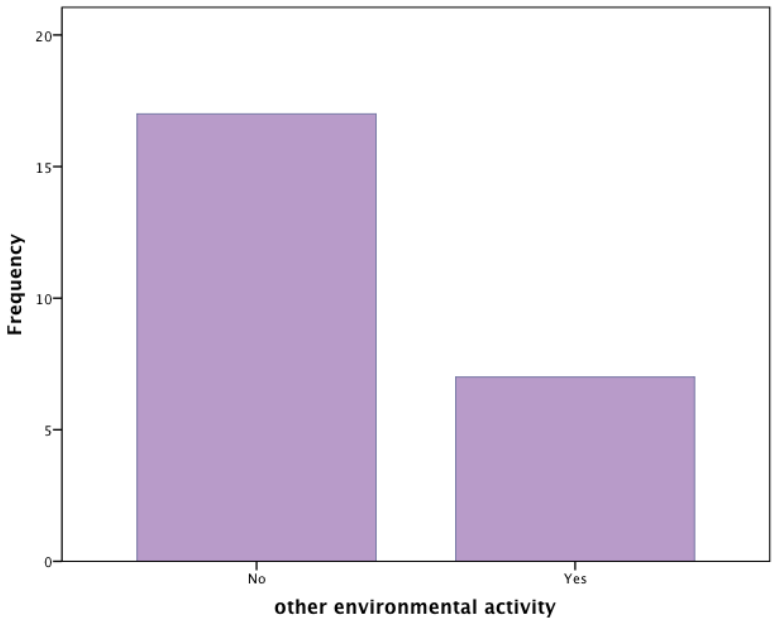
a. 11 cells (91.7%) have expected count less than 5. The minimum expected count is .38.

b. The standardized statistic is -.658.

Other environmental activities

other environmental activity

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	0 No	**17**	**63.0**	**70.8**	**70.8**
	1 Yes	**7**	**25.9**	**29.2**	**100.0**
	Total	**24**	**88.9**	**100.0**	
Missing	999 missing	**1**	**3.7**		
	System	**2**	**7.4**		
	Total	**3**	**11.1**		
Total		**27**	**100.0**		


20
15
10
5
0
Frequency
No
Yes
other environmental activity

refurblevel * other environmental activity Crosstabulation

Count

		other environmental activity		Total
		0 No	1 Yes	
refurblevel	2 minimum (some insulation, some efficient lights)	**2**	**0**	**2**
	3 low (some insulation, lights, draught proofing, some multi glazing)	**2**	**3**	**5**
	4 low-medium (insulation, lights, draughtproofing, boiler, heating controls)	**3**	**1**	**4**
	5 medium (insulation, lights, draughtproofing, boiler, heating controls, heating distribution)	**2**	**2**	**4**
	6 medium-high (greater insulation, lights, draughtproofing, boiler, heating controls, heating distribution)	**5**	**0**	**5**
	7 high (insulation, lights, draughtproofing, boiler, heating controls, heating distribution, low carbon technology)	**2**	**0**	**2**
	8 high (insulation, lights, draughtproofing, boiler, heating controls and distribution, technology, glazing)	**1**	**1**	**2**
Total		**17**	**7**	**24**

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)	Point Probability
Pearson Chi-Square	**7.301**[a]	**6**	**.294**	**.350**		
Likelihood Ratio	**9.428**	**6**	**.151**	**.324**		
Fisher's Exact Test	**6.703**			**.338**		
Linear-by-Linear Association	**.416**[b]	**1**	**.519**	**.538**	**.308**	**.083**
N of Valid Cases	**24**					

a. 14 cells (100.0%) have expected count less than 5. The minimum expected count is .58.

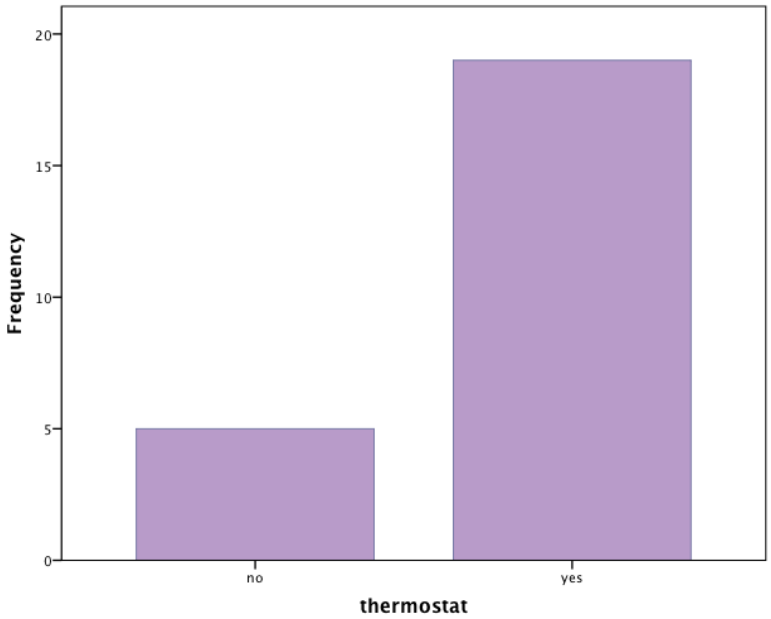
b. The standardized statistic is -.645.

3. ENERGY SAVING BEHAVIOURS

Thermostat

thermostat

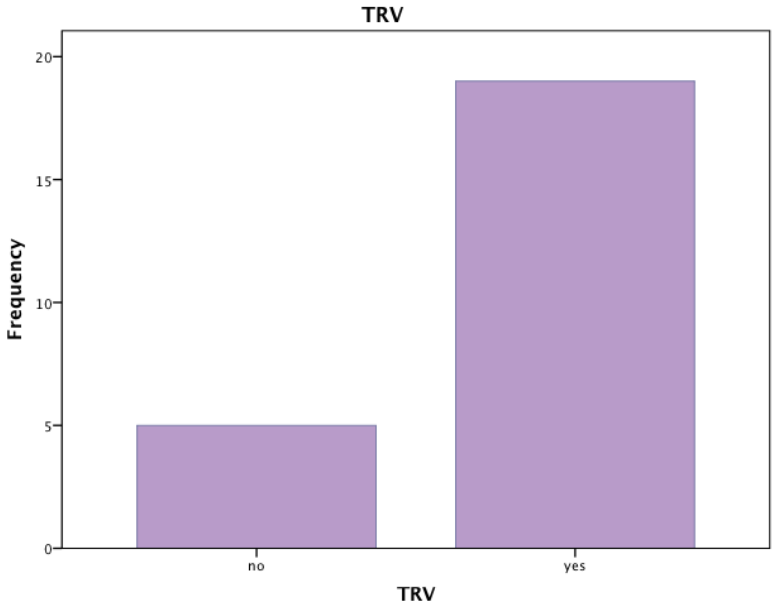
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	0 no	**5**	**18.5**	**20.8**	**20.8**
	1 yes	**19**	**70.4**	**79.2**	**100.0**
	Total	**24**	**88.9**	**100.0**	
Missing	999 missing	**1**	**3.7**		
	System	**2**	**7.4**		
	Total	**3**	**11.1**		
Total		**27**	**100.0**		



Adjust the TRV

TRV

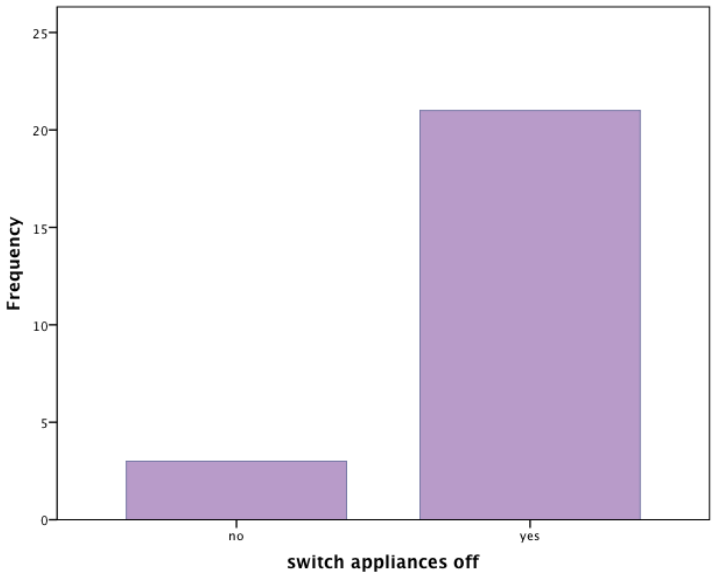
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	0 no	**5**	**18.5**	**20.8**	**20.8**
	1 yes	**19**	**70.4**	**79.2**	**100.0**
	Total	**24**	**88.9**	**100.0**	
Missing	999 missing	**1**	**3.7**		
	System	**2**	**7.4**		
	Total	**3**	**11.1**		
Total		**27**	**100.0**		



Turn off appliances

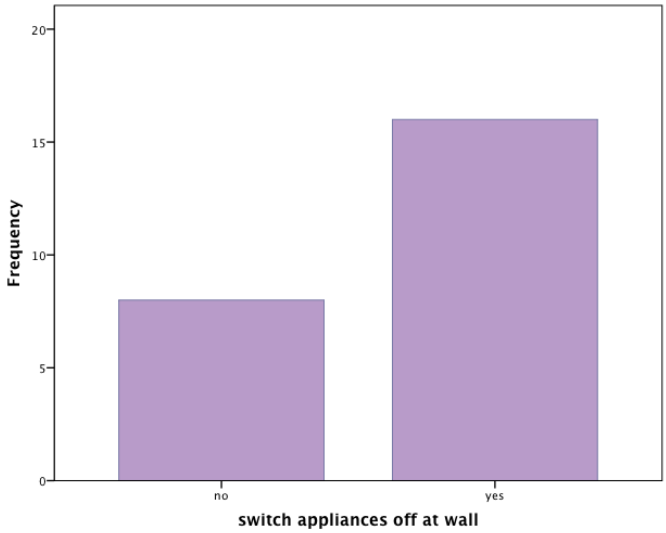
appliancesoff

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	0 no	**3**	**11.1**	**12.5**	**12.5**
	1 yes	**21**	**77.8**	**87.5**	**100.0**
	Total	**24**	**88.9**	**100.0**	
Missing	999 missing	**1**	**3.7**		
	System	**2**	**7.4**		
	Total	**3**	**11.1**		
Total		**27**	**100.0**		



socketwalloff

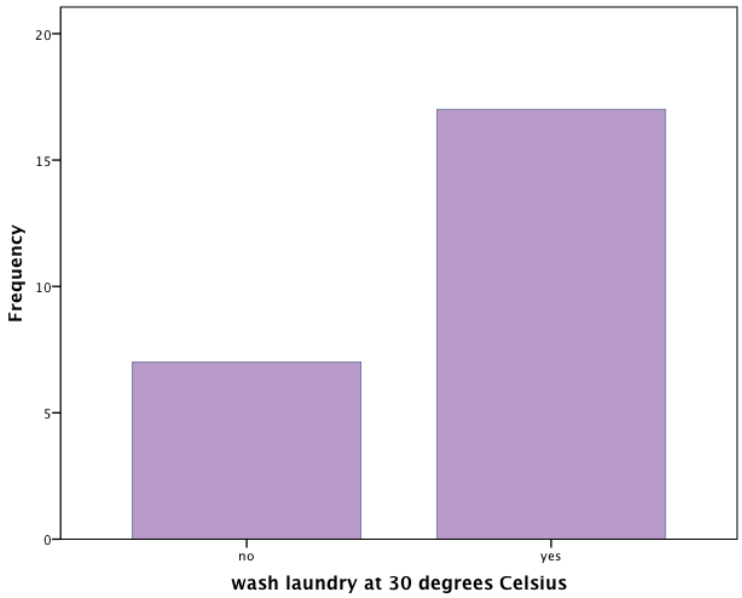
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	0 no	**8**	**29.6**	**33.3**	**33.3**
	1 yes	**16**	**59.3**	**66.7**	**100.0**
	Total	**24**	**88.9**	**100.0**	
Missing	999 missing	**1**	**3.7**		
	System	**2**	**7.4**		
	Total	**3**	**11.1**		
Total		**27**	**100.0**		



Wash clothes at 30°C

laundry

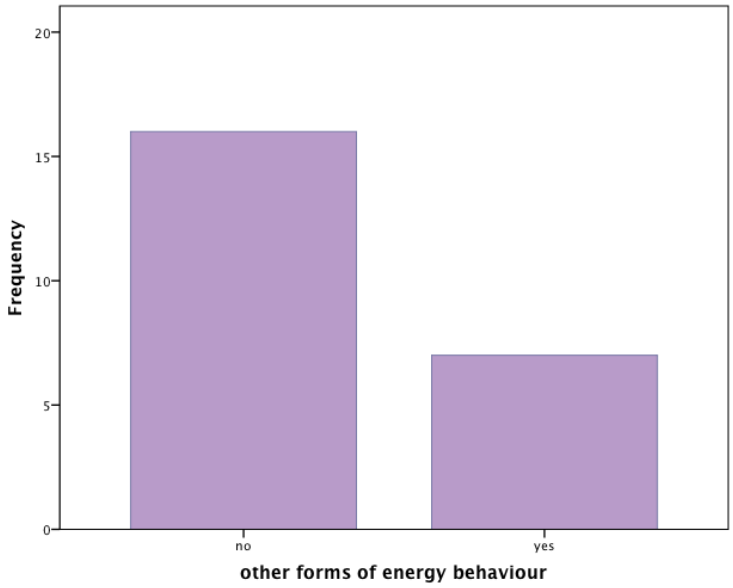
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	0 no	**7**	**25.9**	**29.2**	**29.2**
	1 yes	**17**	**63.0**	**70.8**	**100.0**
	Total	**24**	**88.9**	**100.0**	
Missing	999 missing	**1**	**3.7**		
	System	**2**	**7.4**		
	Total	**3**	**11.1**		
Total		**27**	**100.0**		



Other behaviour

other form of behaviour

		Frequency	Percent	Valid Percent	Cumulative Percent
	0 no	**16**	**59.3**	**69.6**	**69.6**
Valid	1 yes	**7**	**25.9**	**30.4**	**100.0**
	Total	**23**	**85.2**	**100.0**	
	999 missing	**1**	**3.7**		
Missing	System	**3**	**11.1**		
	Total	**4**	**14.8**		
Total		**27**	**100.0**		



4. INTERNAL FACTORS

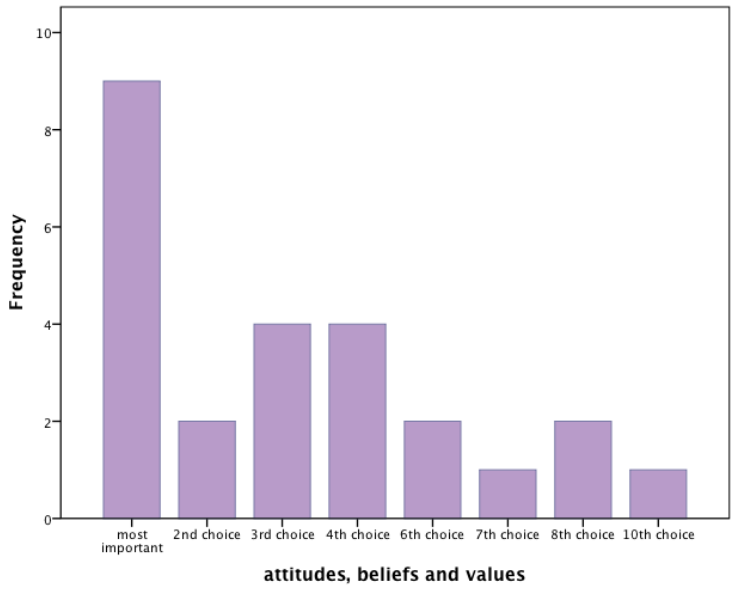
Statistics

		attitudes, beliefs and values	decision making	expectations of the outcomes	fashions and tastes	locus of control	loss aversion	priorities	role of home	self	sense of responsibility	social norms	trust
N	Valid	**25**	**25**	**25**	**25**	**25**	**25**	**25**	**25**	**25**	**25**	**25**	**25**
	Missing	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**
Mean		**3.44**	**6.76**	**5.68**	**10.16**	**7.28**	**7.48**	**3.80**	**5.68**	**6.44**	**3.12**	**9.76**	**7.28**
Median		**3.00**	**6.00**	**5.00**	**11.00**	**7.00**	**8.00**	**3.00**	**5.00**	**6.00**	**3.00**	**11.00**	**7.00**
Mode		**1**	**5**	**5**	**12**	**6**	**9**	**1**	**5**	**6**	**3**	**11**	**7**

Attitudes, beliefs and values

attitudes, beliefs and values

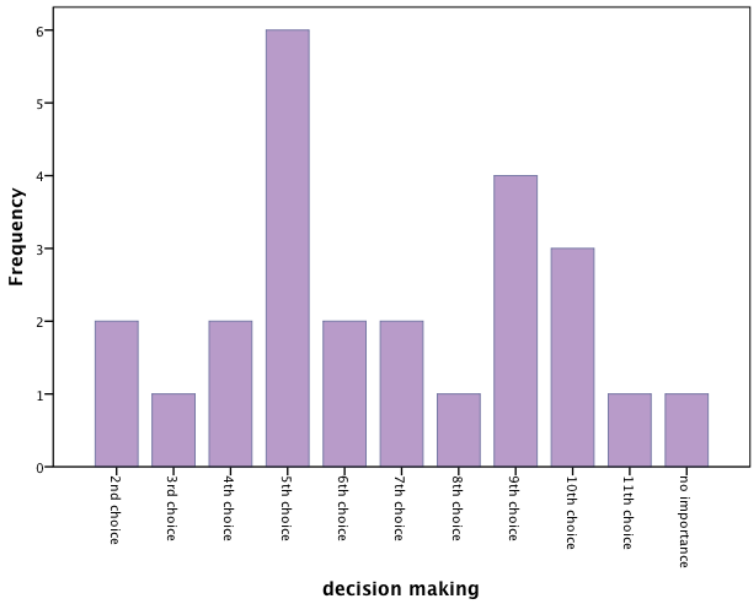
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1 most important	**9**	**33.3**	**36.0**	**36.0**
	2 2nd choice	**2**	**7.4**	**8.0**	**44.0**
	3 3rd choice	**4**	**14.8**	**16.0**	**60.0**
	4 4th choice	**4**	**14.8**	**16.0**	**76.0**
	6 6th choice	**2**	**7.4**	**8.0**	**84.0**
	7 7th choice	**1**	**3.7**	**4.0**	**88.0**
	8 8th choice	**2**	**7.4**	**8.0**	**96.0**
	10 10th choice	**1**	**3.7**	**4.0**	**100.0**
	Total	**25**	**92.6**	**100.0**	
Missing	System	**2**	**7.4**		
Total		**27**	**100.0**		



