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What do people living in deprived communities in the UK think about household energy efficiency interventions?

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### **Abstract**

While physical interventions such as external wall cladding can improve the energy efficiency of domestic properties, how residents think about and respond to such interventions can influence both their uptake and impact on the household's energy use. The present research investigated what residents living within deprived communities in Yorkshire and the Humber (United Kingdom) thought about a number of household energy efficiency interventions proposed as part of a project known as "The BIG Energy Upgrade". The Theory of Planned Behaviour was used as a framework for investigating residents' beliefs. Residents generally felt positive about the proposed interventions and expected that they would lead to financial savings, improve the appearance and warmth of their homes, and sense of pride in the local community. However, while residents intended to adopt energy efficiency interventions if offered them, they were less willing to personally invest in them. Home ownership and the belief in humans' ability to tackle climate change were found to predict willingness to invest. These findings help to understand responses to initiatives that seek to improve the energy efficiency of hard-to-treat homes.

Word count: 180 words

Keywords energy efficiency, deprived communities, beliefs, Theory of Planned Behaviour

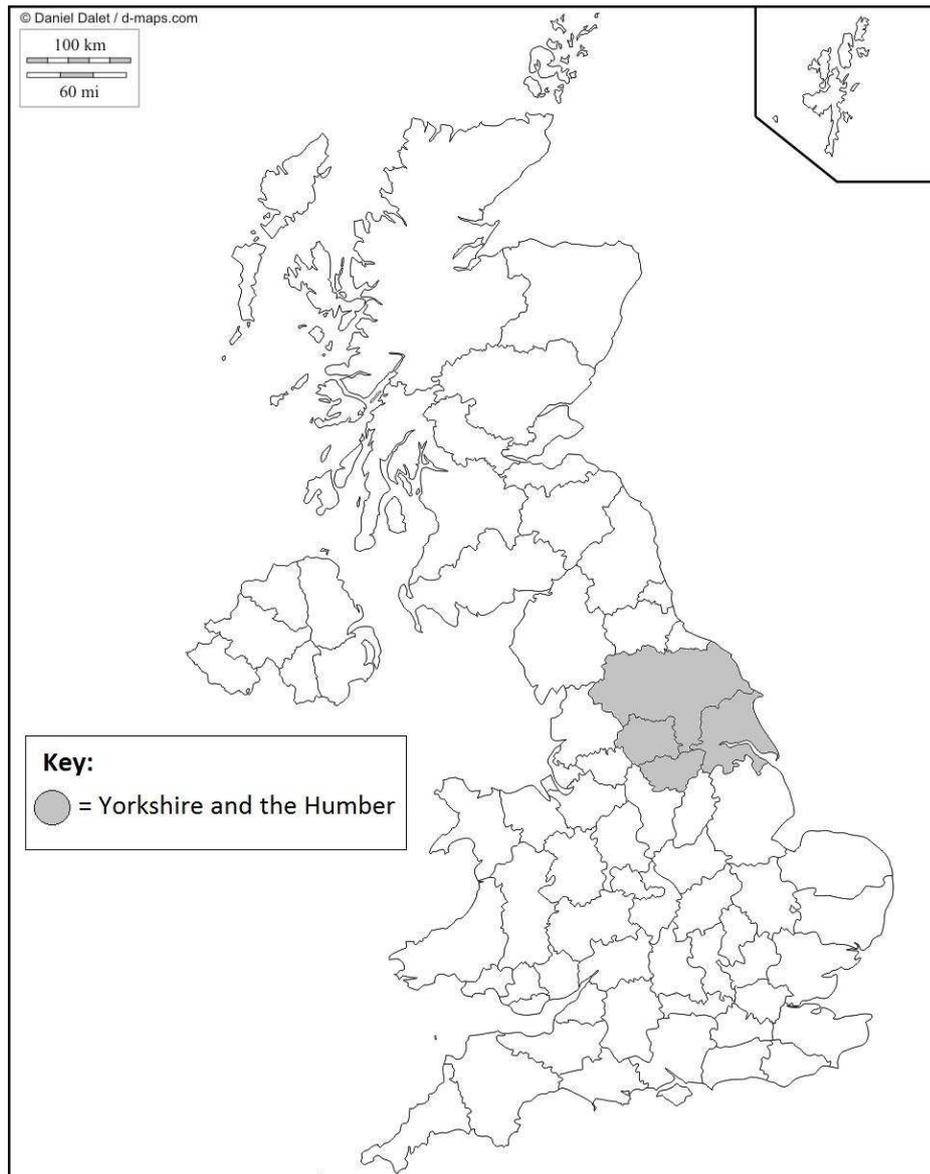
## **What do people living in deprived communities in the UK think about household energy efficiency interventions?**

In 2008, the UK Government passed legislation to reduce greenhouse gas emissions by 80 per cent by 2050, compared to 1990 levels (Climate Change Act, 2008). In 2011, domestic households were responsible for around 26% of total UK energy use (DECC, 2012a) and 15% of the UK's total carbon dioxide emissions (DECC, 2012b). As such, the UK's strategy for meeting its emissions targets must tackle the domestic sector. However, UK legislature has historically paid little heed to energy efficiency within the home. Indeed, it was not until 1965 that the first building regulations were introduced, requiring minimal standards of energy efficiency. Unfortunately, 58% of current domestic households were built prior to 1965 (DCLG, 2012) and more than 60% of the domestic households that will be occupied by 2050 have already been built (Technology Strategy Board, 2010). As such, the UK currently has "one of the oldest and least efficient housing stocks in Europe" (Boardman et al., 2005, p. 38). Coupled with the currently low rate of demolition, the UK must drastically improve the energy efficiency of its existing domestic housing stock if it is to meet its emissions targets (Boardman et al., 2005).

A number of government initiatives, including the 'Warm Front' scheme (Gilbertson et al., 2006), have gone some way to meeting emission reduction targets through interventions such as cavity wall and loft insulation. However, one of the key barriers remains 'hard-to-treat' homes, defined by the Energy Saving Trust (2004) as homes that cannot accommodate such standard energy efficiency measures. These may include homes that are off the gas network, with solid walls, with no loft space, in a state of disrepair, high-rise blocks, and any other homes where, for technical and practical reasons, standard energy efficiency measures cannot be fitted.