Decision making

decision making

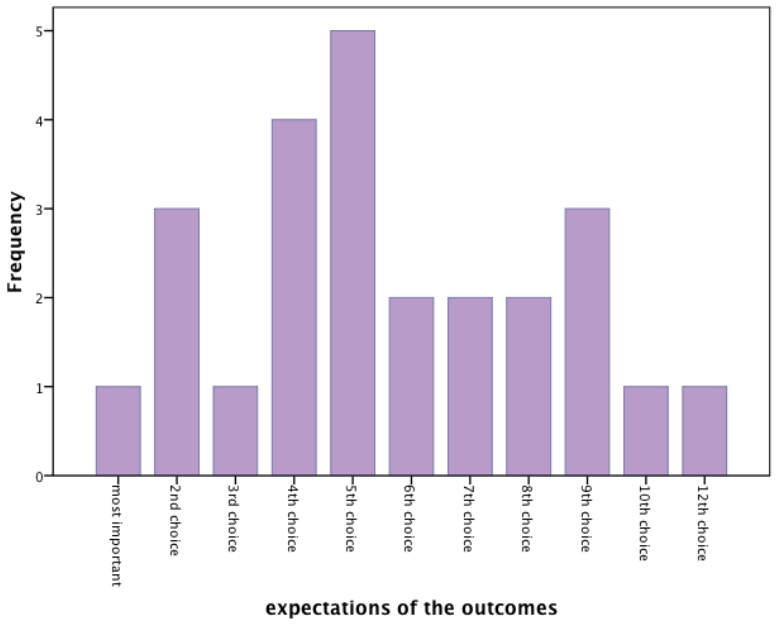
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	2 2nd choice	**2**	**7.4**	**8.0**	**8.0**
	3 3rd choice	**1**	**3.7**	**4.0**	**12.0**
	4 4th choice	**2**	**7.4**	**8.0**	**20.0**
	5 5th choice	**6**	**22.2**	**24.0**	**44.0**
	6 6th choice	**2**	**7.4**	**8.0**	**52.0**
	7 7th choice	**2**	**7.4**	**8.0**	**60.0**
	8 8th choice	**1**	**3.7**	**4.0**	**64.0**
	9 9th choice	**4**	**14.8**	**16.0**	**80.0**
	10 10th choice	**3**	**11.1**	**12.0**	**92.0**
	11 11th choice	**1**	**3.7**	**4.0**	**96.0**
	13 no importance	**1**	**3.7**	**4.0**	**100.0**
	Total	**25**	**92.6**	**100.0**	
Missing	System	**2**	**7.4**		
Total		**27**	**100.0**		



Expectations of the outcomes

expectations of the outcomes

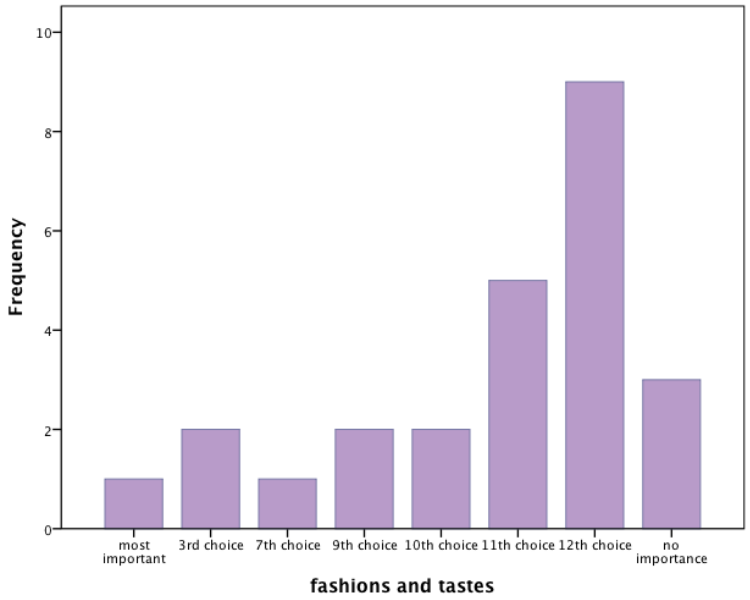
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1 most important	**1**	**3.7**	**4.0**	**4.0**
	2 2nd choice	**3**	**11.1**	**12.0**	**16.0**
	3 3rd choice	**1**	**3.7**	**4.0**	**20.0**
	4 4th choice	**4**	**14.8**	**16.0**	**36.0**
	5 5th choice	**5**	**18.5**	**20.0**	**56.0**
	6 6th choice	**2**	**7.4**	**8.0**	**64.0**
	7 7th choice	**2**	**7.4**	**8.0**	**72.0**
	8 8th choice	**2**	**7.4**	**8.0**	**80.0**
	9 9th choice	**3**	**11.1**	**12.0**	**92.0**
	10 10th choice	**1**	**3.7**	**4.0**	**96.0**
	12 12th choice	**1**	**3.7**	**4.0**	**100.0**
	Total	**25**	**92.6**	**100.0**	
Missing	System	**2**	**7.4**		
Total		**27**	**100.0**		



Fashions and tastes

fashions and tastes

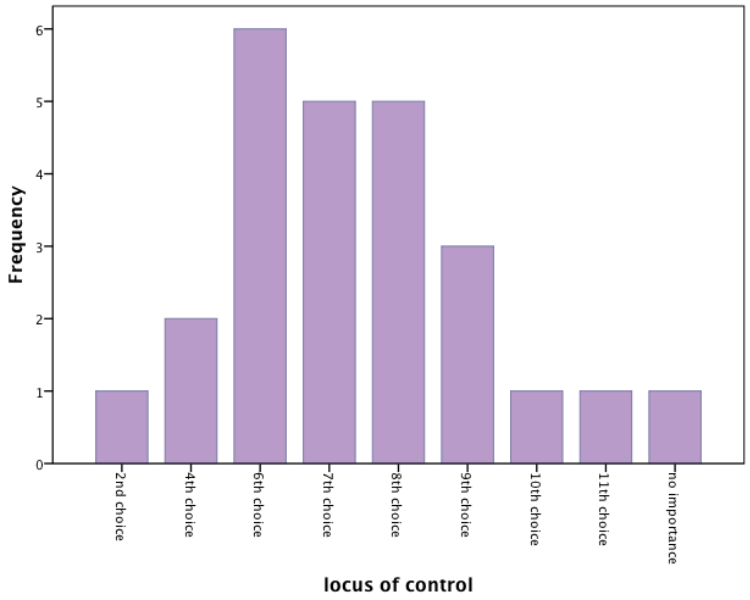
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1 most important	**1**	**3.7**	**4.0**	**4.0**
	3 3rd choice	**2**	**7.4**	**8.0**	**12.0**
	7 7th choice	**1**	**3.7**	**4.0**	**16.0**
	9 9th choice	**2**	**7.4**	**8.0**	**24.0**
	10 10th choice	**2**	**7.4**	**8.0**	**32.0**
	11 11th choice	**5**	**18.5**	**20.0**	**52.0**
	12 12th choice	**9**	**33.3**	**36.0**	**88.0**
	13 no importance	**3**	**11.1**	**12.0**	**100.0**
	Total	**25**	**92.6**	**100.0**	
Missing	System	**2**	**7.4**		
Total		**27**	**100.0**		



Locus of control

locus of control

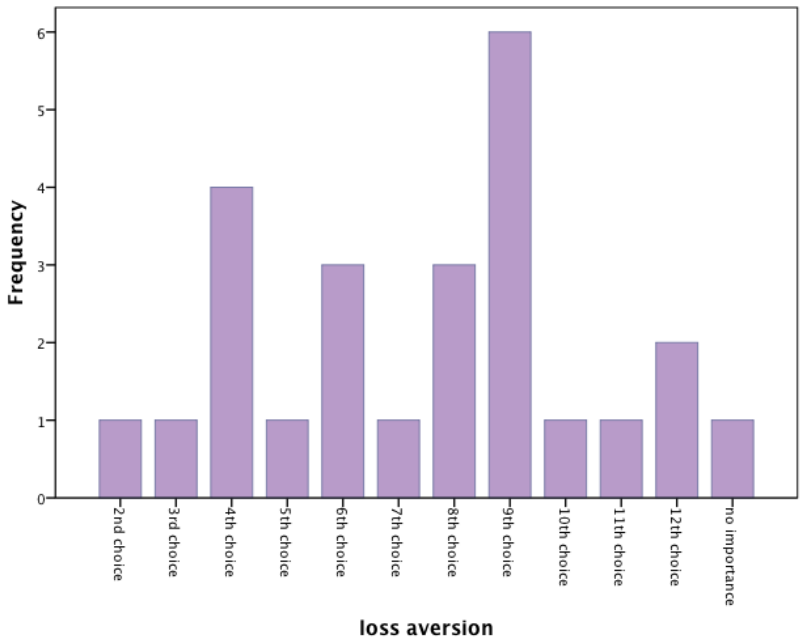
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	2 2nd choice	**1**	**3.7**	**4.0**	**4.0**
	4 4th choice	**2**	**7.4**	**8.0**	**12.0**
	6 6th choice	**6**	**22.2**	**24.0**	**36.0**
	7 7th choice	**5**	**18.5**	**20.0**	**56.0**
	8 8th choice	**5**	**18.5**	**20.0**	**76.0**
	9 9th choice	**3**	**11.1**	**12.0**	**88.0**
	10 10th choice	**1**	**3.7**	**4.0**	**92.0**
	11 11th choice	**1**	**3.7**	**4.0**	**96.0**
	13 no importance	**1**	**3.7**	**4.0**	**100.0**
	Total	**25**	**92.6**	**100.0**	
Missing	System	**2**	**7.4**		
Total		**27**	**100.0**		



Loss aversion

loss aversion

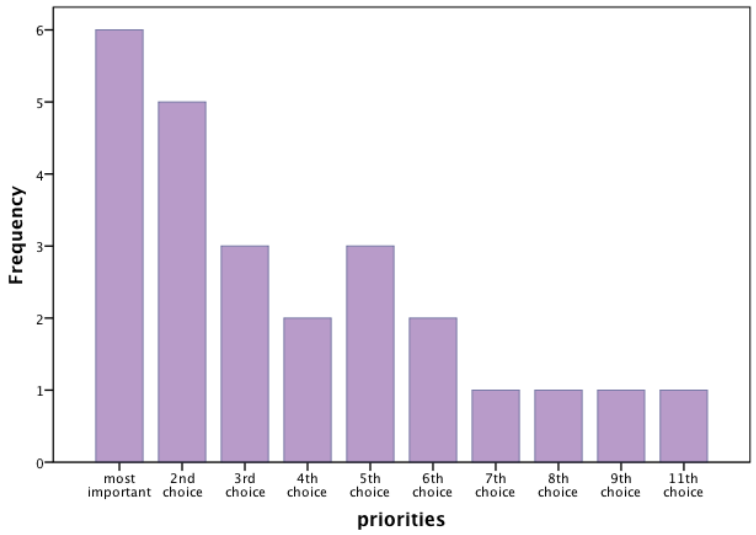
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	2 2nd choice	**1**	**3.7**	**4.0**	**4.0**
	3 3rd choice	**1**	**3.7**	**4.0**	**8.0**
	4 4th choice	**4**	**14.8**	**16.0**	**24.0**
	5 5th choice	**1**	**3.7**	**4.0**	**28.0**
	6 6th choice	**3**	**11.1**	**12.0**	**40.0**
	7 7th choice	**1**	**3.7**	**4.0**	**44.0**
	8 8th choice	**3**	**11.1**	**12.0**	**56.0**
	9 9th choice	**6**	**22.2**	**24.0**	**80.0**
	10 10th choice	**1**	**3.7**	**4.0**	**84.0**
	11 11th choice	**1**	**3.7**	**4.0**	**88.0**
	12 12th choice	**2**	**7.4**	**8.0**	**96.0**
	13 no importance	**1**	**3.7**	**4.0**	**100.0**
	Total	**25**	**92.6**	**100.0**	
Missing	System	**2**	**7.4**		
Total		**27**	**100.0**		



Priorities

priorities

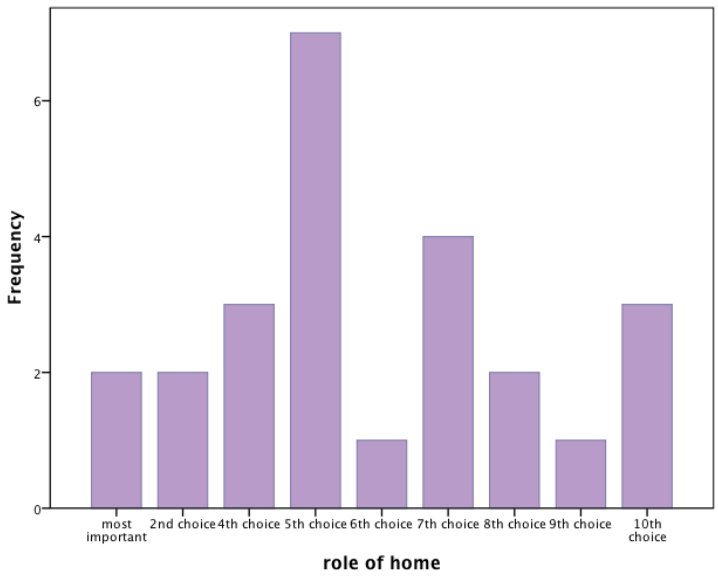
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1 most important	**6**	**22.2**	**24.0**	**24.0**
	2 2nd choice	**5**	**18.5**	**20.0**	**44.0**
	3 3rd choice	**3**	**11.1**	**12.0**	**56.0**
	4 4th choice	**2**	**7.4**	**8.0**	**64.0**
	5 5th choice	**3**	**11.1**	**12.0**	**76.0**
	6 6th choice	**2**	**7.4**	**8.0**	**84.0**
	7 7th choice	**1**	**3.7**	**4.0**	**88.0**
	8 8th choice	**1**	**3.7**	**4.0**	**92.0**
	9 9th choice	**1**	**3.7**	**4.0**	**96.0**
	11 11th choice	**1**	**3.7**	**4.0**	**100.0**
	Total	**25**	**92.6**	**100.0**	
Missing	System	**2**	**7.4**		
Total		**27**	**100.0**		



Role of home

role of home

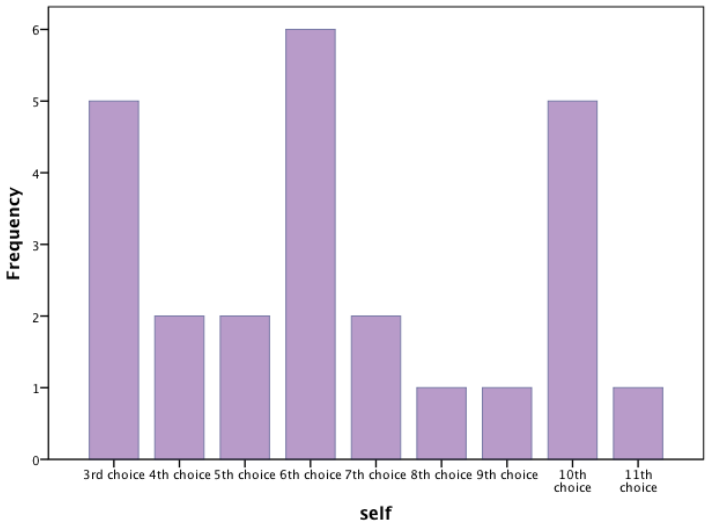
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1 most important	**2**	**7.4**	**8.0**	**8.0**
	2 2nd choice	**2**	**7.4**	**8.0**	**16.0**
	4 4th choice	**3**	**11.1**	**12.0**	**28.0**
	5 5th choice	**7**	**25.9**	**28.0**	**56.0**
	6 6th choice	**1**	**3.7**	**4.0**	**60.0**
	7 7th choice	**4**	**14.8**	**16.0**	**76.0**
	8 8th choice	**2**	**7.4**	**8.0**	**84.0**
	9 9th choice	**1**	**3.7**	**4.0**	**88.0**
	10 10th choice	**3**	**11.1**	**12.0**	**100.0**
	Total	**25**	**92.6**	**100.0**	
Missing	System	**2**	**7.4**		
Total		**27**	**100.0**		



Self

self

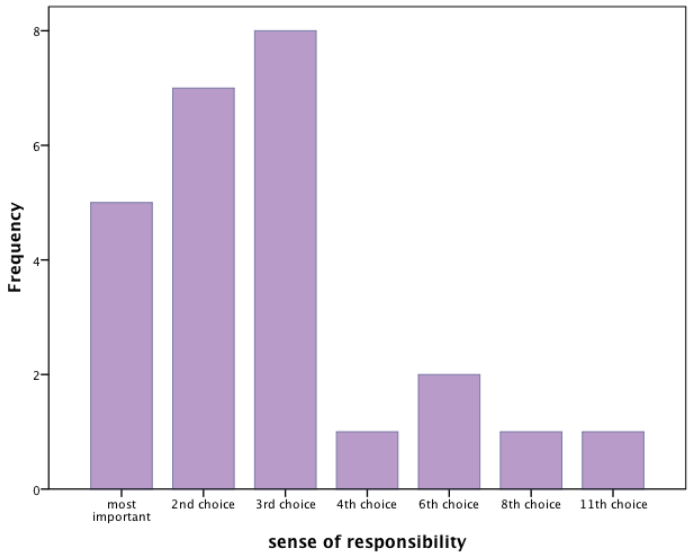
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	3 3rd choice	**5**	**18.5**	**20.0**	**20.0**
	4 4th choice	**2**	**7.4**	**8.0**	**28.0**
	5 5th choice	**2**	**7.4**	**8.0**	**36.0**
	6 6th choice	**6**	**22.2**	**24.0**	**60.0**
	7 7th choice	**2**	**7.4**	**8.0**	**68.0**
	8 8th choice	**1**	**3.7**	**4.0**	**72.0**
	9 9th choice	**1**	**3.7**	**4.0**	**76.0**
	10 10th choice	**5**	**18.5**	**20.0**	**96.0**
	11 11th choice	**1**	**3.7**	**4.0**	**100.0**
	Total	**25**	**92.6**	**100.0**	
Missing	System	**2**	**7.4**		
Total		**27**	**100.0**		



Sense of responsibility

sense of responsibility

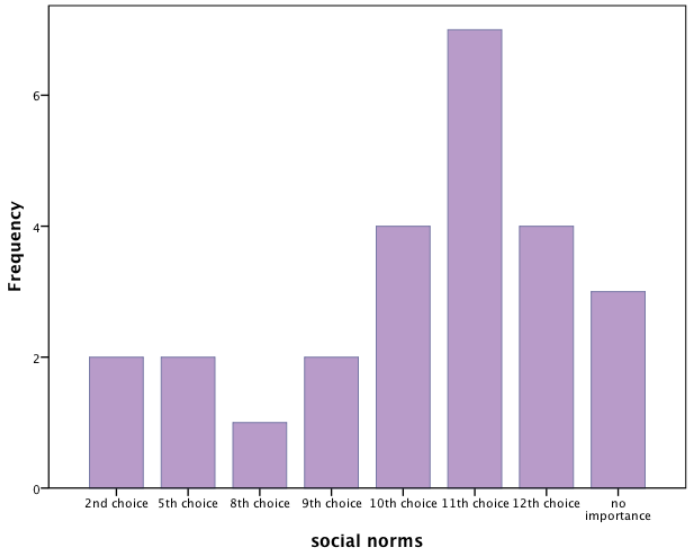
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1 most important	**5**	**18.5**	**20.0**	**20.0**
	2 2nd choice	**7**	**25.9**	**28.0**	**48.0**
	3 3rd choice	**8**	**29.6**	**32.0**	**80.0**
	4 4th choice	**1**	**3.7**	**4.0**	**84.0**
	6 6th choice	**2**	**7.4**	**8.0**	**92.0**
	8 8th choice	**1**	**3.7**	**4.0**	**96.0**
	11 11th choice	**1**	**3.7**	**4.0**	**100.0**
	Total	**25**	**92.6**	**100.0**	
Missing	System	**2**	**7.4**		
Total		**27**	**100.0**		



Social norms

social norms

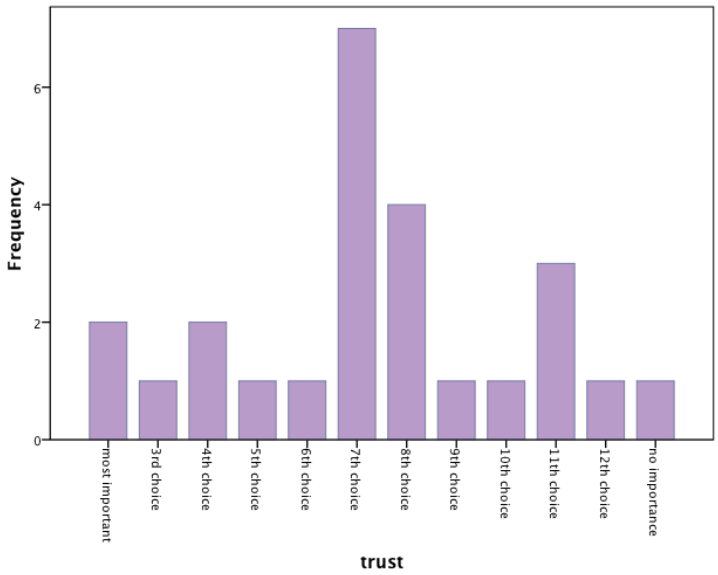
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	2 2nd choice	**2**	**7.4**	**8.0**	**8.0**
	5 5th choice	**2**	**7.4**	**8.0**	**16.0**
	8 8th choice	**1**	**3.7**	**4.0**	**20.0**
	9 9th choice	**2**	**7.4**	**8.0**	**28.0**
	10 10th choice	**4**	**14.8**	**16.0**	**44.0**
	11 11th choice	**7**	**25.9**	**28.0**	**72.0**
	12 12th choice	**4**	**14.8**	**16.0**	**88.0**
	13 no importance	**3**	**11.1**	**12.0**	**100.0**
	Total	**25**	**92.6**	**100.0**	
Missing	System	**2**	**7.4**		
Total		**27**	**100.0**		



Trust

trust

		Frequency	Percent	Valid Percent	Cumulative Percent
	1 most important	**2**	**7.4**	**8.0**	**8.0**
	3 3rd choice	**1**	**3.7**	**4.0**	**12.0**
	4 4th choice	**2**	**7.4**	**8.0**	**20.0**
	5 5th choice	**1**	**3.7**	**4.0**	**24.0**
	6 6th choice	**1**	**3.7**	**4.0**	**28.0**
	7 7th choice	**7**	**25.9**	**28.0**	**56.0**
Valid	8 8th choice	**4**	**14.8**	**16.0**	**72.0**
	9 9th choice	**1**	**3.7**	**4.0**	**76.0**
	10 10th choice	**1**	**3.7**	**4.0**	**80.0**
	11 11th choice	**3**	**11.1**	**12.0**	**92.0**
	12 12th choice	**1**	**3.7**	**4.0**	**96.0**
	13 no importance	**1**	**3.7**	**4.0**	**100.0**
	Total	**25**	**92.6**	**100.0**	
Missing	System	**2**	**7.4**		
Total		**27**	**100.0**		



Rankings – Range, minimum, maximum, and mean

Descriptive Statistics

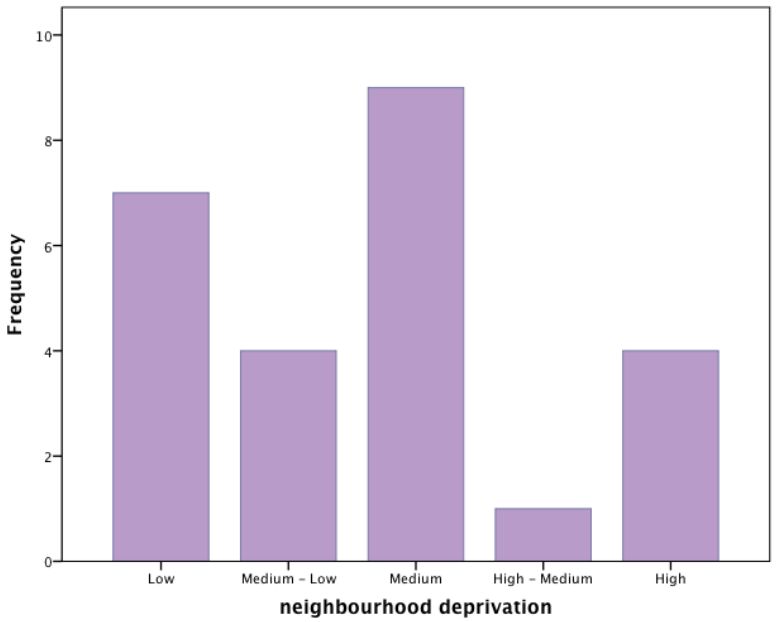
	N	Range	Minimum	Maximum	Mean	Std. Deviation
attitudes, beliefs and values	**25**	**9**	**1**	**10**	**3.44**	**2.663**
decision making	**25**	**11**	**2**	**13**	**6.76**	**2.919**
expectations of the outcomes	**25**	**11**	**1**	**12**	**5.68**	**2.810**
fashions and tastes	**25**	**12**	**1**	**13**	**10.16**	**3.275**
locus of control	**25**	**11**	**2**	**13**	**7.28**	**2.283**
loss aversion	**25**	**11**	**2**	**13**	**7.48**	**3.002**
priorities	**25**	**10**	**1**	**11**	**3.80**	**2.784**
role of home	**25**	**9**	**1**	**10**	**5.68**	**2.641**
self	**25**	**8**	**3**	**11**	**6.44**	**2.663**
sense of responsibility	**25**	**10**	**1**	**11**	**3.12**	**2.369**
social norms	**25**	**11**	**2**	**13**	**9.76**	**3.113**
trust	**25**	**12**	**1**	**13**	**7.28**	**3.129**
Valid N (listwise)	**25**					

5. PHYSICAL

Neighbourhood deprivation

neighbourhood deprivation

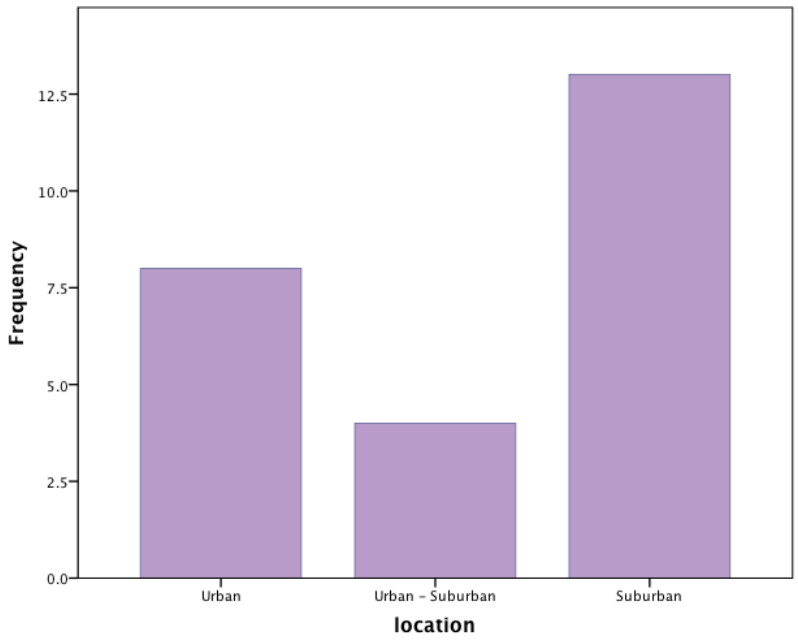
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1 Low	**7**	**25.9**	**28.0**	**28.0**
	2 Medium - Low	**4**	**14.8**	**16.0**	**44.0**
	3 Medium	**9**	**33.3**	**36.0**	**80.0**
	4 High - Medium	**1**	**3.7**	**4.0**	**84.0**
	5 High	**4**	**14.8**	**16.0**	**100.0**
	Total	**25**	**92.6**	**100.0**	
Missing	System	**2**	**7.4**		
Total		**27**	**100.0**		



Location

location

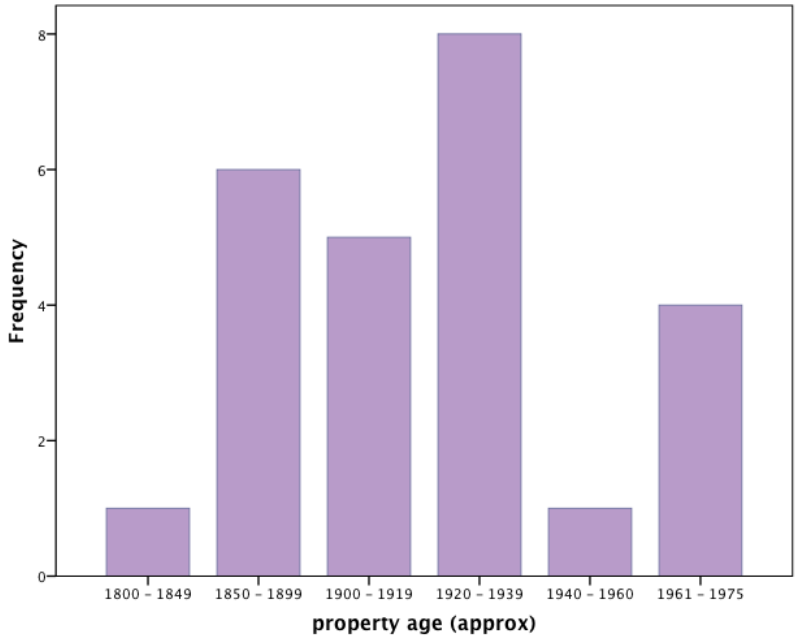
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1 Urban	**8**	**29.6**	**32.0**	**32.0**
	2 Urban - Suburban	**4**	**14.8**	**16.0**	**48.0**
	3 Suburban	**13**	**48.1**	**52.0**	**100.0**
	Total	**25**	**92.6**	**100.0**	
Missing	System	**2**	**7.4**		
Total		**27**	**100.0**		



Property ages and construction type

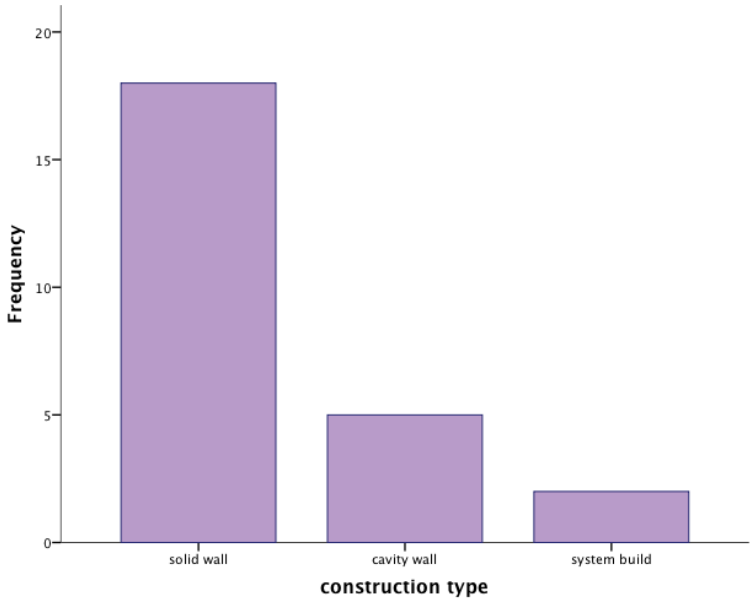
property age (approx)

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1 1800 - 1849	**1**	**3.7**	**4.0**	**4.0**
	2 1850 - 1899	**6**	**22.2**	**24.0**	**28.0**
	3 1900 - 1919	**5**	**18.5**	**20.0**	**48.0**
	4 1920 - 1939	**8**	**29.6**	**32.0**	**80.0**
	5 1940 - 1960	**1**	**3.7**	**4.0**	**84.0**
	6 1961 - 1975	**4**	**14.8**	**16.0**	**100.0**
	Total	**25**	**92.6**	**100.0**	
Missing	System	**2**	**7.4**		
Total		**27**	**100.0**		



construction type

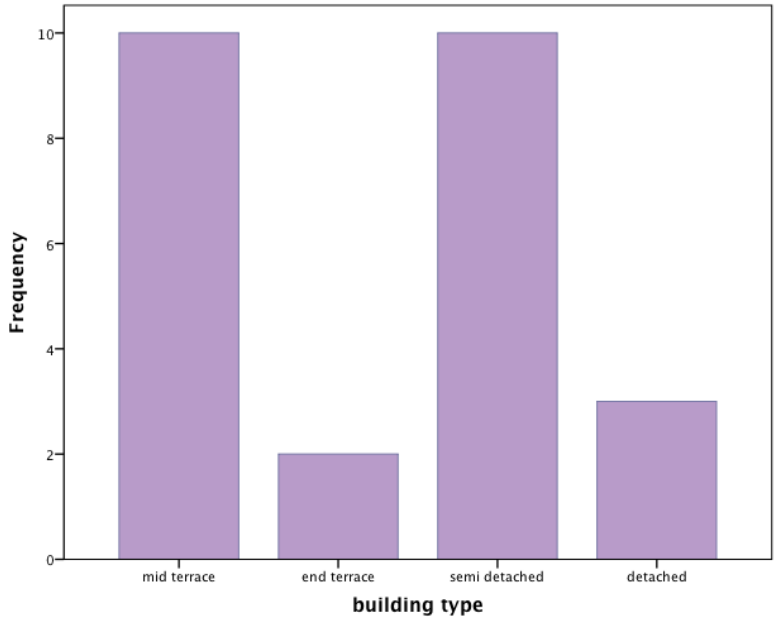
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1 solid wall	**18**	**66.7**	**72.0**	**72.0**
	2 cavity wall	**5**	**18.5**	**20.0**	**92.0**
	4 system build	**2**	**7.4**	**8.0**	**100.0**
	Total	**25**	**92.6**	**100.0**	
Missing	System	**2**	**7.4**		
Total		**27**	**100.0**		



Building type

building type

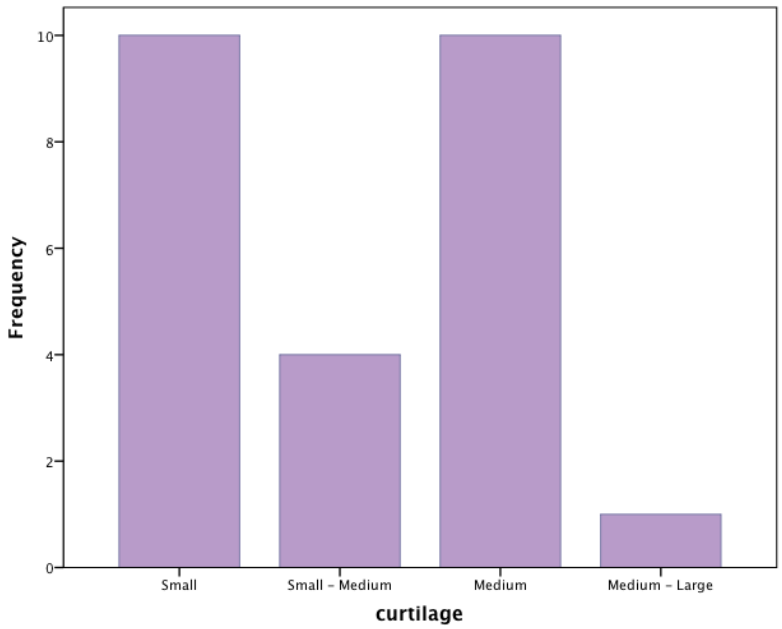
		Frequency	Percent	Valid Percent	Cumulative Percent
	1 mid terrace	**10**	**37.0**	**40.0**	**40.0**
	2 end terrace	**2**	**7.4**	**8.0**	**48.0**
Valid	3 semi detached	**10**	**37.0**	**40.0**	**88.0**
	4 detached	**3**	**11.1**	**12.0**	**100.0**
	Total	**25**	**92.6**	**100.0**	
Missing	System	**2**	**7.4**		
Total		**27**	**100.0**		



Curtilage

curtilage

		Frequency	Percent	Valid Percent	Cumulative Percent
	1 Small	**10**	**37.0**	**40.0**	**40.0**
	2 Small - Medium	**4**	**14.8**	**16.0**	**56.0**
Valid	3 Medium	**10**	**37.0**	**40.0**	**96.0**
	4 Medium - Large	**1**	**3.7**	**4.0**	**100.0**
	Total	**25**	**92.6**	**100.0**	
Missing	System	**2**	**7.4**		
Total		**27**	**100.0**		



growown * curtilage Crosstabulation

Count

		curtilage				Total
		1 Small	2 Small - Medium	3 Medium	4 Medium - Large	
growown	0 No	**2**	**2**	**3**	**1**	**8**
	1 Yes	**8**	**1**	**7**	**0**	**16**
Total		**10**	**3**	**10**	**1**	**24**

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)	Point Probability
Pearson Chi-Square	**4.350**[a]	**3**	**.226**	**.220**		
Likelihood Ratio	**4.508**	**3**	**.212**	**.288**		
Fisher's Exact Test	**4.104**			**.220**		
Linear-by-Linear Association	**.985**[b]	**1**	**.321**	**.399**	**.220**	**.105**
N of Valid Cases	**24**					

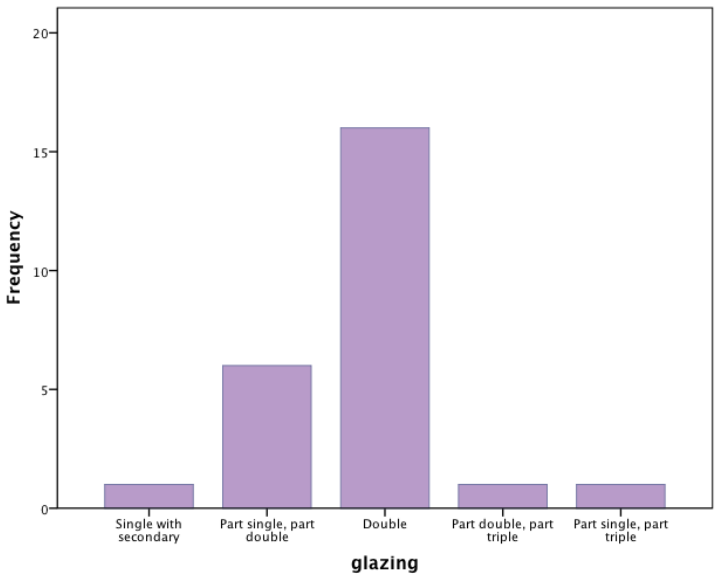
a. 6 cells (75.0%) have expected count less than 5. The minimum expected count is .33.

b. The standardized statistic is -.993.