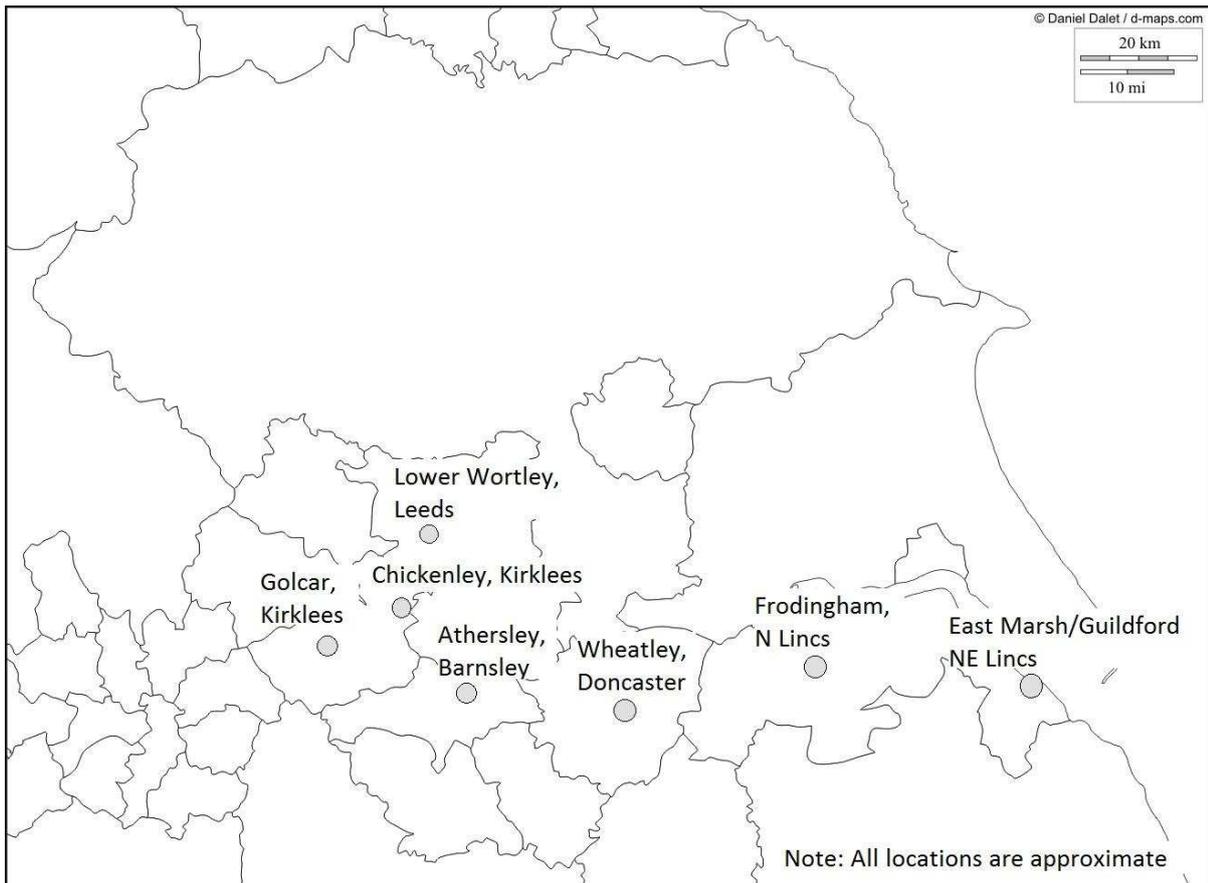
### **The BIG Energy Upgrade**

Launched in September 2011, the ‘Energy Innovation in Deprived Communities’ project (publically known as ‘The BIG Energy Upgrade’ or BEU, see <http://big-energy-upgrade.com/>) targets hard-to-treat homes in Yorkshire and the Humber by retrofitting a variety of household energy efficiency interventions including external wall cladding, energy efficient gas boilers, fuel efficient central heating systems and controls, loft insulation, cavity wall insulation, UPVC windows, heat meters, and photovoltaic panels. In addition to these physical interventions, the project also provides door-to-door energy advice and assessments of individual household energy efficiency interventions. The project’s overarching objectives are to achieve a substantial reduction in CO<sub>2</sub> emissions (approx. 145,113 tonnes of CO<sub>2</sub>e) and to tackle fuel poverty in the region’s most deprived communities (see Figures 1 and 2 for locations). While the project reaches its official completion date in March 2014, much of the physical work was accomplished early on in the project’s lifespan.<sup>1</sup>



**Figure 1**

Map Showing the Location of Yorkshire and the Humber in the UK



**Figure 2**

Map Showing the Location of Communities Involved in the Big Energy Upgrade within the Yorkshire and Humber Region.

The BEU programme targets hard-to-treat homes in nine Lower Layer Super Output Areas (LSOAs)<sup>2</sup>, across the Local Authorities of Barnsley, Doncaster, Kirklees, Leeds, North East Lincolnshire and North Lincolnshire in the UK (see Table 1 for a list of all LSOAs and Figures 1 and 2 for locations). The BEU programme targeted the most deprived 10% of LSOAs as determined by an index of multiple deprivation (a national measure published by DCLG, 2011) at the time of the project's inception in 2010. The communities at the centre of the current research, therefore, represent the nine poorest communities in Yorkshire and the Humber on a variety of deprivation indices including income, employment, health, education, housing, crime and living environment.<sup>3</sup>

**Table 1**

Lower Layer Super Output Areas (LSOAs) Within the Sample Region

LSOA (and LSOA code*)	LSOA (cont'd)
1. E01007325 - Athersley (Barnsley)	6. E01011363 - Lower Wortley (Leeds)
2. E01007651 – Wheatley (Doncaster)	7. E01013137 - East Marsh (NE Lincs)
3. E01007652 – Wheatley (Doncaster)	8. E01013139 – Guildford (NE Lincs)
4. E01011122 - Chickenley District (Kirklees)	9. E01013311 – Frodingham (N Lincs)
5. E01011148 - Golcar District (Kirklees)	

\*LSOA codes are unique reference codes assigned by the Department for Communities and Local Government (DCLG)

## **The Importance of Understanding Residents' Beliefs about Energy Efficiency**

### **Interventions**

The BEU project largely focuses on the impact of physical interventions on the energy efficiency of buildings. However, it is also important to consider how residents think about and respond to such interventions, since these factors can influence both the uptake of such interventions and subsequent energy savings (see Cabinet Office Behavioural Insights Team, 2011; Brown & Swan, 2013). For example, a resident who believes that installing loft insulation will cause hassle and disruption may be unlikely to adopt such an initiative (e.g., Caird, Roy & Herring, 2008), thereby missing out on the benefits that it offers. Similarly, a person who overestimates the personal benefits of an intervention (e.g., because of an erroneous mental model of its likely effects, Krishnamurti et al., 2012) might react negatively or maladaptively to the intervention once installed, which could undermine its effectiveness. A growing literature on the presence and influence of 'rebound' and 'backfire' effects, suggests that the realised savings of energy interventions will often not match those

that are hypothetically achievable because recipients compensate for energy savings with energy inefficient behaviours (see Greening & Greene, 1998; Kaklamanou, Jones, Webb, & Walker, 2013; Sorrell, 2007).

In short, beliefs and behaviour can influence efficiency gains via the day-to-day actions of residents (e.g. whether or not they undertake energy conserving actions around the home) as well as residents' willingness to appropriately adopt energy efficiency interventions and use them in an appropriate way (e.g., Barr, Gilg & Ford, 2005; Farsi, 2010; Janda, 2009; Mullaly, 1998). It is perhaps surprising, therefore, that there has been remarkably little evaluation of residents beliefs about 'whole house' retrofit programmes like the BEU. Furthermore, as noted by Brown and Swan (2013), even when such evaluation does occur, the findings of the evaluation are rarely fed back to those who designed the retrofit programme.

### **The Present Research**

The present research was designed to improve our understanding of how people living in deprived communities think about energy use and, in particular, what they think about different household energy efficiency interventions (see Table 2 for a list). We used the Theory of Planned Behaviour (TPB; Ajzen, 1991) as a framework for understanding how residents think about a particular behaviour (e.g., installing cavity wall insulation) and how these thoughts influence decisions about how to act in the future (e.g., whether to adopt and invest in interventions). The TPB is widely researched (for a review, see Armitage & Connor, 2001) and has been used to examine environmental behaviours including intentions to buy environmentally-friendly products (e.g., Kalafatis et al., 1999), energy conservation (Harland, Staats, & Wilke, 1999), wastepaper recycling (Cheung et al., 1999), and use of public transportation (Heath & Gifford, 2002). The TPB suggests that, to understand someone's behavior, you need to understand that individual's attitudes (e.g., whether they think cavity

wall insulation would be beneficial), subjective norms (e.g., what their neighbours think that they should do), and perceived behavioural control (e.g., the extent to which people feel that they have control over whether or not to have household energy efficiency interventions). These three cognitions are posited to shape an individual's behavioural intentions (e.g., the decision about whether to install cavity wall insulation) that, in turn, are hypothesised to determine their subsequent behaviour (e.g., allowing contractors into their home).

While residents' willingness to adopt the measures provided as part of the BEU will influence the success of this particular project, understanding the intentions of residents in deprived areas to invest in home energy interventions will also have important implications for future energy efficiency and demand reduction schemes. Government initiatives, such as the UK 'Green Deal' scheme, rely on residents to financially invest in household energy efficiency interventions (DECC, 2012c). Thus, success in meeting national emissions targets in the domestic sector will rest, at least in part, on understanding the factors that influence residents' intentions to adopt and invest in such interventions. The TPB would predict that residents with more favourable attitudes toward the household energy efficiency interventions, those who believe that their investing in interventions will be favourably viewed by important others and those who believe that they have control over the decision to adopt and invest in an intervention will be more likely to adopt and invest in them.

**Table 2**

Household Energy Efficiency Interventions being Deployed as part of the BIG Energy Upgrade Programme

Household energy efficiency interventions eligible in original business plan	Barnsley	Doncaster	Kirklees	Leeds	North East Lincolnshire	North Lincolnshire
Cavity wall insulation*	(✓)	(✓)				
Loft insulation*	(✓)	(✓)	(✓)			
Solid wall insulation (external)		✓	✓	✓	✓	✓
Fuel Switching - Replacement of existing non-gas heating systems with gas heating*	✓				✓	
Heating controls - upgrade with new heating system*	✓	(✓)			✓	✓
Solar Water Heater			✓			
Photovoltaic (solar electricity) panels	(✓)		✓			✓
Replacing old boilers with ~65% seasonal efficiency new improved efficiency greater than 88.3%*	✓	(✓)	✓			✓
Window Glazing E to C rated*					✓	✓
Voltage optimisation					✓	
Smart meters					✓	
Energy advice provided by Yorkshire Energy Services	✓	✓	✓	✓	✓	✓

\* no longer eligible for ERDF funding after a contract variation in October 2012

✓ installed as part of the BIG Energy Upgrade

(✓) installed or considered for installation at the same time via other funding sources

It has been argued that the TPB variables may be especially relevant in explaining behaviours with a high perceived or actual personal cost, including financial costs and those to convenience (see Abrahamse & Steg, 2011). Given the levels of deprivation within the sample communities, we therefore anticipated that the TPB would likely provide a good model of intentions to engage with the interventions offered as part of the BEU programme.<sup>4</sup>

The present research also explores the factors that influence attitudes toward and/or intentions to adopt or invest in household energy efficiency interventions. First, we predicted that residents who believed in and who were concerned by anthropogenic climate change (Spence et al., 2010) would have more positive attitudes toward such interventions and a greater willingness to adopt them. Second, we measured familiarity with each of the proposed household energy efficiency interventions. Existing literature (e.g., Farsi, 2010) posits that uncertainty about the benefits in terms of comfort and energy savings of relatively new technologies can lead consumers to undervalue the benefits of these technologies when compared to more conventional commodities. As such, residents may be more willing to adopt and/or invest in interventions that are more familiar to them. Finally, low levels of home ownership are a defining feature of deprived communities. With its specific focus on deprived communities, therefore, the BEU also provides an interesting opportunity to explore whether home ownership influences willingness to invest in home energy interventions.

## **Methods**

### **Location Selection and Distribution Details**

Attempts were made to distribute questionnaires to all households within the LSOAs targeted by the BEU project. In total, N = 1,121 households were approached between August 2011 and February 2012. The questionnaire was closed to further responses at the end of March 2012. A postal questionnaire, with accompanying cover letter and freepost envelope, was distributed to every eligible household in Barnsley, Doncaster, Leeds, North East

Lincolnshire and North Lincolnshire. Where possible, face-to-face contact was made with an adult currently living in the house, enabling the distributor to explain the purpose of the study and to assist with completion of the questionnaire. Door-to-door distribution took place in Barnsley, Doncaster, and Kirklees. A researcher also attended community meetings (e.g., Tenants' and Residents' Association meetings and Family Days in Leeds, Kirklees and North East Lincolnshire). The response rate was highest in areas where more Local Authority support for face-to-face completion was available. When completing the questionnaire in a face-to-face setting, residents typically took around 40 minutes to fully answer the questions. Table 3 summarises the distribution methods employed in each region.

### **Questionnaire**

The questionnaire was designed to assess residents' attitudes, behaviours and beliefs about the energy efficiency interventions offered as part of the BEU project. The questionnaire included an introduction (providing some background to the BEU project and instructions for completion), a series of questions to explore respondents' awareness and expectations of the scheme, then questions to probe residents' perceptions of a range of household energy efficiency interventions, and a section designed to measure relevant demographic information. Appendix 1 provides a full list of the measures and Table 4 provides an overview of the key constructs and respective measures.

First, respondents were asked to rate how beneficial they anticipated that the BEU scheme would be to their household, their community, their council and their energy supplier. When the latter item was removed, these items formed a reliable scale measuring perceived benefits ( $\alpha = 0.69$ ). Next, respondents were given information about seven different household energy efficiency interventions (loft insulation, cavity wall insulation, external wall cladding, solar electricity panels, energy efficient 'A-rated' boilers, new UPVC windows, and home energy monitors) and asked to indicate the extent to which they agreed

or disagreed with statements pertaining to those interventions. The questions were developed using Ajzen's Theory of Planned Behaviour (1991) and associated guidance for questionnaire construction (Ajzen, 2010; Conner & Sparks, 2005). Two statements measured residents' attitudes toward domestic energy efficiency interventions (these proved reliable and were combined,  $\alpha = 0.94$ ) and two statements measured residents' intentions to adopt and invest in interventions (these were not reliable,  $\alpha = 0.13$ , and so were treated as separate items).

Subjective norms, perceived behavioural control, and familiarity with each intervention were measured with single items. Finally, we measured residents' beliefs about climate change by asking respondents to indicate whether they believed in climate change and were concerned about climate change. Residents were also asked to report their beliefs about (i) the cause of climate change, (ii) human's ability to tackle climate change and (iii) the effect of climate change on humans.

**Table 3**

Questionnaire Distribution and Response in each Local Authority Area.

Local Authority	Targeted households <sup>a</sup>	Questionnaire responses received	Percentage response rate	Percentage of total sample	Postal questionnaire	Door-to-door	Attendance at community meetings
Barnsley	271	63	23%	23%	Y	Y	N
Doncaster	288	147	51%	53%	Y	Y	N
Kirklees	201	39	19%	14%	N	Y	Y
Leeds	60	10	17%	4%	Y	N	Y
North East Lincolnshire	50	5	10%	2%	Y	N	Y
North Lincolnshire	251	15	6% <sup>b</sup>	5%	Y	N	N
Total	1121	279	25%	100%	-	-	-

<sup>a</sup> 'Targeted households' means targeted by one or more methods of: postal questionnaire, door-to-door distribution.

<sup>b</sup> Interventions were installed in North Lincolnshire earlier than the other Local Authority areas, and some time prior to distribution. As such, it is possible that the reduced response rate in North Lincolnshire can be attributed to reduced interest in the theme of the questionnaire.

**Approach to Analysis**

Following inspection of the descriptive statistics, we used a series of repeated measures ANOVAs to examine differences in respondents' beliefs about the different interventions (in each case, type of intervention was the independent variable and the relevant belief – e.g., attitude – served as the dependent variable). We then aggregated measures of beliefs across the different interventions and used multiple regression to investigate whether attitudes, subjective norms, and perceived behavioural control predicted intentions to adopt household energy efficiency interventions (in general). Finally, one-way MANOVAs were used to explore the effects of (i) home ownership, (ii) income, (iii) educational attainment, (iv) membership of local community or tenants' groups, and (v) belief in climate change on residents beliefs about the household energy efficiency interventions.

**Table 4**

Items used to Measure Perceived Benefits, Familiarity, and Beliefs Specified by the Theory of Planned Behaviour

Construct	Items
Perceived benefits	To what extent do you feel that the proposed improvements will benefit your household? To what extent do you feel that the proposed improvements will benefit your community?
Attitudes	To what extent do you feel that the proposed improvements will benefit your council? X would help me to reduce my energy bills
Subjective norms	I would feel good about having x People who are important to me would want me to have x
Perceived behavioural control	It would be easy for me to have x installed in my home
Familiarity	How familiar are you with x as a way to conserve energy?
Intentions	I would be willing to have x installed in my home I would be willing to contribute financially to the cost of having x installed

## Results

### Respondents

A total of 279 questionnaires were returned, yielding an overall response rate of 24.9%. Of the 279 respondents, only 3.9% either owned or were paying a mortgage on their home, whilst 56.3% lived in social housing and 36.2% lived in rented accommodation (0.7% of respondents were unsure and 2.9% did not answer).<sup>5</sup> In further support of the deprived nature of the communities, 44.1% of respondents reported that their total household income was £9,999 or less per annum, 31.2% reported that their total household income was between £10,000 and £19,999 per annum and only 6.5% reported that their household income was £20,000 or more per annum (18.3% did not answer).<sup>6</sup> A large proportion of respondents (74.9%) said that they claimed welfare benefits (22.2% of respondents said they did not claim welfare benefits and 2.9% did not answer).

Of the sample, 82.1% lived in a semi-detached house, 11.1% in a terraced house, 3.6% in a detached house and 1.4% in a flat (1.8% did not answer). A typical household consisted of 1.8 adults and 1.0 child. In terms of education level, 40.9% of respondents held no formal qualifications, 26.9% reported that their highest educational qualification was at school level (GCSE/O-Level or A-Level Higher/BTEC, formal qualifications traditionally taken by people in the UK between the ages of 14-16 and 16-18, respectively), 16.1% reported that their highest educational qualification was vocational and 3.9% said their highest educational qualification was at a higher level (degree or equivalent or postgraduate qualification) (5.4% reported that their highest educational qualification was something else). Only 1.1% of respondents were members of environmental organisations such as Greenpeace, World Wildlife Fund or Friends of the Earth and 4.7% were members of a local community group of tenants' association.

Just over half of the respondents used a pre-payment meter for their gas (55.2%), 40.9% paid using a different method and 2.9% did not use gas (1.1% did not answer). Similarly, 56.6% of respondents used a pre-payment meter for their electricity, 38.4% paid using a different method and 0.7% said they did not use electricity (4.3% did not answer). On average, respondents estimated that their monthly spend on gas was £62.36 (SD = 30.77) and that their monthly spend on electricity was £50.45 (SD = 25.37).

### **Beliefs about Climate Change**

Table 5 presents the descriptive statistics for the measures included in the questionnaire. The majority of respondents (77.8%) believed that the world's climate is changing (5.0% did not believe that it was changing and 16.5% were unsure). On average, respondents were 'fairly concerned' about climate change ( $M = 1.72$ ,  $SD = 0.96$ , where 0 = not at all concerned and 3 = very concerned). When asked about the causes of climate change, 40.5% of respondents said that it was caused 'partly by natural processes and partly by human activity'. Almost a quarter of respondents (24.0%) felt that climate change was caused 'mainly' or 'entirely' by human activity, while only 13.6% of respondents felt that climate change was caused 'entirely' or 'mainly' by natural processes. A further 18.3% of respondents were unsure about the cause and 1.4% of respondents said there was 'no such thing' as climate change. Just over a third of respondents (38%) felt that climate change was currently, or was going to, affect them (34.1% did not and 26.9% were unsure). Almost half of the respondents (45.2%) felt that there was something that could be done to tackle climate change, although a quarter of respondents (24.7%) said that there was nothing that could be done and a further 28.7% of respondents were unsure.