Glazing

glazing

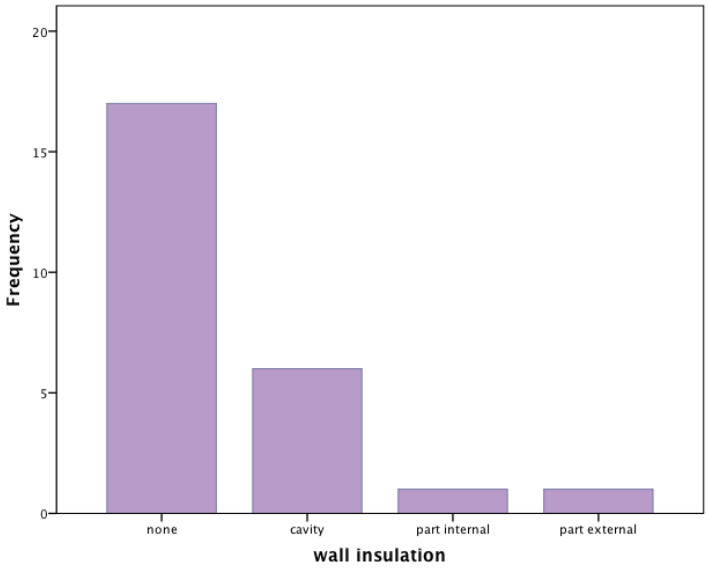
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	2 Single with secondary	**1**	**3.7**	**4.0**	**4.0**
	3 Part single, part double	**6**	**22.2**	**24.0**	**28.0**
	4 Double	**16**	**59.3**	**64.0**	**92.0**
	5 Part double, part triple	**1**	**3.7**	**4.0**	**96.0**
	6 Part single, part triple	**1**	**3.7**	**4.0**	**100.0**
	Total	**25**	**92.6**	**100.0**	
Missing	System	**2**	**7.4**		
Total		**27**	**100.0**		



Wall insulation

wall insulation

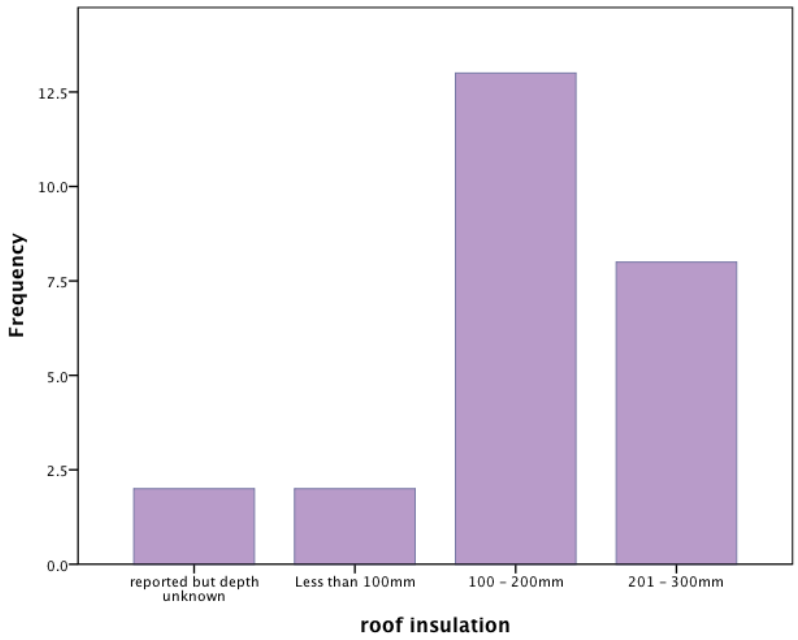
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1 none	**17**	**63.0**	**68.0**	**68.0**
	2 cavity	**6**	**22.2**	**24.0**	**92.0**
	3 part internal	**1**	**3.7**	**4.0**	**96.0**
	6 part external	**1**	**3.7**	**4.0**	**100.0**
	Total	**25**	**92.6**	**100.0**	
Missing	System	**2**	**7.4**		
Total		**27**	**100.0**		



Roof insulation

roof insulation

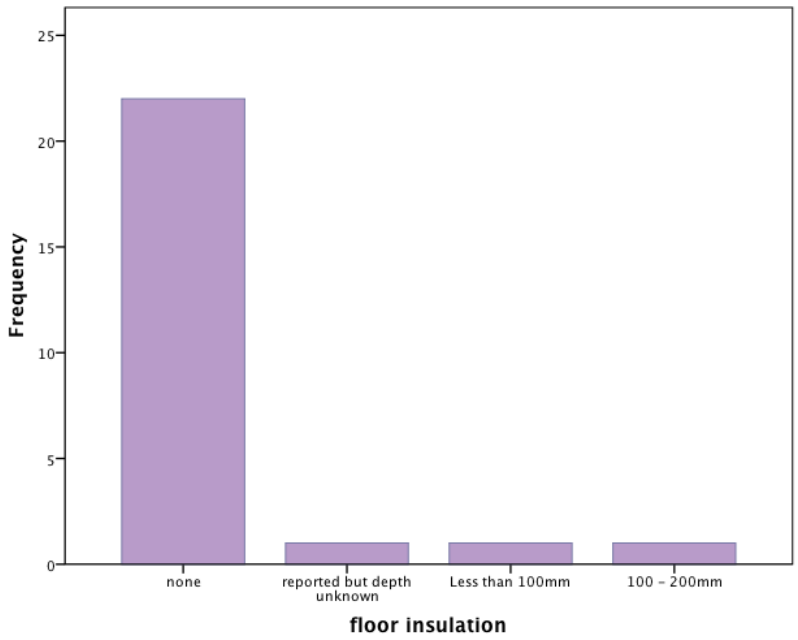
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	2 reported but depth unknown	**2**	**7.4**	**8.0**	**8.0**
	3 Less than 100mm	**2**	**7.4**	**8.0**	**16.0**
	4 100 - 200mm	**13**	**48.1**	**52.0**	**68.0**
	5 201 - 300mm	**8**	**29.6**	**32.0**	**100.0**
	Total	**25**	**92.6**	**100.0**	
Missing	System	**2**	**7.4**		
Total		**27**	**100.0**		



Floor insulation

floor insulation

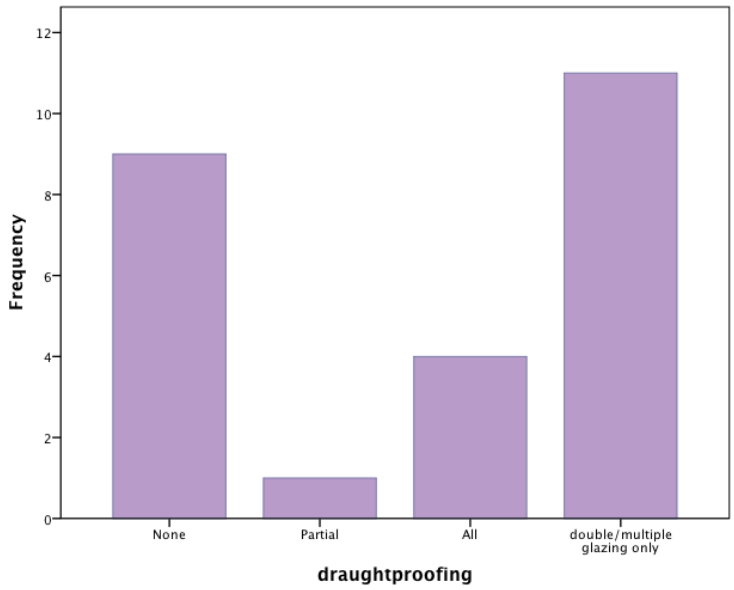
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1 none	**22**	**81.5**	**88.0**	**88.0**
	2 reported but depth unknown	**1**	**3.7**	**4.0**	**92.0**
	3 Less than 100mm	**1**	**3.7**	**4.0**	**96.0**
	4 100 - 200mm	**1**	**3.7**	**4.0**	**100.0**
	Total	**25**	**92.6**	**100.0**	
Missing	System	**2**	**7.4**		
Total		**27**	**100.0**		



Draughtproofing

draughtproofing

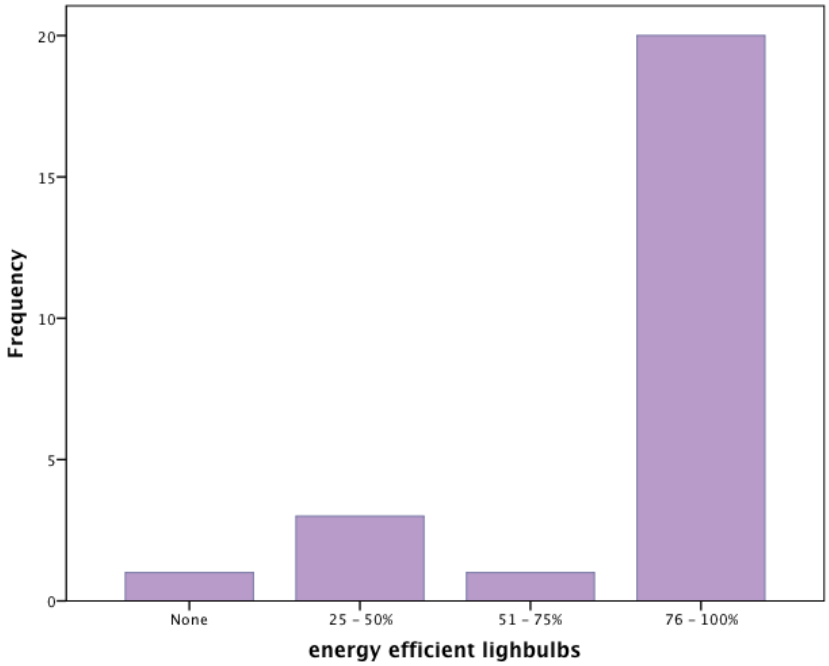
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1 None	**9**	**33.3**	**36.0**	**36.0**
	2 Partial	**1**	**3.7**	**4.0**	**40.0**
	4 All	**4**	**14.8**	**16.0**	**56.0**
	5 double/multiple glazing only	**11**	**40.7**	**44.0**	**100.0**
	Total	**25**	**92.6**	**100.0**	
Missing	System	**2**	**7.4**		
Total		**27**	**100.0**		



Energy efficient lightbulbs

energy efficient lighbulbs

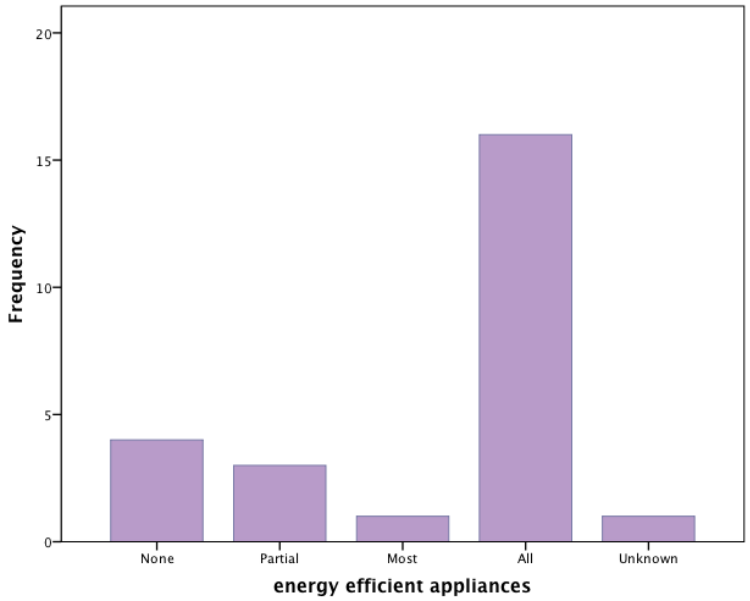
		Frequency	Percent	Valid Percent	Cumulative Percent
	1 None	**1**	**3.7**	**4.0**	**4.0**
	3 25 - 50%	**3**	**11.1**	**12.0**	**16.0**
Valid	4 51 - 75%	**1**	**3.7**	**4.0**	**20.0**
	5 76 - 100%	**20**	**74.1**	**80.0**	**100.0**
	Total	**25**	**92.6**	**100.0**	
Missing	System	**2**	**7.4**		
Total		**27**	**100.0**		



Energy efficient appliances

energy efficient appliances

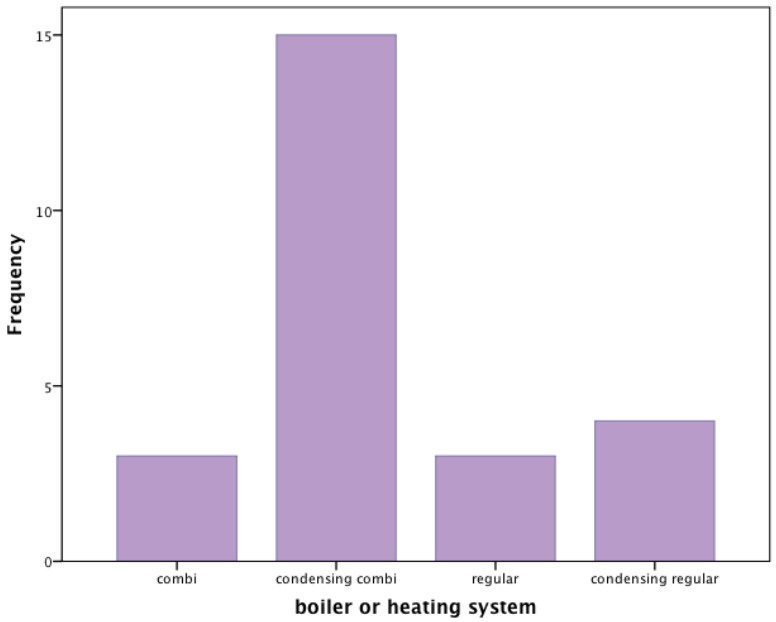
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1 None	**4**	**14.8**	**16.0**	**16.0**
	2 Partial	**3**	**11.1**	**12.0**	**28.0**
	3 Most	**1**	**3.7**	**4.0**	**32.0**
	4 All	**16**	**59.3**	**64.0**	**96.0**
	5 Unknown	**1**	**3.7**	**4.0**	**100.0**
	Total	**25**	**92.6**	**100.0**	
Missing	System	**2**	**7.4**		
Total		**27**	**100.0**		



Primary heating system

boiler or heating system

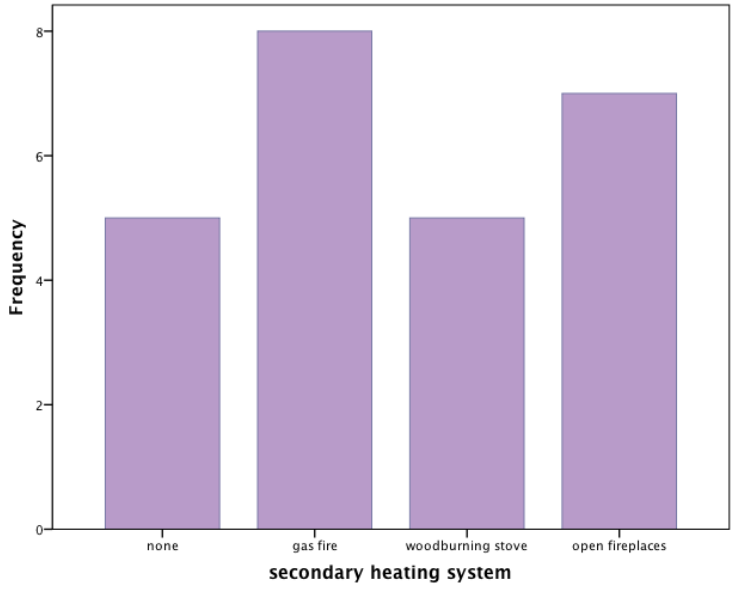
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1 combi	**3**	**11.1**	**12.0**	**12.0**
	2 condensing combi	**15**	**55.6**	**60.0**	**72.0**
	3 regular	**3**	**11.1**	**12.0**	**84.0**
	4 condensing regular	**4**	**14.8**	**16.0**	**100.0**
	Total	**25**	**92.6**	**100.0**	
Missing	System	**2**	**7.4**		
Total		**27**	**100.0**		



Secondary heating system

secondary heating system

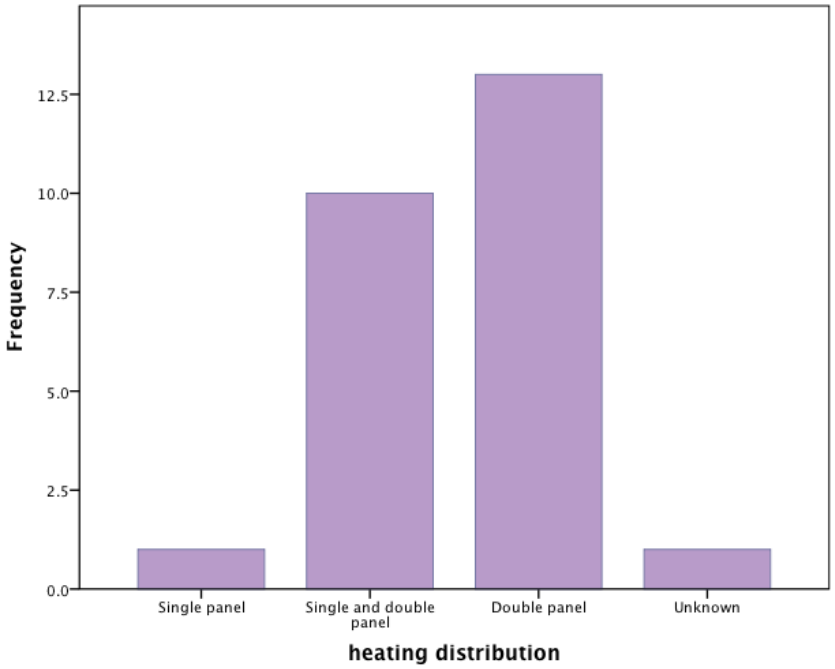
		Frequency	Percent	Valid Percent	Cumulative Percent
	0 none	**5**	**18.5**	**20.0**	**20.0**
	1 gas fire	**8**	**29.6**	**32.0**	**52.0**
Valid	2 woodburning stove	**5**	**18.5**	**20.0**	**72.0**
	3 open fireplaces	**7**	**25.9**	**28.0**	**100.0**
	Total	**25**	**92.6**	**100.0**	
Missing	System	**2**	**7.4**		
Total		**27**	**100.0**		