### **Perceptions of the Proposed Scheme and its Benefits**

Respondents were generally aware of the BEU scheme, with 91.0% stating that they were aware that the local council was planning a scheme of improvements in their

neighbourhood. Most respondents believed that the scheme would be beneficial to their household ( $M = 1.16$ ,  $SD = 1.10$ ) and community ( $M = 0.83$ ,  $SD = 1.21$ ) and also of some benefit to the local council ( $M = 0.33$ ,  $SD = 1.28$ ). Respondents did not believe that the scheme would benefit their energy supplier ( $M = -0.25$ ,  $SD = 1.44$ ).

The majority (80.3%) of respondents believed that they would save money on their energy bills as a result of the proposed improvements (13.6% did not think they would save money and 6.1% did not respond), with the average saving estimated to be £28.34 per month ( $SD = 22.65$ ).<sup>7</sup> Just over a quarter of respondents (27.6%) said that they would spend any savings on improvements to their home or garden and 14.0% said that they would spend any savings on their family (20.1% were unsure what they would spend any savings on).

**Table 5**

## Descriptive Statistics for Each Measure

Characteristic	Mean	SD	Coding	N
<b>Section 1: Perceptions of the proposed scheme and its benefits</b>				
Awareness of scheme	0.91	0.29	1 (yes); 0 (no)	279
Perceived benefit of scheme (combined scale)	0.78	0.94	-2 (no benefit at all) to 2 (very much benefit)	273
Perceived benefit to scheme to household	1.16	1.10	-2 (no benefit at all) to 2 (very much benefit)	278
Perceived benefit of scheme to community	0.83	1.21	-2 (no benefit at all) to 2 (very much benefit)	276
Perceived benefit of scheme to council	0.33	1.28	-2 (no benefit at all) to 2 (very much benefit)	276
Perceived benefit to energy supplier(s)	-0.25	1.44	-2 (no benefit at all) to 2 (very much benefit)	270
Belief in financial saving	0.86	0.35	1 (yes); 0 (no)	262
Projected financial saving	28.34	22.65	Continuous (GBP)	116
<b>Section 2A: Perceptions of loft insulation</b>				
-Familiarity	1.23	0.86	-2 (never heard of it) to 2 (very familiar)	271
-Intentions	0.39	0.80	-2 (strongly disagree) to 2 (strongly agree)	239
-Attitudes	1.24	0.72	-2 (strongly disagree) to 2 (strongly agree)	240
-Subjective norms	1.09	0.81	-2 (strongly disagree) to 2 (strongly agree)	237
-Perceived behavioural control	0.97	0.86	-2 (strongly disagree) to 2 (strongly agree)	233
<b>Section 2B: Perceptions of cavity wall insulation</b>				
-Familiarity	0.85	1.07	-2 (never heard of it) to 2 (very familiar)	228
-Intentions	0.33	0.82	-2 (strongly disagree) to 2 (strongly agree)	142
-Attitudes	1.12	0.82	-2 (strongly disagree) to 2 (strongly agree)	142
-Subjective norms	1.01	0.91	-2 (strongly disagree) to 2 (strongly agree)	138
-Perceived behavioural control	0.67	1.04	-2 (strongly disagree) to 2 (strongly agree)	138
<b>Section 2C: Perceptions of external wall cladding</b>				
-Familiarity	0.26	1.31	-2 (never heard of it) to 2 (very familiar)	255
-Intentions	0.30	0.84	-2 (strongly disagree) to 2 (strongly agree)	232
-Attitudes	1.13	0.84	-2 (strongly disagree) to 2 (strongly agree)	230
-Subjective norms	0.96	0.91	-2 (strongly disagree) to 2 (strongly agree)	228
-Perceived behavioural control	0.66	1.05	-2 (strongly disagree) to 2 (strongly agree)	229
<b>Section 2D: Perceptions of solar electricity panels</b>				
-Familiarity	0.46	1.12	-2 (never heard of it) to 2 (very familiar)	273
-Intentions	0.18	0.76	-2 (strongly disagree) to 2 (strongly agree)	271
-Attitudes	1.02	0.88	-2 (strongly disagree) to 2 (strongly agree)	271
-Subjective norms	0.84	0.91	-2 (strongly disagree) to 2 (strongly agree)	269
-Perceived behavioural control	0.57	0.94	-2 (strongly disagree) to 2 (strongly agree)	270
<b>Section 2E: Perceptions of energy efficient 'A-rated' boilers</b>				
-Familiarity	-0.18	1.42	-2 (never heard of it) to 2 (very familiar)	275
-Intentions	0.26	0.70	-2 (strongly disagree) to 2 (strongly agree)	263
-Attitudes	1.04	0.87	-2 (strongly disagree) to 2 (strongly agree)	263
-Subjective norms	0.86	0.90	-2 (strongly disagree) to 2 (strongly agree)	263
-Perceived behavioural control	0.71	0.90	-2 (strongly disagree) to 2 (strongly agree)	259
<b>Section 2F: Perceptions of new UPVC windows</b>				
-Familiarity	1.31	0.82	-2 (never heard of it) to 2 (very familiar)	270
-Intentions	0.38	0.78	-2 (strongly disagree) to 2 (strongly agree)	245
-Attitudes	1.31	0.76	-2 (strongly disagree) to 2 (strongly agree)	245
-Subjective norms	1.11	0.86	-2 (strongly disagree) to 2 (strongly agree)	243
-Perceived behavioural control	1.07	0.89	-2 (strongly disagree) to 2 (strongly agree)	242
<b>Section 2G: Perceptions of home energy monitors</b>				
-Familiarity	-0.38	1.35	-2 (never heard of it) to 2 (very familiar)	277
-Intentions	0.06	0.85	-2 (strongly disagree) to 2 (strongly agree)	275
-Attitudes	0.67	0.87	-2 (strongly disagree) to 2 (strongly agree)	274
-Subjective norms	0.55	0.94	-2 (strongly disagree) to 2 (strongly agree)	271
-Perceived behavioural control	0.73	0.88	-2 (strongly disagree) to 2 (strongly agree)	271
<b>Perceptions of all household energy efficiency interventions combined</b>				
-Familiarity	0.51	0.72	-2 (strongly disagree) to 2 (strongly agree)	279
-Intentions – willingness to install	1.26	0.59	-2 (strongly disagree) to 2 (strongly agree)	279
-Intentions – willingness to pay for	-0.72	1.04	-2 (strongly disagree) to 2 (strongly agree)	279
-Attitudes	1.07	0.57	-2 (strongly disagree) to 2 (strongly agree)	279
-Subjective norms	0.90	0.66	-2 (strongly disagree) to 2 (strongly agree)	277
-Perceived behavioural control	0.78	0.64	-2 (strongly disagree) to 2 (strongly agree)	278
<b>Section 3: About the respondent and their household</b>				
Number of adults in residence	1.8	0.91	Continuous (number of people)	278

Number of children in residence	0.98	1.35	Continuous (number of people)	278
Claim welfare benefits	0.77	0.42	1 (yes); 0 (no)	271
Membership of environmental organisation	0.01	0.10	1 (yes); 0 (no)	277
Membership of community group	0.05	0.21	1 (yes); 0 (no)	277
Average monthly gas spend	62.36	30.77	Continuous (GBP)	244
Switched gas supplier (last 6 months)	0.11	0.31	1 (yes); 0 (no)	265
Intends to switch gas supplier	0.06	0.24	1 (yes); 0 (no)	259
Knows how to switch gas supplier	0.81	0.39	1 (yes); 0 (no)	260
Average monthly electricity spend	50.45	25.37	Continuous (GBP)	249
Switched electricity supplier (last 6 months)	0.11	0.31	1 (yes); 0 (no)	273
Intends to switch electricity supplier	0.07	0.25	1 (yes); 0 (no)	268
Knows how to switch electricity supplier	0.79	0.41	1 (yes); 0 (no)	272
<b>Section 4: Beliefs about climate change</b>				
Climate change concern	1.72	0.96	0 (not at all concerned) to 3 (very concerned)	254
Is climate changing?	0.94	0.24	1 (yes); 0 (no)	231
Climate change cause: natural or human?	2.06	1.08	0 (entirely natural) to 4 (entirely human)	218
Can we tackle climate change?	0.65	0.48	1 (yes); 0 (no)	195
Is climate change affecting you/going to?	0.53	0.50	1 (yes); 0 (no)	201

Respondents were also asked to describe what they believed to be the ‘best thing’ about the proposed improvements.<sup>8</sup> Responses tended to focus on aesthetic improvements, with 38.7% of respondents commenting that the appearance of their own home or the neighbourhood would improve. In many cases, aesthetic improvements held a broader meaning for respondents relating to a sense of pride in their home and/or community: *‘Improved appearance equals improved respect’* (respondent, Chickenley, Kirklees), *‘Making the estate look a lot better makes it a proper home’* (respondent, Wheatley, Doncaster). A sizeable minority of respondents (17.6%) made reference to expecting improved warmth in their properties. When asked to describe what they believed to be the ‘worst thing’ about the proposed improvements, 39.1% of respondents said that there was ‘nothing bad’ about the work, while 23.7% of respondents predicted that some form of disruption, noise or mess during the work would be the worst thing (see Table 6 for a summary of the main perceived pros and cons of the BEU scheme).

**Table 6***'Best' and 'Worst' Things about the Proposed Household Energy Efficiency Interventions, as Reported by Residents<sup>a</sup>*

<b>'Best' things</b>	<b>%</b>	<b>'Worst' things</b>	<b>%</b>
Positive impact on appearance of the home and/or neighbourhood	38.7	Nothing bad	39.1
Improved warmth of the home	17.6	Disruption, noise or mess during the work	23.7
Saving money	13.3	Fears that work will not be done on time or at all	3.6
Specific wider benefit to the community – pride, reputation etc.	5.7	Missing out on home improvements that are not included	3.2
Replacing older, dissatisfactory systems	3.6	Fears that work will not be done properly or to a high standard	2.5
Wider environmental impact – reduced CO <sub>2</sub> emissions, etc.	3.6	Negative attention from others – jealousy, vandalism etc.	2.2
Improved standard of living	3.2	If rent increases as a result	1.4
Increased safety	1.1	Negative impact on appearance of the neighbourhood	0.7

<sup>a</sup> 'Best' and 'worst' things about the proposed household energy efficiency interventions was an open-ended question. Responses have been coded into the categories above. Categories are not mutually exclusive (residents could provide more than one response).

**Beliefs about Different Types of Household Energy Efficiency Interventions**

Table 7 reports the outcomes of repeated measures ANOVAs examining whether beliefs differ between the interventions.

**Familiarity.** There was a significant difference in respondents' familiarity with the different interventions. Pairwise comparisons revealed that respondents were more familiar with loft insulation and UPVC windows than with any of the other interventions ( $p < .001$ ). Respondents were least familiar with home energy monitors ( $p < .001$ ).

**Attitudes.** There were significant differences in respondents' attitudes toward the different interventions. Pairwise comparisons revealed that respondents had more favourable attitudes towards loft insulation than external wall cladding ( $p < .05$ ), solar electricity ( $p < .05$ ), and home energy monitors ( $p < .001$ ). They had less favourable attitudes towards home energy monitors than loft insulation ( $p < .001$ ), cavity wall insulation ( $p < .05$ ) and UPVC windows ( $p < .001$ ).

**Subjective Norms.** There were significant differences in levels of subjective norm (perceptions of whether important others would approve or disapprove of the participants having the intervention) associated with each type of intervention. Pairwise comparisons revealed that respondents felt more normative pressure towards adopting loft insulation than toward external wall cladding ( $p < .05$ ), solar electricity panels ( $p < .05$ ) and home energy monitors ( $p < .001$ ). Respondents felt a weaker normative pressure towards home energy monitors than toward loft insulation ( $p < .001$ ) and UPVC windows ( $p < .05$ ).

**Perceived Behavioural Control.** There were significant differences in respondents' perceptions of control over the adoption of different types of intervention. Pairwise comparisons revealed that respondents believed that they had more control over acquiring UPVC windows than over acquiring cavity wall insulation ( $p < .01$ ), external cladding ( $p < .01$ ), solar electricity ( $p < .01$ ), 'A-rated' boilers ( $p < .01$ ) and home energy monitors ( $p < .01$ ).

.01). They also believed that they had more control over acquiring loft insulation than cavity wall insulation ( $p < .01$ ), external cladding ( $p < .05$ ) and solar electricity panels ( $p < .01$ ).

**Intentions to adopt and to invest.** Finally, there were significant differences in respondents' intentions to adopt the different interventions. Pairwise comparisons revealed that, although intentions to adopt were relatively high for all interventions, respondents were more willing to adopt loft insulation than external wall cladding ( $p < .01$ ), solar electricity panels ( $p < .01$ ) or home energy monitors ( $p < .001$ ). Respondents were also more willing to adopt new UPVC windows than external wall cladding ( $p < .05$ ) or home energy monitors ( $p < .01$ ). There were no significant differences between the other interventions.

Intentions to invest were much lower across all interventions and the type of intervention did not influence respondents' intentions to invest, suggesting that respondents were largely felt unwilling or unable to invest financially in energy interventions, regardless of the type of intervention offered.

**Table 7**

Statistics from Repeated Measures ANOVAs Examining the Effect of Type of Energy Intervention Offered on Theory of Planned Behaviour Constructs and Familiarity.

Measure	Multivariate effects (F)	Significance (p-values) from pairwise comparisons (with Bonferroni correction)					
		Loft insulation	Cavity wall insulation	External wall cladding	Solar electricity panels	'A-rated' boilers	New UPVC windows
<b>Familiarity</b>	<b>60.22*</b>						
-Loft insulation		-					
-Cavity wall insulation		0.000*	-				
-External wall cladding		0.000*	0.001*	-			
-Solar electricity panels		0.000*	0.008	1.000	-		
-Energy efficient 'A-rated' boilers		0.000*	0.000*	1.000	0.044	-	
-New UPVC windows		1.000*	0.000*	0.000*	0.000*	0.000*	-
-Home energy monitors		0.000*	0.000*	0.000*	0.000*	0.001*	0.000*
<b>Attitudes</b>	<b>6.32*</b>						
-Loft insulation		-					
-Cavity wall insulation		0.125	-				
-External wall cladding		0.021*	1.000	-			
-Solar electricity panels		0.018*	1.000	1.000	-		
-Energy efficient 'A-rated' boilers		0.069	1.000	1.000	1.000	-	
-New UPVC windows		1.000	1.000	0.238	0.245	0.466	-
-Home energy monitors		0.000*	0.013*	0.139	0.102	0.206	0.000*
<b>Subjective norms</b>	<b>3.96*</b>						
-Loft insulation		-					
-Cavity wall insulation		0.975	-				
-External wall cladding		0.015*	1.000	-			
-Solar electricity panels		0.023*	1.000	1.000	-		
-Energy efficient 'A-rated' boilers		0.096	1.000	1.000	1.000	-	

-New UPVC windows	1.000	1.000	0.237	0.329	0.556	-
-Home energy monitors	0.000*	0.329	1.000	1.000	1.000	0.025*
<b>Perceived behavioural control</b>	<b>9.48*</b>					
-Loft insulation	-					
-Cavity wall insulation	0.002*	-				
-External wall cladding	0.049*	1.000	-			
-Solar electricity panels	0.004*	1.000	1.000	-		
-Energy efficient 'A-rated' boilers	0.208	1.000	1.000	1.000	-	
-New UPVC windows	1.000	0.000*	0.000*	0.000*	0.000*	-
-Home energy monitors	0.603	0.617	1.000	0.764	1.000	0.004*
<b>Intentions to adopt</b>	<b>5.45*</b>					
-Loft insulation	-					
-Cavity wall insulation	0.421	-				
-External wall cladding	0.001*	1.000	-			
-Solar electricity panels	0.001*	1.000	1.000	-		
-Energy efficient 'A-rated' boilers	0.208	1.000	1.000	1.000	-	
-New UPVC windows	1.000	1.000	0.045*	0.112	1.000	-
-Home energy monitors	0.000*	0.096	1.000	1.000	0.741	0.003*
<b>Intentions to invest</b>	<b>1.05</b>					
-Loft insulation	-					
-Cavity wall insulation	1.000	-				
-External wall cladding	1.000	1.000	-			
-Solar electricity panels	1.000	1.000	1.000	-		
-Energy efficient 'A-rated' boilers	1.000	1.000	1.000	0.876	-	
-New UPVC windows	1.000	1.000	1.000	1.000	1.000	-
-Home energy monitors	1.000	1.000	1.000	1.000	1.000	1.000

Note. \* = < .05

## **Using the Theory of Planned Behaviour to Predict Intentions to Adopt Energy Efficiency Interventions**

Multiple regression revealed that, consistent with the predictions of the TPB, attitudes, subjective norms, and perceived behavioural control explained 70.2% of the variance in intentions to adopt domestic energy efficiency interventions (see Table 8). Of these variables, however, only respondents' attitudes made a unique contribution to intentions to adopt (the more positive the attitude, the more likely they were to adopt). Subjective norms and perceived behavioural control did not make a statistically significant contribution.

### **What Factors Predict Beliefs about Household Energy Efficiency Interventions?**

Table 9 reports the effect of various factors on intentions (to adopt and to invest in energy efficiency interventions), attitudes, subjective norms and perceived behavioural control regarding household energy efficiency interventions.

**Home Ownership.** Respondents who owned their own home were significantly more willing to invest in interventions ( $M = 0.36$ ,  $SD = 0.30$ ) than respondents who did not own their own home ( $M = -0.77$ ,  $SD = 0.06$ ). There were no significant differences between the other beliefs as a function of home ownership.