Heating distribution systems

heating distribution

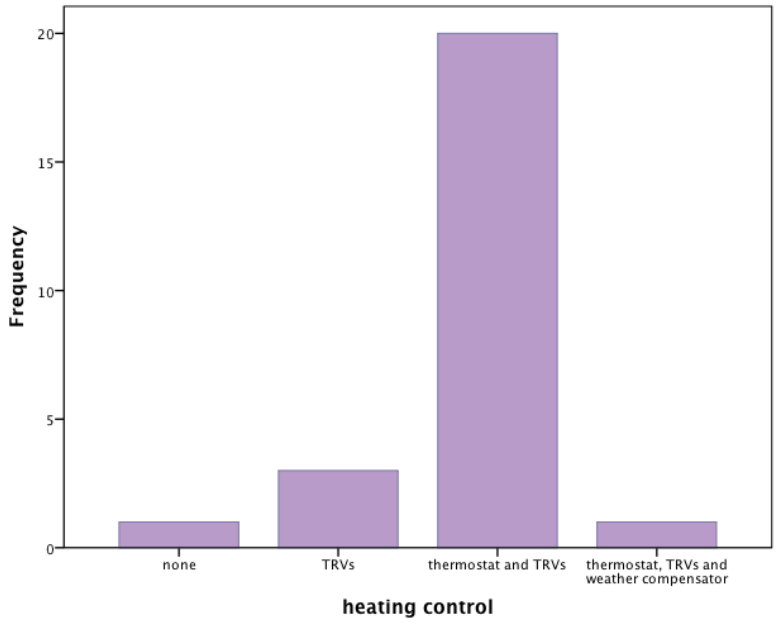
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1 Single panel	**1**	**3.7**	**4.0**	**4.0**
	2 Single and double panel	**10**	**37.0**	**40.0**	**44.0**
	4 Double panel	**13**	**48.1**	**52.0**	**96.0**
	7 Unknown	**1**	**3.7**	**4.0**	**100.0**
	Total	**25**	**92.6**	**100.0**	
Missing	System	**2**	**7.4**		
Total		**27**	**100.0**		



Heating controls

heating control

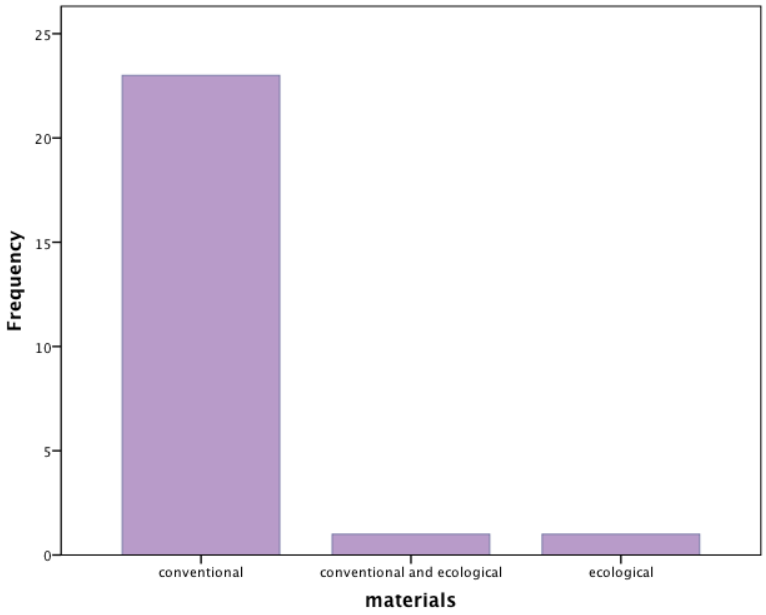
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1 none	**1**	**3.7**	**4.0**	**4.0**
	3 TRVs	**3**	**11.1**	**12.0**	**16.0**
	4 thermostat and TRVs	**20**	**74.1**	**80.0**	**96.0**
	5 thermostat, TRVs and weather compensator	**1**	**3.7**	**4.0**	**100.0**
	Total	**25**	**92.6**	**100.0**	
Missing	System	**2**	**7.4**		
Total		**27**	**100.0**		



Type of materials

materials

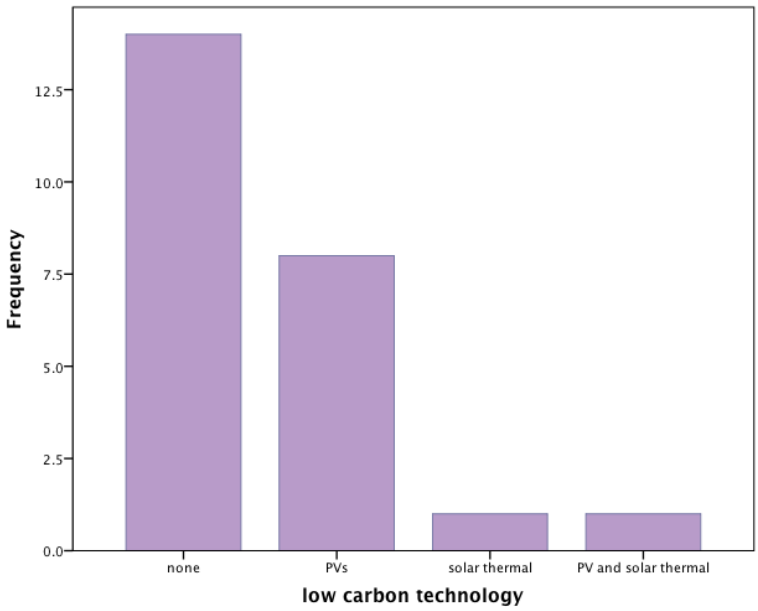
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1 conventional	**23**	**85.2**	**92.0**	**92.0**
	2 conventional and ecological	**1**	**3.7**	**4.0**	**96.0**
	3 ecological	**1**	**3.7**	**4.0**	**100.0**
	Total	**25**	**92.6**	**100.0**	
Missing	System	**2**	**7.4**		
Total		**27**	**100.0**		



Low carbon technology

low carbon technology

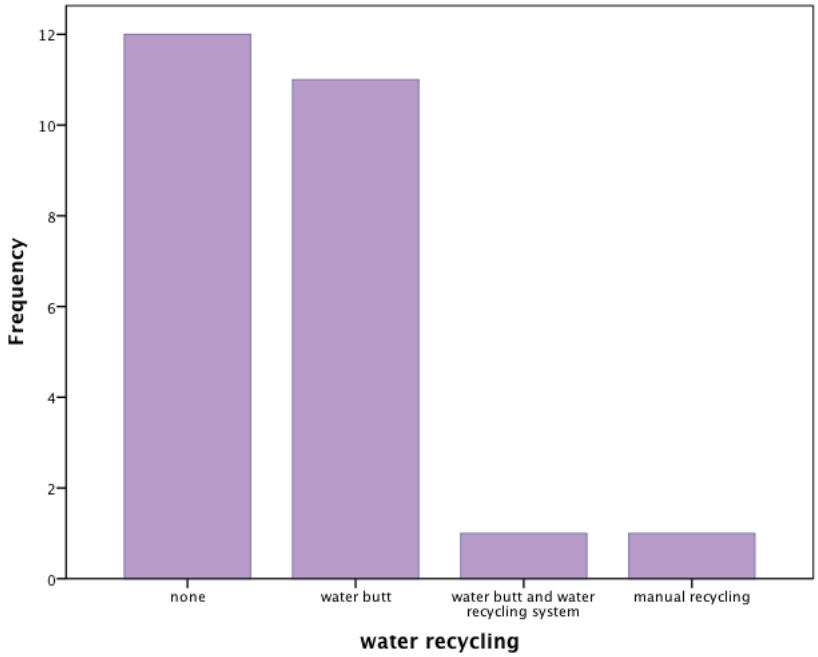
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1 none	**14**	**51.9**	**58.3**	**58.3**
	2 PVs	**8**	**29.6**	**33.3**	**91.7**
	3 solar thermal	**1**	**3.7**	**4.2**	**95.8**
	4 PV and solar thermal	**1**	**3.7**	**4.2**	**100.0**
	Total	**24**	**88.9**	**100.0**	
Missing	System	**3**	**11.1**		
Total		**27**	**100.0**		



Water recycling

water recycling

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1 none	**12**	**44.4**	**48.0**	**48.0**
	2 water butt	**11**	**40.7**	**44.0**	**92.0**
	4 water butt and water recycling system	**1**	**3.7**	**4.0**	**96.0**
	6 manual recycling	**1**	**3.7**	**4.0**	**100.0**
	Total	**25**	**92.6**	**100.0**	
Missing	System	**2**	**7.4**		
Total		**27**	**100.0**		



Airtightness

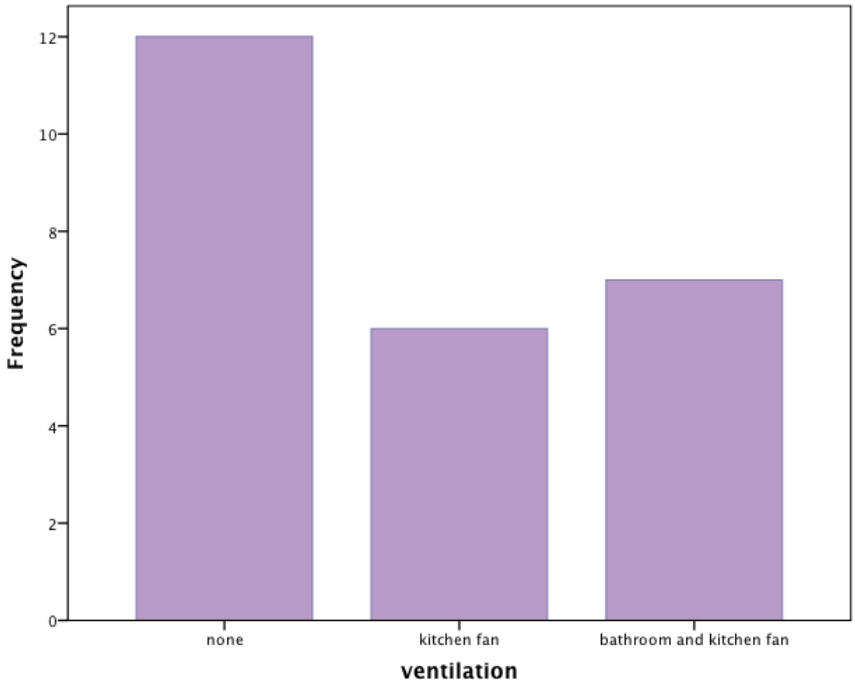
airtightness

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1 none	**25**	**92.6**	**100.0**	**100.0**
Missing	System	**2**	**7.4**		
Total		**27**	**100.0**		

Ventilation

ventilation

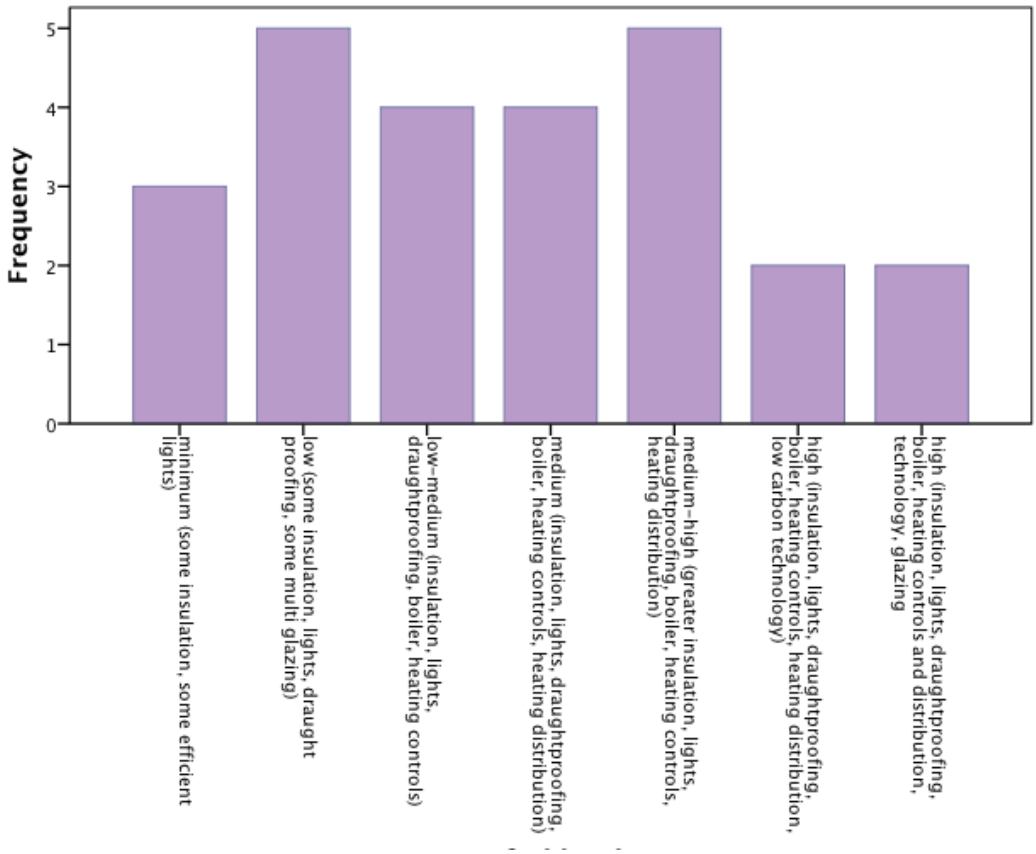
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1 none	**12**	**44.4**	**48.0**	**48.0**
	2 kitchen fan	**6**	**22.2**	**24.0**	**72.0**
	4 bathroom and kitchen fan	**7**	**25.9**	**28.0**	**100.0**
	Total	**25**	**92.6**	**100.0**	
Missing	System	**2**	**7.4**		
Total		**27**	**100.0**		


12
10
8
6
4
2
0
Frequency
none
kitchen fan
bathroom and kitchen fan
ventilation

Energy efficiency refurbishment levels

refurblevel

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	2 minimum (some insulation, some efficient lights)	**3**	**11.1**	**12.0**	**12.0**
	3 low (some insulation, lights, draught proofing, some multi glazing)	**5**	**18.5**	**20.0**	**32.0**
	4 low-medium (insulation, lights, draughtproofing, boiler, heating controls)	**4**	**14.8**	**16.0**	**48.0**
	5 medium (insulation, lights, draughtproofing, boiler, heating controls, heating distribution)	**4**	**14.8**	**16.0**	**64.0**
	6 medium-high (greater insulation, lights, draughtproofing, boiler, heating controls, heating distribution)	**5**	**18.5**	**20.0**	**84.0**
	7 high (insulation, lights, draughtproofing, boiler, heating controls, heating distribution, low carbon technology)	**2**	**7.4**	**8.0**	**92.0**
	8 high (insulation, lights, draughtproofing, boiler, heating controls and distribution, technology, glazing)	**2**	**7.4**	**8.0**	**100.0**
	Total	**25**	**92.6**	**100.0**	
Missing	System	**2**	**7.4**		
Total		**27**	**100.0**		


Frequency
0
1
2
3
4
5
minimum (some insulation, some efficient lights)
low (some insulation, lights, draught proofing, some multi glazing)
low-medium (insulation, lights, draughtproofing, boiler, heating controls)
medium (insulation, lights, draughtproofing, boiler, heating controls, heating distribution)
medium-high (greater insulation, lights, draughtproofing, boiler, heating controls, heating distribution)
high (insulation, lights, draughtproofing, boiler, heating controls, heating distribution, low carbon technology)
high (insulation, lights, draughtproofing, boiler, heating controls and distribution, technology, glazing

NON-PARAMETRIC ANALYSIS

1. Chi-Squared Test

Construction type vs. Refurbishment level

construction type * refurblevel Crosstabulation

Count

		refurblevel							Total
		2 minimum (some insulation, some efficient lights)	3 low (some insulation, lights, draught proofing, some multi glazing)	4 low-medium (insulation, lights, draughtproofing, boiler, heating controls)	5 medium (insulation, lights, draughtproofing, boiler, heating controls, heating distribution)	6 medium-high (greater insulation, lights, draughtproofing, boiler, heating controls, heating distribution)	7 high (insulation, lights, draughtproofing, boiler, heating controls, heating distribution, low carbon technology)	8 high (insulation, lights, draughtproofing, boiler, heating controls and distribution, technology, glazing)	
construction type	1 solid wall	**3**	**4**	**4**	**2**	**4**	**1**	**0**	**18**
	2 cavity wall	**0**	**0**	**0**	**2**	**1**	**0**	**2**	**5**
	4 system build	**0**	**1**	**0**	**0**	**0**	**1**	**0**	**2**
Total		**3**	**5**	**4**	**4**	**5**	**2**	**2**	**25**

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)	Point Probability
Pearson Chi-Square	**20.444**[a]	**12**	**.059**	**.041**		
Likelihood Ratio	**19.698**	**12**	**.073**	**.045**		
Fisher's Exact Test	**15.060**			**.051**		
Linear-by-Linear Association	**1.841**[b]	**1**	**.175**	**.186**	**.106**	**.022**
N of Valid Cases	**25**					

a. 21 cells (100.0%) have expected count less than 5. The minimum expected count is .16.

b. The standardized statistic is 1.357.

Energy efficiency refurbishment level vs. building type

building type * refurblevel Crosstabulation

Count

		refurblevel							Total
		2 minimum (some insulation, some efficient lights)	3 low (some insulation, lights, draught proofing, some multi glazing)	4 low-medium (insulation, lights, draughtproofing, boiler, heating controls)	5 medium (insulation, lights, draughtproofing, boiler, heating controls, heating distribution)	6 medium-high (greater insulation, lights, draughtproofing, boiler, heating controls, heating distribution)	7 high (insulation, lights, draughtproofing, boiler, heating controls, heating distribution, low carbon technology)	8 high (insulation, lights, draughtproofing, boiler, heating controls and distribution, technology, glazing)	
building type	1 mid terrace	**3**	**3**	**2**	**1**	**0**	**1**	**0**	**10**
	2 end terrace	**0**	**0**	**0**	**0**	**2**	**0**	**0**	**2**
	3 semi detached	**0**	**2**	**2**	**2**	**3**	**1**	**0**	**10**
	4 detached	**0**	**0**	**0**	**1**	**0**	**0**	**2**	**3**
Total		**3**	**5**	**4**	**4**	**5**	**2**	**2**	**25**

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)	Point Probability
Pearson Chi-Square	**32.875**[a]	**18**	**.017**	**.013**		
Likelihood Ratio	**29.380**	**18**	**.044**	**.038**		
Fisher's Exact Test	**21.487**			**.064**		
Linear-by-Linear Association	**7.706**[b]	**1**	**.006**	**.004**	**.002**	**.001**
N of Valid Cases	**25**					

a. 28 cells (100.0%) have expected count less than 5. The minimum expected count is .16.

b. The standardized statistic is 2.776.