**Belief in Climate Change, its Impacts and the Ability of Humans to Tackle Climate Change.** Belief in climate change did not significantly affect respondents' beliefs about household energy efficiency interventions. However, the belief that humans can do something to tackle climate change did significantly influence respondents' responses to the different household energy efficiency interventions. Respondents who believed that humans can do something to tackle climate change (a) were more willing to invest in household energy efficiency interventions ( $M = -0.53$ ,  $SD = 0.09$ ); (b) had more positive attitudes toward household energy efficiency interventions ( $M = 1.21$ ,  $SD = 0.05$ ); (c) had a stronger sense of subjective norms in respect of household energy efficiency interventions ( $M = 1.04$ ,

SD = 0.06); (d) perceived themselves to have more control over whether or not to adopt energy efficiency interventions (M = 0.89, SD = 0.06); and (e) were more willing to adopt household energy efficiency interventions (M = 1.40, SD = 0.05) than respondents who did not believe that humans can do something to tackle climate change.<sup>9</sup>

The belief that climate change is currently affecting, or is going to affect, human beings influenced respondents' beliefs about household energy efficiency interventions. Respondents who believed that climate change is affecting them had more positive attitudes toward household energy efficiency interventions (M = 1.19, SD = 0.06) than respondents who did not believe that climate change would affect them (M = 0.99, SD = 0.06). Respondents who believed that climate change affects them also had a stronger sense of subjective norms with respect to household energy efficiency interventions (M = 1.05, SD = 0.06) than those who did not (M = 0.74, SD = 0.07). The belief that climate change is currently affecting, or is going to affect, the individual did not influence intentions or perceived behavioural control.

**Familiarity.** Familiarity with the household energy efficiency interventions also influenced respondents' responses to the interventions.<sup>10</sup> Respondents who were more familiar with the measures were more willing to adopt interventions (M = 1.42, SD = 0.50) than were respondents who were less familiar with the measures (M = 1.08, SD = 0.62). Respondents who were more familiar with the interventions also had more positive attitudes toward the interventions (M = 1.24, SD = 0.50) than respondents who were less familiar with them (M = 0.87, SD = 0.58). Respondents who were relatively more familiar with the interventions also perceived that they had more control over the installation of interventions (M = 0.89, SD = 0.64) than respondents who were relatively less familiar with them (M = 0.65, SD = 0.63).

**Other Variables.** Further exploration of the effects of income, educational attainment, membership of local community or tenants' group, and belief in climate change on intentions (to adopt and invest), attitudes, subjective norms and perceived behavioural control in regards to the interventions suggested that these factors did not influence respondents' beliefs about household energy efficiency interventions.

**Table 8**

Regression of Intention to Adopt Household Energy Efficiency Interventions on Attitudes, Subjective Norms and Perceived Behavioural Control (across interventions)

Independent variable	B	SE B	$\beta$	p
Attitudes	0.84	0.06	0.82	.00*
Subjective norms	0.04	0.05	0.05	.41
Perceived behavioural control	-0.03	0.05	-0.03	.53
Model F			218.41	.00*
R <sup>2</sup>			0.71	

Note. \*  $p < .01$

**Table 9**

Effect of Various Factors on Theory of Planned Behaviour Constructs, Regarding

Interventions

Intervention	N	Multivariate effect (F)	Int Adopt	Int. Invest	Attitudes	Subj. Norms	PBC
			Between-measures effects (univariate F tests)				
Home ownership	269	4.39*	0.04	13.43*	1.32	0.08	1.11
Membership of environmental organisations	275	2.50*	1.12	0.04	0.03	1.67	0.70
'Green' behaviours	277	3.09*	3.40	12.59*	2.60	3.07	2.22
Belief in our ability to tackle climate change	194	3.05*	6.02*	4.50	11.66*	9.06*	7.70*
Belief that climate change is currently affecting or will affect you	200	2.73*	2.98	0.41	5.99*	11.36*	1.92
Income	227	1.31	1.73	1.90	1.87	1.22	0.43
Educational attainment	258	0.76	0.65	0.79	0.15	0.36	0.85
Belief in climate change	229	1.28	1.45	0.01	2.25	0.06	0.04
Membership of community group or tenants' association	275	1.63	1.71	4.22*	1.01	1.69	0.06
Familiarity with energy efficiency interventions <sup>7</sup>	277	10.54*	25.03*	6.25	32.47*	5.39	10.32*

Note. \* p &lt; .05.

## Discussion

While physical interventions can improve the energy efficiency of buildings, how residents think about and respond to such interventions can influence their uptake and impact on any subsequent energy savings (Brown & Swan, 2013). The present research distributed questionnaires to residents living in deprived communities who were offered household energy efficiency interventions as part of a scheme known as ‘The Big Energy Upgrade’ (BEU). Residents were generally aware of the scheme and perceived it to be beneficial. The majority of residents believed that the physical changes being made to their homes would lead to significant savings on their energy bills and the scheme was anticipated to have wide reaching impacts, particularly in terms of the appearance of residential areas and, therefore, sense of pride felt by the local community. Within this context, the present research sought to investigate how residents living in deprived communities feel about energy-related issues and, specifically, different household energy efficiency interventions. A primary aim was to understand the factors that influence residents’ perceptions of energy efficiency measures and, thus, to identify potential targets for those wishing to increase willingness to adopt and invest in such interventions in the future.

### Key Findings

We applied an established model of reasoned action—namely, the Theory of Planned Behaviour (Ajzen, 1991) – in order to understand the determinants of residents’ intentions to adopt home energy efficiency interventions. Respondents typically held positive attitudes toward household energy efficiency interventions, felt personally capable of accessing the interventions, and believed that others would view their adoption of the interventions positively. Residents were also willing to adopt the interventions, particularly, loft insulation and UPVC windows. Our findings provide support for the TPB to the extent that over 70% of the variance in residents’ intentions was explained by TPB constructs. Closer examination,

however, revealed that only residents' attitudes toward the interventions (e.g., whether they think that cavity wall insulation would be beneficial) predicted intentions to adopt. Subjective norms (i.e., what important others think that residents should do) and perceived behavioural control (e.g., the extent to which residents' feel that they have control over whether or not to have household energy efficiency interventions) did not predict intentions to adopt energy efficiency measures in the current study.

The finding that attitudes were a significant predictor of intentions to adopt the energy efficiency measures is consistent with research into the predictors of household energy use and energy conservation behaviour (Abrahamse & Steg, 2011; Harland et al., 1999). The subjective norm construct is generally found to be a weak predictor of intentions (Armitage & Conner, 2001) and some research indicates that it might not be predictive of intentions to conserve energy (Midden & Ritsema, 1986). The finding that perceived behavioural control did not predict intentions to adopt or invest in energy efficiency interventions in the present research is less consistent with previous work (Armitage & Conner, 2001). This may, however, reflect the specifics of the BEU programme in that the interventions were taking place in predominantly council-owned properties. Thus, unlike other household energy efficiency schemes, little action (and hence less control) was required on the part of residents in order to receive the proposed interventions, as these were offered and installed for free by the local authorities/housing associations for qualifying households. The nature of the BEU might also account for why the majority of residents were generally willing to adopt the listed interventions, but were less inclined to financially invest in them. This trend differed, however, for the minority of home-owners in the sample, who were more willing to personally invest in the interventions.

It is interesting to note that residents' attitudes toward the interventions tended to be shaped by how familiar they were with those interventions. The importance of familiarity in

the decision to adopt household energy efficiency interventions could be due to reductions in the perceived risks to health and safety (Fischhoff et al., 1978) or the perceived costs and inconvenience of installation (Farsi, 2010). Perceptions of familiarity may also relate to a number of factors known to influence people's adoption of technology: complexity, relative advantage, compatibility, observability, and ability to communicate about the benefits (see Mohr et al., 2009; Faiers et al., 2007; Rogers, 2003). For example, loft insulation and UPVC windows (the most familiar measures) present arguably the least complex and technical of the interventions that respondents were asked to comment on. UPVC windows and loft insulation could also be viewed as two of the more compatible interventions. Both interventions were also likely to be suitable for the majority of the households and would not require large changes to lifestyle. The other interventions (e.g., cavity wall insulation, solar panels and external wall cladding) were less ubiquitous and/or might necessitate perceived changes to lifestyle (e.g., smart meters). Future research might usefully elicit the salient beliefs underlying perceptions of familiarity with energy efficiency interventions and identify how these relate to models of technology adoption.

The majority of respondents believed in climate change and were fairly concerned about its impact, although fewer than half felt that anything could be done to tackle climate change. While a belief in climate change per se did not impact upon attitudes or willingness to adopt and invest in the interventions, the belief that people can take action to mitigate climate change was correlated with attitudes and willingness to adopt and invest in the measures. Respondents who believed that humans can do something to tackle climate change held more positive attitudes, a greater sense of perceived control, stronger normative beliefs, and a greater willingness to invest and adopt the measures. These findings could indicate that such respondents were more aware of the environmental benefits of the interventions, and perceived a greater sense of personal responsibility and/or moral obligation to take action to

mitigate the threat of climate change. A number of models of pro-environmental behaviour indicate important roles for these constructs (e.g., Bamberg & Möser, 2007; Hines, Hungerford, & Tomera, 1986-87; Stern 2000; Kollmus & Agyeman, 2002). At the very least, however, these findings suggest that it is wrong to assume that residents in deprived communities do not invest in household energy efficiency interventions because they are disinterested, doubtful or unconcerned about climate change (the levels of belief in climate change within our sample were similar to those observed in nationally representative samples, e.g., Green Alliance, 2008; Spence et al., 2010). Rather, the issue for encouraging residents in deprived communities to adopt household energy efficiency interventions would appear to be one of empowerment and responsibility.