Primary heating system vs. low carbon technology

boiler or heating system * low carbon technology Crosstabulation

Count

		low carbon technology				Total
		1 none	2 PVs	3 solar thermal	4 PV and solar thermal	
boiler or heating system	1 combi	**3**	**0**	**0**	**0**	**3**
	2 condensing combi	**11**	**4**	**0**	**0**	**15**
	3 regular	**0**	**1**	**0**	**1**	**2**
	4 condensing regular	**0**	**3**	**1**	**0**	**4**
Total		**14**	**8**	**1**	**1**	**24**

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)	Point Probability
Pearson Chi-Square	**24.421**[a]	**9**	**.004**	**.005**		
Likelihood Ratio	**20.713**	**9**	**.014**	**.002**		
Fisher's Exact Test	**18.697**			**.003**		
Linear-by-Linear Association	**9.057**[b]	**1**	**.003**	**.002**	**.002**	**.002**
N of Valid Cases	**24**					

a. 14 cells (87.5%) have expected count less than 5. The minimum expected count is .08.

b. The standardized statistic is 3.010.

Construction type vs. wall insulation

construction type * wall insulation Crosstabulation

Count

		wall insulation				Total
		1 none	2 cavity	3 part internal	6 part external	
construction type	1 solid wall	**17**	**0**	**0**	**1**	**18**
	2 cavity wall	**0**	**5**	**0**	**0**	**5**
	4 system build	**0**	**1**	**1**	**0**	**2**
Total		**17**	**6**	**1**	**1**	**25**

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)	Point Probability
Pearson Chi-Square	**35.417**[a]	**6**	**.000**	**.000**		
Likelihood Ratio	**32.617**	**6**	**.000**	**.000**		
Fisher's Exact Test	**28.223**			**.000**		
Linear-by-Linear Association	**3.208**[b]	**1**	**.073**	**.086**	**.086**	**.003**
N of Valid Cases	**25**					

a. 11 cells (91.7%) have expected count less than 5. The minimum expected count is .08.

b. The standardized statistic is 1.791.

Refurbishment level vs. energy efficiency appliances

energy efficient appliances * refurblevel Crosstabulation

Count

		refurblevel							Total
		2 minimum (some insulation, some efficient lights)	3 low (some insulation, lights, draught proofing, some multi glazing)	4 low-medium (insulation, lights, draughtproofing, boiler, heating controls)	5 medium (insulation, lights, draughtproofing, boiler, heating controls, heating distribution)	6 medium-high (greater insulation, lights, draughtproofing, boiler, heating controls, heating distribution)	7 high (insulation, lights, draughtproofing, boiler, heating controls, heating distribution, low carbon technology)	8 high (insulation, lights, draughtproofing, boiler, heating controls and distribution, technology, glazing)	
energy efficient appliances	1 None	**1**	**1**	**2**	**0**	**0**	**0**	**0**	**4**
	2 Partial	**0**	**0**	**0**	**3**	**0**	**0**	**0**	**3**
	3 Most	**0**	**0**	**0**	**1**	**0**	**0**	**0**	**1**
	4 All	**2**	**3**	**2**	**0**	**5**	**2**	**2**	**16**
	5 Unknown	**0**	**1**	**0**	**0**	**0**	**0**	**0**	**1**
Total		**3**	**5**	**4**	**4**	**5**	**2**	**2**	**25**

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)	Point Probability
Pearson Chi-Square	**35.104**[a]	**24**	**.067**	**.045**		
Likelihood Ratio	**31.173**	**24**	**.149**	**.014**		
Fisher's Exact Test	**30.061**			**.023**		
Linear-by-Linear Association	**1.430**[b]	**1**	**.232**	**.248**	**.128**	**.018**
N of Valid Cases	**25**					

a. 35 cells (100.0%) have expected count less than 5. The minimum expected count is .08.

b. The standardized statistic is 1.196.

Energy efficiency refurbishment level vs. energy efficient lighting

energy efficient appliances * refurblevel Crosstabulation

Count

		refurblevel							Total
		2 minimum (some insulation, some efficient lights)	3 low (some insulation, lights, draught proofing, some multi glazing)	4 low-medium (insulation, lights, draughtproofing, boiler, heating controls)	5 medium (insulation, lights, draughtproofing, boiler, heating controls, heating distribution)	6 medium-high (greater insulation, lights, draughtproofing, boiler, heating controls, heating distribution)	7 high (insulation, lights, draughtproofing, boiler, heating controls, heating distribution, low carbon technology)	8 high (insulation, lights, draughtproofing, boiler, heating controls and distribution, technology, glazing)	
energy efficient appliances	1 None	**1**	**1**	**2**	**0**	**0**	**0**	**0**	**4**
	2 Partial	**0**	**0**	**0**	**3**	**0**	**0**	**0**	**3**
	3 Most	**0**	**0**	**0**	**1**	**0**	**0**	**0**	**1**
	4 All	**2**	**3**	**2**	**0**	**5**	**2**	**2**	**16**
	5 Unknown	**0**	**1**	**0**	**0**	**0**	**0**	**0**	**1**
Total		**3**	**5**	**4**	**4**	**5**	**2**	**2**	**25**

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)	Point Probability
Pearson Chi-Square	**35.104**[a]	**24**	**.067**	**.045**		
Likelihood Ratio	**31.173**	**24**	**.149**	**.014**		
Fisher's Exact Test	**30.061**			**.023**		
Linear-by-Linear Association	**1.430**[b]	**1**	**.232**	**.248**	**.128**	**.018**
N of Valid Cases	**25**					

a. 35 cells (100.0%) have expected count less than 5. The minimum expected count is .08.

b. The standardized statistic is 1.196.

Energy efficiency refurbishment level vs. neighbourhood deprivation

neighbourhood deprivation * refurblevel Crosstabulation

Count

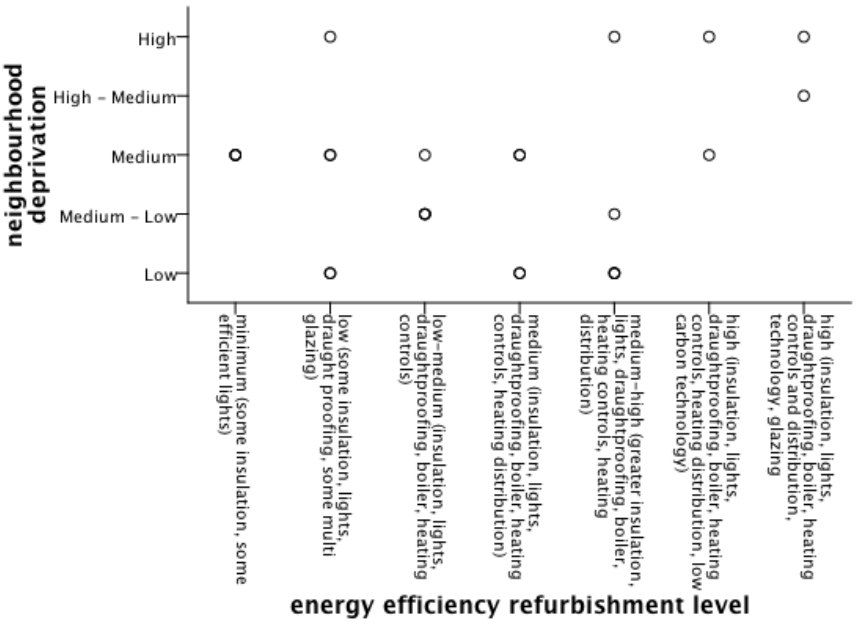
		refurblevel							Total
		2 minimum (some insulation, some efficient lights)	3 low (some insulation, lights, draught proofing, some multi glazing)	4 low-medium (insulation, lights, draughtproofing, boiler, heating controls)	5 medium (insulation, lights, draughtproofing, boiler, heating controls, heating distribution)	6 medium-high (greater insulation, lights, draughtproofing, boiler, heating controls, heating distribution)	7 high (insulation, lights, draughtproofing, boiler, heating controls, heating distribution, low carbon technology)	8 high (insulation, lights, draughtproofing, boiler, heating controls and distribution, technology, glazing)	
neighbourhood deprivation	1 Low	**0**	**2**	**0**	**2**	**3**	**0**	**0**	**7**
	2 Medium - Low	**0**	**0**	**3**	**0**	**1**	**0**	**0**	**4**
	3 Medium	**3**	**2**	**1**	**2**	**0**	**1**	**0**	**9**
	4 High - Medium	**0**	**0**	**0**	**0**	**0**	**0**	**1**	**1**
	5 High	**0**	**1**	**0**	**0**	**1**	**1**	**1**	**4**
Total		**3**	**5**	**4**	**4**	**5**	**2**	**2**	**25**

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)	Point Probability
Pearson Chi-Square	**39.836**[a]	**24**	**.022**	**.010**		
Likelihood Ratio	**36.329**	**24**	**.051**	**.031**		
Fisher's Exact Test	**28.651**			**.038**		
Linear-by-Linear Association	**.970**[b]	**1**	**.325**	**.339**	**.177**	**.020**
N of Valid Cases	**25**					

a. 35 cells (100.0%) have expected count less than 5. The minimum expected count is .08.

b. The standardized statistic is .985.



Construction type vs. neighbourhood deprivation

construction type * neighbourhood deprivation Crosstabulation

Count

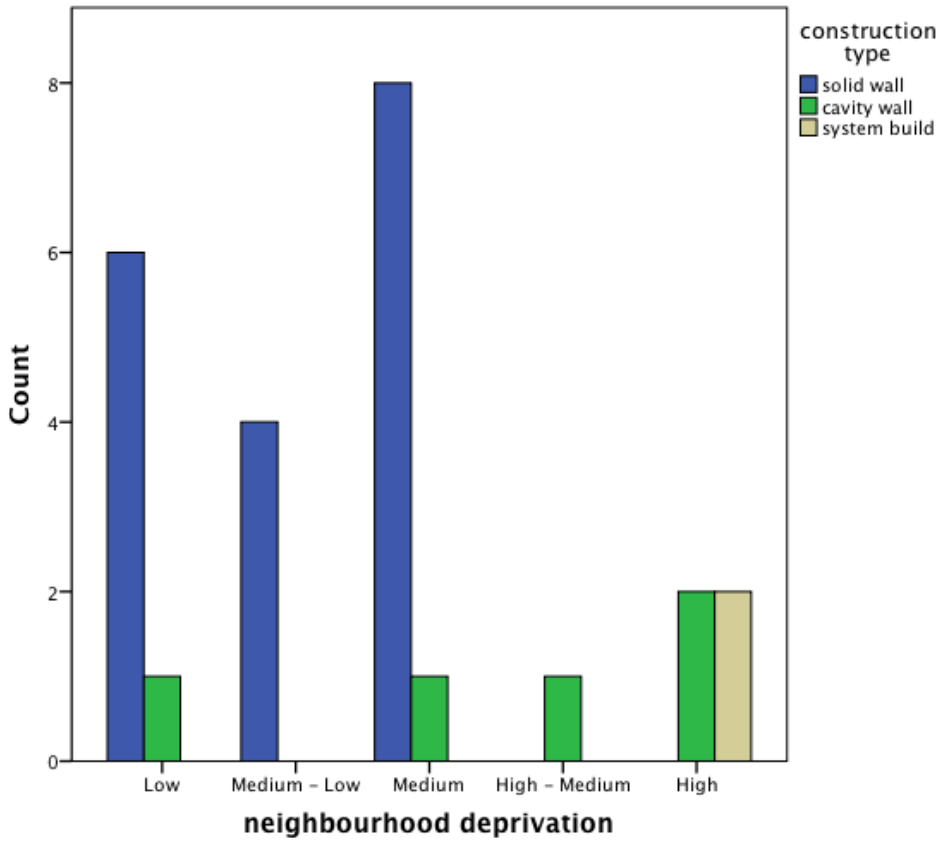
		neighbourhood deprivation					Total
		1 Low	2 Medium - Low	3 Medium	4 High - Medium	5 High	
construction type	1 solid wall	**6**	**4**	**8**	**0**	**0**	**18**
	2 cavity wall	**1**	**0**	**1**	**1**	**2**	**5**
	4 system build	**0**	**0**	**0**	**0**	**2**	**2**
Total		**7**	**4**	**9**	**1**	**4**	**25**

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)	Point Probability
Pearson Chi-Square	**21.345**[a]	**8**	**.006**	**.007**		
Likelihood Ratio	**20.458**	**8**	**.009**	**.002**		
Fisher's Exact Test	**16.143**			**.003**		
Linear-by-Linear Association	**10.382**[b]	**1**	**.001**	**.000**	**.000**	**.000**
N of Valid Cases	**25**					

a. 13 cells (86.7%) have expected count less than 5. The minimum expected count is .08.

b. The standardized statistic is 3.222.


construction type
solid wall
cavity wall
system build
Count
0
2
4
6
8
Low
Medium – Low
Medium
High – Medium
High
neighbourhood deprivation

Energy efficiency refurbishment level vs. Gender

gender * refurblevel Crosstabulation

Count

		refurblevel							Total
		2 minimum (some insulation, some efficient lights)	3 low (some insulation, lights, draught proofing, some multi glazing)	4 low-medium (insulation, lights, draughtproofing, boiler, heating controls)	5 medium (insulation, lights, draughtproofing, boiler, heating controls, heating distribution)	6 medium-high (greater insulation, lights, draughtproofing, boiler, heating controls, heating distribution)	7 high (insulation, lights, draughtproofing, boiler, heating controls, heating distribution, low carbon technology)	8 high (insulation, lights, draughtproofing, boiler, heating controls and distribution, technology, glazing)	
gender	1 male	**0**	**1**	**2**	**2**	**2**	**0**	**1**	**8**
	2 female	**2**	**4**	**2**	**2**	**2**	**2**	**1**	**15**
	3 both present	**1**	**0**	**0**	**0**	**1**	**0**	**0**	**2**
Total		**3**	**5**	**4**	**4**	**5**	**2**	**2**	**25**

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)	Point Probability
Pearson Chi-Square	**8.993**[a]	**12**	**.704**	**.802**		
Likelihood Ratio	**10.423**	**12**	**.579**	**.788**		
Fisher's Exact Test	**9.328**			**.832**		
Linear-by-Linear Association	**.854**[b]	**1**	**.355**	**.408**	**.208**	**.050**
N of Valid Cases	**25**					

a. 21 cells (100.0%) have expected count less than 5. The minimum expected count is .16.

b. The standardized statistic is -.924.

Energy efficiency refurbishment level vs. education level

highest level of education * refurblevel Crosstabulation

Count

		refurblevel							Total
		2 minimum (some insulation, some efficient lights)	3 low (some insulation, lights, draught proofing, some multi glazing)	4 low-medium (insulation, lights, draughtproofing, boiler, heating controls)	5 medium (insulation, lights, draughtproofing, boiler, heating controls, heating distribution)	6 medium-high (greater insulation, lights, draughtproofing, boiler, heating controls, heating distribution)	7 high (insulation, lights, draughtproofing, boiler, heating controls, heating distribution, low carbon technology)	8 high (insulation, lights, draughtproofing, boiler, heating controls and distribution, technology, glazing)	
highest level of education	2 A-Levels/Scottish Highers	**0**	**1**	**1**	**0**	**0**	**1**	**0**	**3**
	4 Undergraduate	**0**	**1**	**0**	**0**	**2**	**1**	**0**	**4**
	5 Masters	**0**	**2**	**0**	**1**	**1**	**0**	**0**	**4**
	6 Postgraduate	**2**	**1**	**3**	**3**	**2**	**0**	**2**	**13**
Total		**2**	**5**	**4**	**4**	**5**	**2**	**2**	**24**

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)	Point Probability
Pearson Chi-Square	**17.638**[a]	**18**	**.480**	**.533**		
Likelihood Ratio	**21.445**	**18**	**.258**	**.479**		
Fisher's Exact Test	**16.143**			**.559**		
Linear-by-Linear Association	**.029**[b]	**1**	**.865**	**.902**	**.447**	**.032**
N of Valid Cases	**24**					

a. 28 cells (100.0%) have expected count less than 5. The minimum expected count is .25.

b. The standardized statistic is -.170.

Energy efficiency refurbishment level vs. Income

income * refurblevel Crosstabulation

Count

		refurblevel							Total
		2 minimum (some insulation, some efficient lights)	3 low (some insulation, lights, draught proofing, some multi glazing)	4 low-medium (insulation, lights, draughtproofing, boiler, heating controls)	5 medium (insulation, lights, draughtproofing, boiler, heating controls, heating distribution)	6 medium-high (greater insulation, lights, draughtproofing, boiler, heating controls, heating distribution)	7 high (insulation, lights, draughtproofing, boiler, heating controls, heating distribution, low carbon technology)	8 high (insulation, lights, draughtproofing, boiler, heating controls and distribution, technology, glazing)	
income	1 Less than £12,000	**0**	**0**	**0**	**0**	**1**	**0**	**0**	**1**
	2 £13,000 - £19,000	**0**	**1**	**0**	**1**	**0**	**1**	**0**	**3**
	3 £20,000 - £29,000	**0**	**2**	**0**	**0**	**0**	**0**	**1**	**3**
	4 £30,000 - 39,000	**1**	**1**	**1**	**3**	**1**	**1**	**0**	**8**
	5 £40,000 - 49,000	**0**	**1**	**1**	**0**	**2**	**0**	**0**	**4**
	6 Over £49,000	**1**	**0**	**2**	**0**	**1**	**0**	**1**	**5**
Total		**2**	**5**	**4**	**4**	**5**	**2**	**2**	**24**

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)	Point Probability
Pearson Chi-Square	**28.560**[a]	**30**	**.541**	**.642**		
Likelihood Ratio	**31.130**	**30**	**.409**	**.619**		
Fisher's Exact Test	**28.158**			**.623**		
Linear-by-Linear Association	**.140**[b]	**1**	**.708**	**.721**	**.372**	**.030**
N of Valid Cases	**24**					

a. 42 cells (100.0%) have expected count less than 5. The minimum expected count is .08.

b. The standardized statistic is -.375.