The present research also found that the BEU scheme stimulated a desire among some residents to personally invest in their property, even among those who did not own their home. Indeed, over a quarter of residents who did not own their own home commented that they would invest money saved via the BEU scheme to improve the appearance of their homes. These comments including: ‘Decorating and new carpets’ (Council Renter in Wheatley, Doncaster); ‘Putting up a fence at the side and rear of house’ (Social Housing Tenant in Wheatley, Doncaster); ‘Improvements within the home - making it look better for our own comfort’ (Social Housing Tenant in Golcar, Kirklees). Thus, it appeared that the prospect of the BEU positively affected notions of place and increased residents’ willingness to protect and invest in the local community and environment.

Previous research suggests that regeneration programmes can improve feelings of attachment, pride and ownership of communities (e.g., Evans, 1998; Renzaho et al., 2012) and the present findings may be indicative of some of the indirect (or ‘spillover’) effects of that might be gained from programmes targeting energy efficiency (e.g., Thørgerson & Olander, 2005). Future research should, however, investigate the extent to which this

willingness to invest translates into actual behaviour and the extent to which improvement programmes like the BEU lead to significant and sustained reductions in energy use.

### **Recommendations for Ensuring the Success of Programmes like the BEU**

Steg and Vlek (2009) argue that the most effective schemes for promoting pro-environmental behaviour are those that combine structural and informational strategies (see also Gardner & Stern, 2002). The BEU provides such an opportunity, pairing a large scale structural intervention (i.e., retrofitted home energy efficiency measures) with the provision of door-to-door energy advice. The findings of our research, however, highlight considerations for the future success of this project and similar projects, and emphasise the importance of tailoring interventions to address the circumstances of the target population.

We recommend to policy makers that schemes like the BEU, which offer an array of (at times, unfamiliar) measures, should make efforts to engage with residents in order to familiarise them with the measures and promote their compatibility with existing lifestyles. Offering opportunities to trial measures or to speak with advocates who have experienced observable benefits might be useful ways to do so. Our findings suggest that increases in residents' familiarity with interventions will be accompanied by corresponding (positive) changes in attitudes and intention to adopt the interventions.

Schemes should also account for differences in residents' willingness to adopt new technologies. The technology adoption lifecycle (Rogers, 2003) indicates that people differ in how willing and prepared they are to engage with new technology. Therefore, improvement schemes and engagement activities should recognize these differences. This could be especially important within deprived communities, as research indicates that the people who are most willing to adopt newer technologies (i.e., innovators and earlier adopters) tend to be of higher social-economic status and better educated (e.g., Rogers, 2003).

The manner in which a programme is framed should also be tailored to fit the context and to address the principal concerns and desires of the community. For instance, within the current study, when respondents were asked to describe what they believed to be the ‘best thing’ about the proposed improvements, the majority of residents commented that the appearance of their own home or the neighbourhood would improve. This finding suggests that the focus of public engagement within the BEU should not solely be on the possible financial and global environmental benefits of the programme, but also (and perhaps principally) on the aesthetic benefits of the scheme. Respondents’ focus on the anticipated aesthetic improvements of the BEU could relate to the feelings of stigma that some people associate with social housing estates (for a review, see Hastings, 2004). The focus on aesthetic improvements is also consistent with research that has found that quality of life factors, such as a perceived sense of safety and an attractive environment, are more important than factors such as the actual quality and affordability of properties in making somewhere an attractive place to live (Evans, 1998). Thus, policy makers may find that focusing on the regeneration potential of energy efficiency programmes such as the BEU (as opposed to the energy efficiency benefits per se) might promote greater buy-in from residents.

Our final recommendation pertains to residents’ sense of agency over issues like climate change. It was notable that it was the belief that action could be taken to reduce climate change, rather than awareness of the issue per se that influenced respondents’ willingness to adopt and invest in the measures in the present research. The issue for schemes like the BEU that target relatively deprived communities, therefore, is that residents who do not own their homes may be less likely to feel that they personally can make a difference to their impact on the environment; either because they feel less responsibility for doing so or because they feel thwarted by their circumstances. As Power (2003) attests, people in deprived communities suffer disproportionately from direct environmental problems

alongside concern for wider environmental problems, yet they are often constrained in how they can respond (for example, when poor local services struggle to tackle issues such as illegal dumping of waste and pollution). While the issues identified with empowerment within our study are not new (e.g., Hull, 2001; Rich et al, 1995), our findings confirm the importance of fostering a sense of control and responsibility within communities in order to maximise the success of programmes like the BEU.

### **Conclusion**

In conclusion, the present research capitalised on a major energy efficiency initiative being implemented in deprived communities in the North of England to investigate what residents in such communities think about energy-related issues, and specifically, different energy efficiency measures. Our findings suggest that residents were willing to adopt the interventions, as a consequence of positive social cognitions (notably, familiarity with the interventions and positive attitudes toward them). However, positive beliefs were not necessarily based on improved energy efficiency, as expected, but were based on anticipating that the scheme would have a positive impact on the appearance of homes and communities. We therefore suggest that future research consider how notions of place and community are influenced by energy efficiency intervention programmes like the BEU. Such research may also provide a useful way to frame similar interventions so as to maximise uptake and investment.

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### Footnotes

<sup>1</sup> For instance, work was well underway in five of the six Local Authority areas involved in the project by March 2012, with 1,280 household energy efficiency interventions installed across 465 dwellings (SQW, 2012).

<sup>2</sup> A geographical area with boundaries based on population size (each LSOA has a minimum population size of 1000 and an average of 1500). LSOAs were designed for the collection and publication of small area statistics (ONS, 2010).

<sup>3</sup> The BIG Energy Upgrade (and this paper) takes its definition of ‘deprivation’ from the UK’s Indices of Multiple Deprivation (a national measure published by the UK Government Department for Communities and Local Government, see DCLG, 2011). Deprivation is defined within this context by income as well as a raft of other factors including employment, health, education, housing, crime and living environment. A combined ‘deprivation’ measure incorporating all of these factors is calculated and communities in the UK are then ranked according to their relative ‘deprivation’ at a geographic Lower Layer Super Output Area (LSOA) level.

<sup>4</sup> Residents living in social housing in the UK are expected to pay their own energy bills. Depending on their circumstances, UK residents may pay the full bill themselves or receive additional benefits that are intended to be put towards the cost of energy bills (e.g. ‘Winter Fuel Payment’ or ‘Warm Home Discount scheme’). These benefits are not directly sensitive to the actual cost of energy bills and do not necessarily cover the full cost. As such, residents themselves will still be financially affected (positively or negatively) by any change in their energy bills

<sup>5</sup> In contrast, figures for the Yorkshire and Humber region (Government Office, 2008) suggest that around 69% of households in the region are owner-occupied, with only 18% socially rented and 13% privately rented. That only 3.9% of respondents in our survey

owned or were paying a mortgage on their home, therefore, confirms the deprived nature of the communities under investigation.

<sup>6</sup> Household income was determined using a self-report measure and it is unclear whether respondents interpreted the question as disposable or total income. ONS figures released in Spring 2012 placed regional gross disposable household income at £15,709 for the UK and £13,594 for Yorkshire and the Humber in 2010, suggesting that even if respondents interpreted the question as disposable household income, at least 44.1% of respondents in our sample were living on well below the regional average.

<sup>7</sup> Of the 224 respondents who thought that they would save money, 119 (53.1%) provided an estimate of their predicted savings. Values which were + or – 2 SDs from the mean (£36.03) were removed (3 values) as outliers may indicate low level of energy literacy or a misreading of the question as annual saving.

<sup>8</sup> ‘Best’ and ‘worst’ things about the proposed household energy efficiency interventions was an open-ended question. Responses have been analysed and coded. The resulting statistics describe the percentage of participants who stated this response (total responses account to more than 100% of respondents since the open-ended format allowed for more than one response).

<sup>9</sup> The mean values for respondents who did not believe that humans can do something to tackle climate change were as follows: (a) willingness to invest:  $M = -0.87$ ,  $SD = 0.13$ ; (b) attitudes:  $M = 0.92$ ,  $SD = 0.07$ ; (c) subjective norms:  $M = 0.75$ ,  $SD = 0.08$ ; (d) perceived behavioural control:  $M = 0.61$ ,  $SD = 0.08$ ; and (e) willingness to adopt:  $M = 1.19$ ,  $SD = 0.07$ .

<sup>10</sup> A median split was used to divide respondents into those who were familiar with the interventions versus those who were relatively less familiar.