Number of children and age of children vs. energy efficiency refurbishment level

number of children * refurblevel Crosstabulation

Count

		refurblevel							Total
		2 minimum (some insulation, some efficient lights)	3 low (some insulation, lights, draught proofing, some multi glazing)	4 low-medium (insulation, lights, draughtproofing, boiler, heating controls)	5 medium (insulation, lights, draughtproofing, boiler, heating controls, heating distribution)	6 medium-high (greater insulation, lights, draughtproofing, boiler, heating controls, heating distribution)	7 high (insulation, lights, draughtproofing, boiler, heating controls, heating distribution, low carbon technology)	8 high (insulation, lights, draughtproofing, boiler, heating controls and distribution, technology, glazing)	
number of children	1 none	**0**	**3**	**1**	**3**	**1**	**1**	**0**	**9**
	2 1	**0**	**1**	**1**	**0**	**0**	**0**	**0**	**2**
	3 2	**2**	**1**	**2**	**1**	**1**	**1**	**2**	**10**
	4 3	**0**	**0**	**0**	**0**	**2**	**0**	**0**	**2**
	5 4	**0**	**0**	**0**	**0**	**1**	**0**	**0**	**1**
Total		**2**	**5**	**4**	**4**	**5**	**2**	**2**	**24**

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)	Point Probability
Pearson Chi-Square	**23.893**[a]	**24**	**.468**	**.553**		
Likelihood Ratio	**22.986**	**24**	**.521**	**.579**		
Fisher's Exact Test	**24.020**			**.593**		
Linear-by-Linear Association	**1.305**[b]	**1**	**.253**	**.268**	**.141**	**.021**
N of Valid Cases	**24**					

a. 35 cells (100.0%) have expected count less than 5. The minimum expected count is .08.

b. The standardized statistic is 1.142.

children ages * refurblevel Crosstabulation

Count

		refurblevel							Total
		2 minimum (some insulation, some efficient lights)	3 low (some insulation, lights, draught proofing, some multi glazing)	4 low-medium (insulation, lights, draughtproofing, boiler, heating controls)	5 medium (insulation, lights, draughtproofing, boiler, heating controls, heating distribution)	6 medium-high (greater insulation, lights, draughtproofing, boiler, heating controls, heating distribution)	7 high (insulation, lights, draughtproofing, boiler, heating controls, heating distribution, low carbon technology)	8 high (insulation, lights, draughtproofing, boiler, heating controls and distribution, technology, glazing)	
children ages	0 n/a	**0**	**3**	**1**	**3**	**1**	**1**	**0**	**9**
	1 Less than 1 year	**0**	**0**	**1**	**0**	**0**	**0**	**0**	**1**
	2 1 - 2 years	**0**	**1**	**1**	**0**	**0**	**0**	**0**	**2**
	3 3 - 5 years	**1**	**0**	**0**	**0**	**0**	**0**	**0**	**1**
	6 16 - 18 years	**1**	**0**	**0**	**0**	**0**	**0**	**0**	**1**
	7 Over 18 years	**0**	**1**	**1**	**1**	**4**	**1**	**2**	**10**
Total		**2**	**5**	**4**	**4**	**5**	**2**	**2**	**24**

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)	Point Probability
Pearson Chi-Square	**40.093**[a]	**30**	**.103**	**.084**		
Likelihood Ratio	**28.531**	**30**	**.542**	**.293**		
Fisher's Exact Test	**34.911**			**.224**		
Linear-by-Linear Association	**2.764**[b]	**1**	**.096**	**.101**	**.050**	**.004**
N of Valid Cases	**24**					

a. 42 cells (100.0%) have expected count less than 5. The minimum expected count is .08.

b. The standardized statistic is 1.663.

children ages * refurblevel Crosstabulation

Count

		refurblevel							Total
		2 minimum (some insulation, some efficient lights)	3 low (some insulation, lights, draught proofing, some multi glazing)	4 low-medium (insulation, lights, draughtproofing, boiler, heating controls)	5 medium (insulation, lights, draughtproofing, boiler, heating controls, heating distribution)	6 medium-high (greater insulation, lights, draughtproofing, boiler, heating controls, heating distribution)	7 high (insulation, lights, draughtproofing, boiler, heating controls, heating distribution, low carbon technology)	8 high (insulation, lights, draughtproofing, boiler, heating controls and distribution, technology, glazing)	
children ages	0 n/a	**0**	**4**	**2**	**3**	**1**	**1**	**0**	**11**
	3 3 - 5 years	**1**	**1**	**1**	**0**	**0**	**0**	**0**	**3**
	7 Over 18 years	**1**	**0**	**1**	**1**	**4**	**1**	**2**	**10**
Total		**2**	**5**	**4**	**4**	**5**	**2**	**2**	**24**

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)	Point Probability
Pearson Chi-Square	**15.280**[a]	**12**	**.226**	**.211**		
Likelihood Ratio	**18.780**	**12**	**.094**	**.184**		
Fisher's Exact Test	**14.390**			**.149**		
Linear-by-Linear Association	**3.689**[b]	**1**	**.055**	**.055**	**.028**	**.002**
N of Valid Cases	**24**					

a. 21 cells (100.0%) have expected count less than 5. The minimum expected count is .25.

b. The standardized statistic is 1.921.

Wall insulation vs. energy efficiency refurbishment level

property age (approx) * refurblevel Crosstabulation

Count

		refurblevel							Total
		2 minimum (some insulation, some efficient lights)	3 low (some insulation, lights, draught proofing, some multi glazing)	4 low-medium (insulation, lights, draughtproofing, boiler, heating controls)	5 medium (insulation, lights, draughtproofing, boiler, heating controls, heating distribution)	6 medium-high (greater insulation, lights, draughtproofing, boiler, heating controls, heating distribution)	7 high (insulation, lights, draughtproofing, boiler, heating controls, heating distribution, low carbon technology)	8 high (insulation, lights, draughtproofing, boiler, heating controls and distribution, technology, glazing)	
property age (approx)	1 1800 - 1849	**0**	**0**	**0**	**1**	**0**	**0**	**0**	**1**
	2 1850 - 1899	**1**	**1**	**1**	**0**	**2**	**1**	**0**	**6**
	3 1900 - 1919	**2**	**1**	**2**	**0**	**0**	**0**	**0**	**5**
	4 1920 - 1939	**0**	**2**	**1**	**3**	**2**	**0**	**0**	**8**
	5 1940 - 1960	**0**	**1**	**0**	**0**	**0**	**0**	**0**	**1**
	6 1961 - 1975	**0**	**0**	**0**	**0**	**1**	**1**	**2**	**4**
Total		**3**	**5**	**4**	**4**	**5**	**2**	**2**	**25**

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)	Point Probability
Pearson Chi-Square	**37.285**[a]	**30**	**.169**	**.155**		
Likelihood Ratio	**35.708**	**30**	**.218**	**.183**		
Fisher's Exact Test	**32.646**			**.201**		
Linear-by-Linear Association	**4.223**[b]	**1**	**.040**	**.041**	**.021**	**.004**
N of Valid Cases	**25**					

a. 42 cells (100.0%) have expected count less than 5. The minimum expected count is .08.

b. The standardized statistic is 2.055.

Energy efficiency refurbishment level vs. orientation

orientation * refurblevel Crosstabulation

Count

		refurblevel							Total
		2 minimum (some insulation, some efficient lights)	3 low (some insulation, lights, draught proofing, some multi glazing)	4 low-medium (insulation, lights, draughtproofing, boiler, heating controls)	5 medium (insulation, lights, draughtproofing, boiler, heating controls, heating distribution)	6 medium-high (greater insulation, lights, draughtproofing, boiler, heating controls, heating distribution)	7 high (insulation, lights, draughtproofing, boiler, heating controls, heating distribution, low carbon technology)	8 high (insulation, lights, draughtproofing, boiler, heating controls and distribution, technology, glazing)	
orientation	1 North	**1**	**2**	**0**	**2**	**2**	**0**	**1**	**8**
	2 North east	**0**	**0**	**2**	**0**	**0**	**1**	**0**	**3**
	4 South	**0**	**1**	**0**	**0**	**0**	**0**	**1**	**2**
	5 South east	**1**	**1**	**1**	**0**	**1**	**0**	**0**	**4**
	6 South west	**1**	**0**	**1**	**0**	**2**	**0**	**0**	**4**
	7 East	**0**	**0**	**0**	**1**	**0**	**0**	**0**	**1**
	8 West	**0**	**1**	**0**	**1**	**0**	**1**	**0**	**3**
Total		**3**	**5**	**4**	**4**	**5**	**2**	**2**	**25**

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)	Point Probability
Pearson Chi-Square	**35.938**[a]	**36**	**.472**	**.558**		
Likelihood Ratio	**36.893**	**36**	**.427**	**.638**		
Fisher's Exact Test	**33.275**			**.641**		
Linear-by-Linear Association	**.029**[b]	**1**	**.864**	**.882**	**.442**	**.017**
N of Valid Cases	**25**					

a. 49 cells (100.0%) have expected count less than 5. The minimum expected count is .08.

b. The standardized statistic is -.172.

Orientation vs. low carbon technology

orientation * low carbon technology Crosstabulation

Count

		low carbon technology				Total
		1 none	2 PVs	3 solar thermal	4 PV and solar thermal	
orientation	1 North	**5**	**1**	**0**	**1**	**7**
	2 North east	**1**	**2**	**0**	**0**	**3**
	4 South	**2**	**0**	**0**	**0**	**2**
	5 South east	**3**	**1**	**0**	**0**	**4**
	6 South west	**2**	**2**	**0**	**0**	**4**
	7 East	**0**	**1**	**0**	**0**	**1**
	8 West	**1**	**1**	**1**	**0**	**3**
Total		**14**	**8**	**1**	**1**	**24**

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)	Point Probability
Pearson Chi-Square	**15.872**[a]	**18**	**.601**	**.638**		
Likelihood Ratio	**13.779**	**18**	**.743**	**.680**		
Fisher's Exact Test	**19.954**			**.641**		
Linear-by-Linear Association	**.173**[b]	**1**	**.677**	**.733**	**.364**	**.036**
N of Valid Cases	**24**					

a. 28 cells (100.0%) have expected count less than 5. The minimum expected count is .04.

b. The standardized statistic is .416.

Heating system vs low carbon technology

boiler or heating system * low carbon technology Crosstabulation

Count

		low carbon technology				Total
		1 none	2 PVs	3 solar thermal	4 PV and solar thermal	
boiler or heating system	1 combi	**3**	**0**	**0**	**0**	**3**
	2 condensing combi	**11**	**4**	**0**	**0**	**15**
	3 regular	**0**	**1**	**0**	**1**	**2**
	4 condensing regular	**0**	**3**	**1**	**0**	**4**
Total		**14**	**8**	**1**	**1**	**24**

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)	Point Probability
Pearson Chi-Square	**24.421**[a]	**9**	**.004**	**.005**		
Likelihood Ratio	**20.713**	**9**	**.014**	**.002**		
Fisher's Exact Test	**18.697**			**.003**		
Linear-by-Linear Association	**9.057**[b]	**1**	**.003**	**.002**	**.002**	**.002**
N of Valid Cases	**24**					

a. 14 cells (87.5%) have expected count less than 5. The minimum expected count is .08.

b. The standardized statistic is 3.010.

Wall insulation vs. refurbishment level

wall insulation * refurblevel Crosstabulation

Count

		refurblevel							Total
		2 minimum (some insulation, some efficient lights)	3 low (some insulation, lights, draught proofing, some multi glazing)	4 low-medium (insulation, lights, draughtproofing, boiler, heating controls)	5 medium (insulation, lights, draughtproofing, boiler, heating controls, heating distribution)	6 medium-high (greater insulation, lights, draughtproofing, boiler, heating controls, heating distribution)	7 high (insulation, lights, draughtproofing, boiler, heating controls, heating distribution, low carbon technology)	8 high (insulation, lights, draughtproofing, boiler, heating controls and distribution, technology, glazing)	
wall insulation	1 none	**3**	**4**	**4**	**2**	**3**	**1**	**0**	**17**
	2 cavity	**0**	**1**	**0**	**2**	**1**	**0**	**2**	**6**
	3 part internal	**0**	**0**	**0**	**0**	**0**	**1**	**0**	**1**
	6 part external	**0**	**0**	**0**	**0**	**1**	**0**	**0**	**1**
Total		**3**	**5**	**4**	**4**	**5**	**2**	**2**	**25**

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)	Point Probability
Pearson Chi-Square	**26.520**[a]	**18**	**.088**	**.063**		
Likelihood Ratio	**20.289**	**18**	**.317**	**.125**		
Fisher's Exact Test	**22.307**			**.138**		
Linear-by-Linear Association	**3.528**[b]	**1**	**.060**	**.051**	**.035**	**.009**
N of Valid Cases	**25**					

a. 28 cells (100.0%) have expected count less than 5. The minimum expected count is .08.

b. The standardized statistic is 1.878.

Length of residence vs. refurbishment level

length of time at current property * refurblevel Crosstabulation

Count

		refurblevel							Total
		2 minimum (some insulation, some efficient lights)	3 low (some insulation, lights, draught proofing, some multi glazing)	4 low-medium (insulation, lights, draughtproofing, boiler, heating controls)	5 medium (insulation, lights, draughtproofing, boiler, heating controls, heating distribution)	6 medium-high (greater insulation, lights, draughtproofing, boiler, heating controls, heating distribution)	7 high (insulation, lights, draughtproofing, boiler, heating controls, heating distribution, low carbon technology)	8 high (insulation, lights, draughtproofing, boiler, heating controls and distribution, technology, glazing)	
length of time at current property	1 Less than 1 year	**0**	**0**	**0**	**1**	**1**	**1**	**0**	**3**
	2 1 - 3 years	**0**	**2**	**0**	**1**	**0**	**0**	**0**	**3**
	3 4 - 8 years	**1**	**1**	**1**	**0**	**1**	**0**	**0**	**4**
	4 9 - 15 years	**0**	**1**	**1**	**0**	**1**	**1**	**0**	**4**
	5 16 - 20 years	**0**	**0**	**1**	**1**	**1**	**0**	**0**	**3**
	6 Over 20 years	**1**	**1**	**1**	**1**	**1**	**0**	**2**	**7**
Total		**2**	**5**	**4**	**4**	**5**	**2**	**2**	**24**

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)	Point Probability
Pearson Chi-Square	**23.057**[a]	**30**	**.813**	**.945**		
Likelihood Ratio	**26.206**	**30**	**.665**	**.992**		
Fisher's Exact Test	**22.531**			**.992**		
Linear-by-Linear Association	**.135**[b]	**1**	**.713**	**.724**	**.373**	**.024**
N of Valid Cases	**24**					

a. 42 cells (100.0%) have expected count less than 5. The minimum expected count is .25.

b. The standardized statistic is .367.

APPENDIX G – Tables 9.1 full table principal motivation themes, external and internal factors elicited from the interviews

INTERVIEWEES	Case 001	Case 002	Case 003	Case 004	Case 005	Case 006	Case 007	Case 008	Case 009	Case 010	Case 011	Case 012	Case 013	Case 014	Case 015	Case 016	Case 017	Case 018	Case 019	Case 020	Case 021	Case 022	Case 023	Case 024	Case 025
Gender	Female	Female	Male	Female	Male	Female	Female and Male	Female	Female	Male	Female	Female and Male	Female and Male	Female	Male	Male	Female	Female	Female	Female and Male	Female and Male	Female	Male	Female and Male	Male
Age (years)	50s	26 - 30	36 - 45	26 - 35	26 - 35	46 - 55	61 - 70	36 - 45	61 - 70	56 - 60	36 - 45	56 - 60	61 - 70	46 - 55	Over 70	61 - 70	56 - 60	46 - 55	61 - 70	56 - 60	61 - 70	36 - 45	61 - 70	36 - 45	61 - 70
Location	Knowle	Windmill Hill	Henleaze	Henleaze	Bedminster	Henbury	Henleaze	Southville	Windmill Hill	Bedminster	Windmill Hill	Whitchurch Park	Whitchurch Park	Henleaze	Redland	Redland	Southville	Windmill Hill	Whitchurch Park	Whitchurch Park	Clifton East	Bedminster	Stoke Bishop	Bedminster	Henleaze
Deprivation level	Medium	Medium	Lowest	Lowest	Medium	Medium to High	Lowest	Medium to Low	Medium	Medium to Low	Medium	High	High	Low	Medium to Low	Medium to Low	Medium	Medium	High	High	Low	Medium	2nd lowest	Medium	Lowest
KEY THEMES																									
Fashions and tastes	Nominal	Moderately	No	Nominal	No	Nominal	Nominal		No	Moderately	Moderately; unconscious	Nominal	No	No	Moderately	Nominal	Moderately	Nominal	No	Nominal	Nominal	Nominal	No	Moderately	No
Compromises and priorities	Yes	Yes	Yes	Important	Yes	Important	Yes	Yes	Yes	Yes	Important	Important	Yes	Yes		Yes		Yes		No	Yes	Important	Important	Important	
Loss aversion			Variable				Issue	Issue			Issue		Issue	Issue					Yes. Linked to values		Variable	Issue	Variable	Issue	
Expectations					Difficult to say	Met		Perceptions-based	Variable			Exceeded	Met							Exceeded	Exceeded				
Awareness (relating to works)		Work-related	Survey	Personal research; unaware of other measures	Increased through work experience	Personal research and experience	Personal research	Professionals and personal research			Issue		Professionals			Neighbours	Personal research and friends	Issue	Variable	Issue	Issue				
Physical structure				Condition is an important factor; liveability		Issue	Issue					Condition is important factor	Condition is important factor	Condition and defects factor	Condition and defects factor	Condition and liveability important		Condition and liveability important	Condition and liveability important	Condition and liveability important	Condition and liveability important	Condition and defects	Condition and defects	Important; liveability	
Opportunity		Timing with moving in and general improvements	Timing with other works; incentives	Timing with other works, particularly when moving in		Important	Important	Timing with other works; planned vs. urgent works	Timing with replacement needs	Timing with moving in and defects	Timing with moving in and improvements	Important	Important	Important; timing with defects and condition	Important (fire damage)	Timing with moving in and condition	Timing with defects and subsidies	Timing with moving in and condition	Timing with necessary works and with grant offered for insulation, and Feed-in Tariff	Timing with defects	Timing with moving in, condition and capital availability	Timing with condition, defects and capital availability	Timing with condition and other works	Timing with moving in and improvements for liveability	Timing with moving in, changing requirement and defects
Economic (external factor)								Consideration		Issue	Issue	Important	Important						Important (wait for accumulated savings to pay for work)	Significant issue		Most important	Payback for external wall insulation a barrier	Threshold of spending	Important
Savings					Important	Important	Important	Unrealistic	Important			Important	Incentive; important; unlikely to reach payback	Important					Important		Important		Important		Important
Grants, loans, schemes	Important but wouldn't be sufficient to undertake works	Not eligible for help	Helpful	Not eligible for help	Uncertainty	Grants required certified installers and increased overall costs	Loans disincentive; mixed message through incentive mix	Important but wouldn't be sufficient to undertake works	Not eligible for help	Would perform works without help anyway	Incentive	Incentives helped (cavity insulation)	Incentives helped (loft insulation); not loans. More help would be useful	Incentives helped (loft insulation); no interest in loans	No help given beyond Feed-in Tariff	More grants needed	Important; had loft insulation installed previously under grant		Not enough. Reduced Feed-in Tariff will deter people. Had insulation grant		Unlikely to payback without grant (EWI); important		Not eligible	Grant or free installation would be useful	Not interested in assistance
Green Deal	Not an incentive	Would consider	Would consider	Would need more information	Considering but can get more favourable financing					Skeptical				Unlikely to consider a loan		Would need more information	If possible to combine Green Deal with grants	Possibly consider		Disincentive		Consideration dependent on job security		Uninterested; unattractive	Not interested
Cost	Issue	Issue	Issue	Issue	Issue	Consideration	Consideration	Issue	Issue				Issue	Important		Issue	Issue	Issue		Significant issue	Issue	Issue	Issue	Issue	Issue
Inconvenience	Issue		Issue	Issue	Issue		Issue		Issue	Issue								Issue		Issue		Issue			
Information	Family members			Internet	Own research	Partner	Internet	Issue. Internet				Own experience	From contractor	Various			Friends		Important - 'if you don't know anything, you can't do anything'		Family		Unreliable/issue. Own research and word of mouth	Local newsletter	
Practicality, and product availability		Improving	Issue	Issue	Issue		Issue	Issue	Issue			Issue			Issue			Issue			Issue				
Time considering and implementing works		Long	Long	Short	Long	Long	Short	Short and long	Long		Short and long	Short and long	Short	Long	Short and long	Long	Short and long	Short	Long	Long	Long	Long	Mixed	Short and long	Long
Installed anything, money no object	Windows	Windows; solar thermal; PV	PV; wind turbine	Wall insulation; loft insulation						Self-build			Solar thermal; underfloor heating	PV; water butt; bathroom insulation	Floor insulation	Windows; wall insulation; energy efficient appliances; floor insulation; replace kitchen fan	Wall insulation; PV	Windows; heating system			More PVs; wall insulation; windows	Thermostat		Reconfigure living area; woodburning stove; windows; replace bathroom	PV
Expected future time of residence	Uncertain																	Couple more years						Not long	Within next 2 years

APPENDIX H - Validation Pack

VALIDATION INFORMATION PACK

My name is **Samantha Organ** and the purpose of this information sheet form is to outline the study procedures, inform you of your rights as a participant and the data being collected on you in this study.

If you wish to confirm that I am a research student at **The University of the West of England** in the Faculty of Environment and Technology, please contact my supervisor on 0117 32 83562 or at David.Proverbs@uwe.ac.uk.

Please carefully read the following.

Purpose of the Study:
The purpose of the study is to investigate the motivations of owner-occupiers for performing (or not performing) energy efficiency refurbishments; that is, why people improve the energy efficiency of their home.

Procedures:
Once you have read the information about the study and where you choose to accept this consent form, we can proceed with the telephone interview on the date agreed. The interview will be in the form of a discussion of the key findings, provided later in this information pack.

Unless otherwise indicated, the interview will be recorded (audio). It is suggested that you leave around 30 minutes for the interview.

Voluntary Participation:
Participation in this study is purely voluntary. You can decline to answer any questions, and you are free to terminate the investigation at any time. There is no penalty if you decide not to answer particular questions or end your participation.

Should you wish to leave the study, any data collected on you and your property will be removed and destroyed.

Right to Ask Questions:
You are welcome to ask questions or concerns about this research by contacting Samantha Organ at Samantha2.Organ@uwe.ac.uk or on 07969 638 590.

Use of Data:
The data produced as a result of the investigation will be used for a PhD study on owner-occupier motivations for energy efficiency refurbishment. It is also likely that it will be contribute to other academic publications.

Confidentiality and Anonymity:
Your participation and data is confidential. You will have the option of opting out of anonymity where you do not mind having your name and company disclosed in the study. Where you choose to remain anonymous, you will be assigned an identification code, your real identification retained in a lockable safe only for the duration of the study and not retained electronically. Audio recordings will be placed on a USB stick and this will also be stored in the safe for the duration of the study. This information will be destroyed after the completion of the study. No information will be passed on to anyone connected with you.

You must be 18 years or above and own your home to be eligible to participate in this study.

CONSENT FORM

My name is **Samantha Organ** and the purpose of this consent form is to outline the study procedures, inform you of your rights as a participant and the data being collected on you in this study.

If you wish to confirm that I am a research student at **The University of the West of England** in the Faculty of Environment and Technology, please contact my supervisor on 0117 32 83562 or at David.Proverbs@uwe.ac.uk.

Please indicate whether you give consent for any of the following:

1. I am happy for the interview to be recorded (audio)

   Yes

   No

2. The anonymised records may be used to show other researchers and/or to students in classrooms

   Yes

   No

3. I would like to opt out of anonymity and my true identity used.

   Yes

   No

Please retain a signed copy of this consent form for your records.

Signed [participant] _____

Printed name [participant] _____

Date _____

Signature of researcher _____

Glossary

EER – energy efficiency refurbishment

Summary of Key Findings

1. Owner-occupiers perform EER for multiple reasons. Works were principally opportunistic (i.e. malfunctioning technology, building defects, or property condition) to ensure a sufficiently functional home.

2. Owner-occupier values are central to EER motivation, shaping other internal factors, emotions, and the decision-making process. Values also shape the principal EER motivation theme, how this manifests as action, and the type of measures adopted within participants' contexts.

3. There are four primary motivation themes – environmental, social (e.g. comfort, social interaction), economic (e.g. savings on utility bills), and waste (e.g. material, energy, time). Owner-occupiers are typically motivated by two or more of these themes. These themes did not differ significantly between neighbourhood deprivation or sociodemographic groups within the study (there were some nuances within the groups). Motivation themes and, where it takes place, EER action are affected by internal and external factors.

4. Owner-occupier values are associated with the their concepts of waste and the waste motivation theme. This was often founded in childhood and/or life experience, but could also develop through regular interaction with the local environment.

5. The principal drivers for EER within these four motivation categories were varied contributed to overall motivation. Some of these drivers could overlap the motivation themes (e.g. loss aversion and sense of responsibility) – motivation and drivers are inter-related.

6. Social, economic, and waste motivations were reflected across participant sociodemographic and neighbourhood deprivation categories, regardless of the level of owner-occupiers' environmental motivation. The environment motivation theme was a stronger motivation amongst those with higher environmental values. However, the environment could also drive EER amongst those with low environmental values through 'moral norms' (i.e. a sense of right and wrong) and emotions (e.g. guilt, embarrassment). Moral norms have a greater impact on participants, particularly for those with higher environmental values.

7. Those with higher environmental values were more likely to have already undertaken some form of action in relation to improving home energy efficiency performance, and more strongly motivated by environmental motivation. This appeared to be to avoid a dissonance with their personal values.

8. Factors influencing EER motivation include barriers (costs and/or financing); inconvenience; time; information (trust, conflicting and mixed messages); and loss aversion – a driver and barrier.

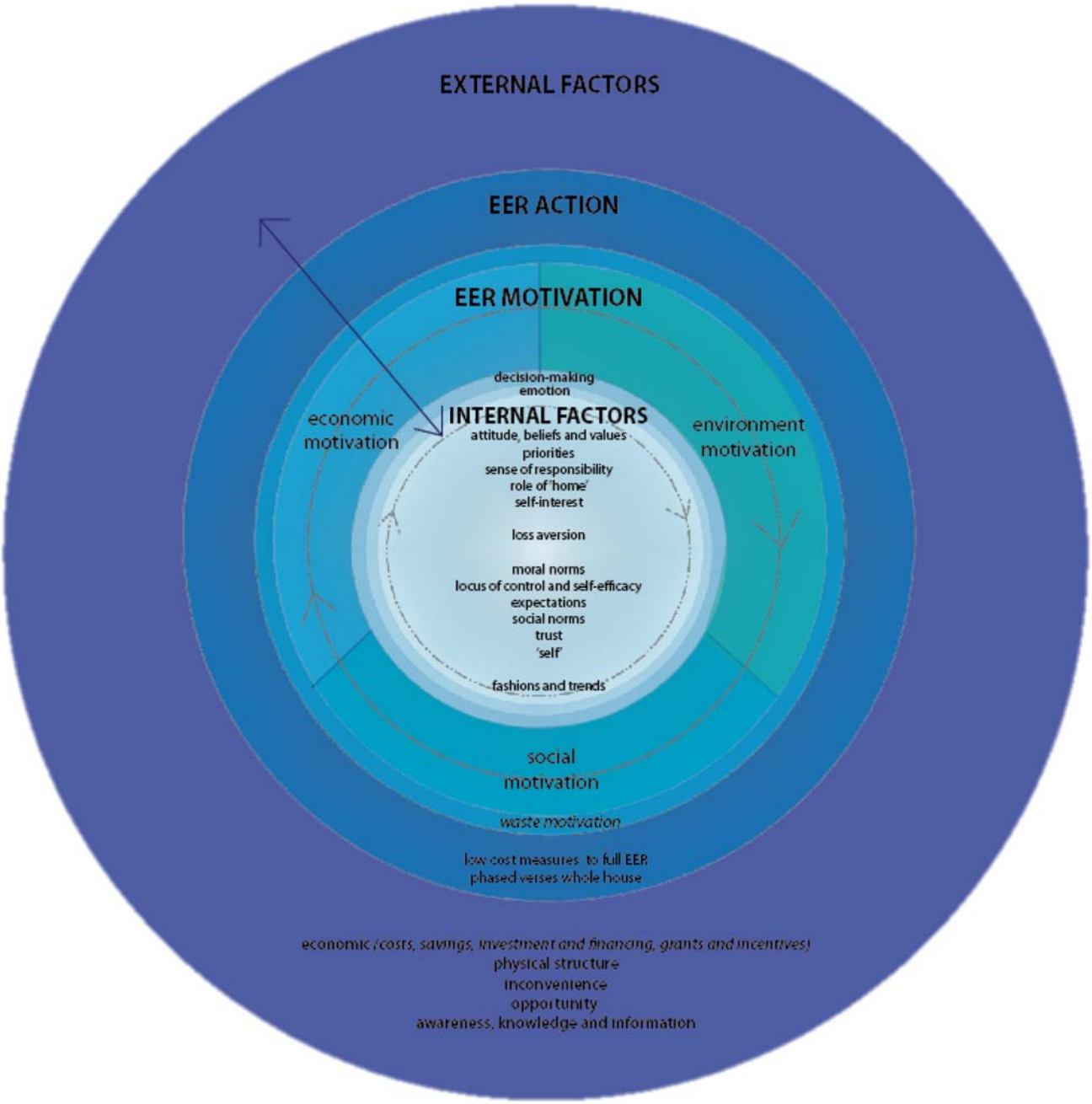
9. Higher neighbourhood deprivation has a positive association with EER, attributed to such neighbourhoods in the Bristol study as having the opportunity to act in relation to EER (i.e. recent retirement, recent house moves, defective building elements).

10. Property characteristics (construction types – solid wall, etc.; and building types – terraced, etc.) were indicated to have an association with EER (but not neighbourhood deprivation) reflecting applicability, suitability and affordability of measures in relation to construction and building types.

11. A lower level of self-efficacy has a negative affect on EER motivation.

12. A hybrid of motivation models could be used to contribute to an explanation for EER motivation:
    a. Maslow's Hierarchy – functions of a home, owner-occupier needs and priorities.
    b. Festinger's Theory and Self-Discrepancy Theory – emotions such as guilt and embarrassment
    c. Prospect Theory – loss aversion
    d. Vroom's Theory and Expected-Value Theory – locus of control and self-efficacy.

The Model and Explanation



Owner-occupiers' internal factors are at the core of the model. These can change in strength order as represented by the cyclical arrow within this layer. The order of the internal factors presented in the model reflect the likely order for the study participants. Emotion will modify these internal factors (e.g. their strength and order through negative and positive emotions). Emotions are affected by internal factors, particularly attitude, beliefs and values. EER motivation and EER action in relation to emotion is not solely based on dissonance – owner-occupiers can act based on emotional feedback, affected particularly by attitude, beliefs and values; moral norms, and social norms. In turn, emotions will have a particular affect on *sense of responsibility*, *self-interest* and '*self*', *locus of control* and *self-efficacy*, and *priorities*. However, emotions are likely to have an affect on, and be affected by **all** the internal factors.

Decision-making is a process. It will modify the internal factors (acting in favour of delivering on other internal factors, and values in particular), motivations and EER action.

EER motivation is divided into 4 categories, with the waste motivation theme shown to be spread between economic, social and environment motivations. These motivations can alter in influence during a lifetime, and also alter between projects and EER measures. This is represented by the cyclical arrow within this layer.

EER action can form different levels of intervention. This will be shaped by the internal factors, owner-occupiers' principal motivations, decision-making (e.g. in preference of meeting different internal factors and motivations over others), and by external factors. When one action has occurred, the order of internal factors and primary motivation can change.

The external factors must be considered. They can change more frequently than owner-occupiers' internal factors, but they provide the context including the constraints in which the owner-occupiers are situated. This not only can direct the form of EER action, but it will have an affect on motivation, emotions, decision-making and, to some extent on the internal factors. For example, by providing a tariff for electricity-generating technology such as photovoltaic panels result in such technology being favoured over heat-generating technology (decision-making); increase owner-occupier economic motivation; it can also reduce the overestimation of losses of the internal factor 'loss aversion'. The knowledge of a time limit on such a tariff can alter the internal factor 'priorities', where the owner-occupier has the financing to act (external factor). The arrows between the outer and inner layers represents the interplay between these.

APPENDIX I - Publications to date

1 - Structural Survey

Organ, S., Proverbs, D. and Squires, G. (2013), Motivations for energy efficiency refurbishment in owner-occupied housing, *Structural Survey*, 31, 2, pp.101 – 120.

The current issue and full text archive of this journal is available at
www.emeraldinsight.com/0263-080X.htm

Motivations for energy efficiency refurbishment in owner-occupied housing

Samantha Organ, David Proverbs and Graham Squires
The University of the West of England, Bristol, UK

Abstract

Purpose – The existing housing stock needs substantial adaptation to meet national and international carbon reduction targets. The largest proportion of housing is owner-occupied, and will require improvement works which go beyond those measures provided through the Green Deal and similar programmes. Therefore, the motivation of owner-occupiers to perform more substantial energy efficiency refurbishments is essential to facilitate greater action. This paper aims to address these issues.

Design/methodology/approach – A synthesis of the extant literature from a range of disciplines reveals the role of motivation and the factors influencing motivation and pro-environmental action in the context of the home. Based on this synthesis of the literature, a new motivation model for energy efficiency refurbishment in the owner-occupied housing stock is then described.

Findings – The study has found that multiple factors affect motivation to refurbish in the owner-occupied housing stock. Key motivations for energy efficient refurbishment can be categorized into the broad themes of economic, social, and environmental motivations. These motivations will be affected by a wide number of interrelated internal and external factors and mediated by the emotions of the individual. The model presented demonstrates the relationship between the multiple factors that affect energy efficiency refurbishment in relation to specific contexts.

Originality/value – The study represents a potential addition to motivational theory and concepts for use within the field of energy efficient refurbishment of the owner-occupied housing stock. Implications for future government policy and towards raising the motivation of owner-occupiers are identified: it can be used to shape national and local policy and information campaigns to motivate energy efficiency refurbishment in the owner-occupied housing stock. To be successful, this should take differing internal factors and contexts into consideration and the dynamic nature of owner-occupier motivation. The model can also be used by industry professionals to better understand the owner-occupier customer motivations for energy efficiency refurbishment and therein provide a better service.

Keywords Motivations, Energy efficiency, Refurbishment, Owner-occupation, Housing, Motivation (Psychology), Private ownership

Paper type Conceptual paper

1. Introduction

The current drive towards reducing energy consumption and carbon emissions has lead to a focus on energy efficiency of buildings (Boardman, 2007). The existing housing stock, much of which is owner-occupied, has been recognized as a significant contributor to total carbon emissions (Banfill and Peacock, 2007; Boardman, 2007; Mansfield, 2011; Bichard and Kazmierczak, 2012), and has a vital role in meeting national and international reduction targets. Studies and reports have shown the importance of an "all measures" approach rather than "business as usual" (Johnston *et al.*, 2005; Peacock *et al.*, 2007; Natarajan and Levermore, 2007; World Wildlife Foundation (WWF), 2008). Substantial intervention to our homes is required to meet targets and to provide habitable homes for the future, but the emphasis on "low-cost" or "quick win" interventions and behavioural changes has over-shadowed

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2 - WIT Transactions on Ecology and Environment (Sustainable Cities Conference 2013

Organ, S., Squires, G. and Proverbs, D., G. (2013), New Research Methods in Identifying Motivations for Energy Efficiency Refurbishment of Owner-occupied Homes, *In:* Zubir, S., S. and Brebbia, C., A. (Eds.) (2013), *Sustainable City VIII – Urban Regeneration and Sustainability*, Volume 2, UK: WIT Press.

New Research Methods in Identifying Motivations for Energy Efficiency Refurbishment of Owner-occupied Homes

S. Organ, G. Squires and D.G. Proverbs
Construction and Property Research Centre, University of the West of England (UWE), Bristol, UK

Abstract

Previous studies on home energy efficiency have traditionally focused on either the technical savings or on social aspects such as behavioural change. These studies have typically excluded the role of motivation, a key component in the implementation of energy efficiency refurbishment in owner-occupied housing. Previous research studies of motivation have typically incorporated Likert scales and questionnaire surveys, but this provides a somewhat superficial view of motivation and can result in disproportionate and inaccurate responses. A new research approach for investigating the motivation of home-owners for energy efficient refurbishment is presented. The approach incorporates in-depth interviews and a detailed physical survey of the properties to explore the underlying mechanisms for motivation for energy efficiency refurbishment, and to provide a means of comparison between cases. Through better integration of methods from the social science and surveying disciplines a more complete understanding of owner-occupier motivations for energy efficiency refurbishment and the underlying mechanisms affecting it can be realised.

Keywords: Motivation, Energy efficiency, Refurbishment, Interviews, Surveys, Housing, Owner-occupier

Introduction

The need to improve the energy performance of the existing housing stock has increasingly recognized in academic literature, reports and government policy [1] [2]. Since the introduction of insulation requirements in the Building Regulations in the 1970s to present day, performance has continued to improve. However, to prevent irreversible damage to our climate and maintain comfort in our homes, further significant improvements are necessary in light of and climate change. It is understood that neither maintenance nor modest refurbishments will achieve necessary improvements [3]; without regulation, owner-occupied home energy improvements are left to the motivations of owner-occupiers.

The primary aim of this paper is to present a methodological procedure to investigate why owner-occupiers are motivated to undertake an energy efficiency refurbishment (EER) and how their EER motivation is affected by both their internal and external factors. To enable this, it is argued that a combination of social science methods and physical surveying methods is needed. Traditionally, these have been kept mutually separate in motivation studies. Although physical surveys have been previously used in studies of refurbishment and energy efficiency measure adoption, their use has typically focused on purely assessing property condition rather than providing greater contextual understanding. By drawing social science methods and surveying methods together it is suggested that