**Appendix 1: The Questionnaire Distributed to Targeted Households**

**Q1.1** Were you aware that your local council was planning a scheme of improvements in your neighbourhood? (Yes / No)

**Q1.2** To what extent do you feel that the proposed improvements will benefit each of the following: a.) Your household (not at all / a little / somewhat / quite a bit / very much); b.) Your community (not at all / a little / somewhat / quite a bit / very much); c.) Your council (not at all / a little / somewhat / quite a bit / very much); d.) Your energy supplier(s) (not at all / a little / somewhat / quite a bit / very much)

**Q1.3** What do you think will be the best thing about the proposed improvements in your neighbourhood? (open-ended)

**Q1.4** What do you think will be the worst thing about the proposed improvements in your neighbourhood? (open-ended)

**Q1.5** Do you think you will save money on your energy bills as a result of the proposed improvements? (yes / no) If yes, how much money do you think you might save a month? (£)

**Q1.6** If you were to save money on your energy bills as a result of the proposed improvements, what would you spend this on? (open-ended)

**QA2.1** How familiar are you with loft insulation as a way to conserve energy? (never heard of it / not very familiar / somewhat familiar / familiar / very familiar)

**QA2.2** Does your home currently have loft insulation? (yes / no / house not suitable / don't know)

**QA2.3a** I would be willing to have loft insulation installed in my home (strongly disagree / disagree / not sure / agree / strongly agree)

**QA2.3b** Loft insulation would help me to reduce my energy bills (strongly disagree / disagree / not sure / agree / strongly agree)

**QA2.3c** I would feel good about having loft insulation (strongly disagree / disagree / not sure / agree / strongly agree)

**QA2.3d** People who are important to me would want me to have loft insulation (strongly disagree / disagree / not sure / agree / strongly agree)

**QA2.3e** It would be easy for me to have loft insulation installed in my home (strongly disagree / disagree / not sure / agree / strongly agree)

**QA2.3f** I would be willing to contribute to the cost of having loft insulation installed (strongly disagree / disagree / not sure / agree / strongly agree)

**QB2.1** How familiar are you with cavity wall insulation as a way to conserve energy? (never heard of it / not very familiar / somewhat familiar / familiar / very familiar)

**QB2.2** Does your home currently have cavity wall insulation? (yes / no / house not suitable / don't know)

**QB2.3a** I would be willing to have cavity wall insulation installed in my home (strongly disagree / disagree / not sure / agree / strongly agree)

**QB2.3b** Cavity wall insulation would help me to reduce my energy bills (strongly disagree / disagree / not sure / agree / strongly agree)

**QB2.3c** I would feel good about having cavity wall insulation (strongly disagree / disagree / not sure / agree / strongly agree)

**QB2.3d** People who are important to me would want me to have cavity wall insulation (strongly disagree / disagree / not sure / agree / strongly agree)

**QB2.3e** It would be easy for me to have cavity wall insulation installed in my home (strongly disagree / disagree / not sure / agree / strongly agree)

**QB2.3f** I would be willing to contribute to the cost of having cavity wall insulation installed (strongly disagree / disagree / not sure / agree / strongly agree)

**QC2.1** How familiar are you with external wall cladding as a way to conserve energy? (never heard of it / not very familiar / somewhat familiar / familiar / very familiar)

**QC2.2** Does your home currently have external wall cladding? (yes / no / house not suitable / don't know)

**QC2.3a** I would be willing to have external wall cladding installed in my home (strongly disagree / disagree / not sure / agree / strongly agree)

**QC2.3b** External wall cladding would help me to reduce my energy bills (strongly disagree / disagree / not sure / agree / strongly agree)

**QC2.3c** I would feel good about having external wall cladding (strongly disagree / disagree / not sure / agree / strongly agree)

**QC2.3d** People who are important to me would want me to have external wall cladding (strongly disagree / disagree / not sure / agree / strongly agree)

**QC2.3e** It would be easy for me to have external wall cladding installed in my home (strongly disagree / disagree / not sure / agree / strongly agree)

**QC2.3f** I would be willing to contribute to the cost of having external wall cladding installed (strongly disagree / disagree / not sure / agree / strongly agree)

**QD2.1** How familiar are you with solar electricity panels as a way to conserve energy? (never heard of it / not very familiar / somewhat familiar / familiar / very familiar)

**QD2.2** Does your home currently have solar electricity panels? (yes / no / house not suitable / don't know)

**QD2.3a** I would be willing to have solar electricity panels installed in my home (strongly disagree / disagree / not sure / agree / strongly agree)

**QD2.3b** Solar electricity panels would help me to reduce my energy bills (strongly disagree / disagree / not sure / agree / strongly agree)

**QD2.3c** I would feel good about having solar electricity panels (strongly disagree / disagree / not sure / agree / strongly agree)

**QD2.3d** People who are important to me would want me to have solar electricity panels (strongly disagree / disagree / not sure / agree / strongly agree)

**QD2.3e** It would be easy for me to have solar electricity panels installed in my home (strongly disagree / disagree / not sure / agree / strongly agree)

**QD2.3f** I would be willing to contribute to the cost of having solar electricity panels installed (strongly disagree / disagree / not sure / agree / strongly agree)

**QE2.1** How familiar are you with ‘A-Rated’ boilers as a way to conserve energy? (never heard of it / not very familiar / somewhat familiar / familiar / very familiar)

**QE2.2** Does your home currently have an ‘A-Rated’ boiler? (yes / no / house not suitable / don’t know)

**QE2.3a** I would be willing to have an ‘A-Rated’ boiler installed in my home (strongly disagree / disagree / not sure / agree / strongly agree)

**QE2.3b** An ‘A-Rated’ boiler would help me to reduce my energy bills (strongly disagree / disagree / not sure / agree / strongly agree)

**QE2.3c** I would feel good about having an ‘A-Rated’ boiler (strongly disagree / disagree / not sure / agree / strongly agree)

**QE2.3d** People who are important to me would want me to have an ‘A-Rated’ boiler (strongly disagree / disagree / not sure / agree / strongly agree)

**QE2.3e** It would be easy for me to have an ‘A-Rated’ boiler installed in my home (strongly disagree / disagree / not sure / agree / strongly agree)

**QE2.3f** I would be willing to contribute to the cost of having an ‘A-Rated’ boiler installed (strongly disagree / disagree / not sure / agree / strongly agree)

**QF2.1** How familiar are you with new windows as a way to conserve energy? (never heard of it / not very familiar / somewhat familiar / familiar / very familiar)

**QF2.2** Does your home currently have new windows? (yes / no / house not suitable / don't know)

**QF2.3a** I would be willing to have new windows installed in my home (strongly disagree / disagree / not sure / agree / strongly agree)

**QF2.3b** New windows would help me to reduce my energy bills (strongly disagree / disagree / not sure / agree / strongly agree)

**QF2.3c** I would feel good about having new windows (strongly disagree / disagree / not sure / agree / strongly agree)

**QF2.3d** People who are important to me would want me to have new windows (strongly disagree / disagree / not sure / agree / strongly agree)

**QF2.3e** It would be easy for me to have new windows installed in my home (strongly disagree / disagree / not sure / agree / strongly agree)

**QF2.3f** I would be willing to contribute to the cost of having new windows installed (strongly disagree / disagree / not sure / agree / strongly agree)

**QG2.1** How familiar are you with home energy monitors as a way to conserve energy? (never heard of it / not very familiar / somewhat familiar / familiar / very familiar)

**QG2.2** Does your home currently have a home energy monitor? (yes / no / house not suitable / don't know)

**QG2.3a** I would be willing to have a home energy monitor installed in my home (strongly disagree / disagree / not sure / agree / strongly agree)

**QG2.3b** A home energy monitors would help me to reduce my energy bills (strongly disagree / disagree / not sure / agree / strongly agree)

**QG2.3c** I would feel good about having a home energy monitor (Strongly disagree / Disagree / Not sure / Agree / Strongly agree)

**QG2.3d** People who are important to me would want me to have a home energy monitor (strongly disagree / disagree / not sure / agree / strongly agree)

**QG2.3e** It would be easy for me to have new windows installed in my home (strongly disagree / disagree / not sure / agree / strongly agree)

**QG2.3f** I would be willing to contribute to the cost of having a home energy monitor installed (strongly disagree / disagree / not sure / agree / strongly agree)

**Q3.1** Installing an energy efficient boiler can compensate for not installing insulation (strongly disagree / disagree / neither agree nor disagree / agree / strongly agree)

**Q3.2** Installing solar electricity panels can compensate for the unnecessary use of electricity in the home (strongly disagree / disagree / neither agree nor disagree / agree / strongly agree)

**Q3.3** Installing insulation can compensate the unnecessary use of electricity in the home (strongly disagree / disagree / neither agree nor disagree / agree / strongly agree)

**Q3.4** The efficient use of electricity in the home can compensate for not installing an energy efficient boiler (strongly disagree / disagree / neither agree nor disagree / agree / strongly agree)

**Q3.5** Installing an energy efficient boiler can compensate for not installing solar electricity panels (strongly disagree / disagree / neither agree nor disagree / agree / strongly agree)

**Q3.6** The efficient use of electricity in the home can compensate for not installing insulation (strongly disagree / disagree / neither agree nor disagree / agree / strongly agree)

**Q3.7** Installing an energy efficient boiler can compensate for the unnecessary use of electricity in the home (strongly disagree / disagree / neither agree nor disagree / agree / strongly agree)

**Q3.8** Installing solar electricity panels can compensate for not installing an energy efficient boiler (strongly disagree / disagree / neither agree nor disagree / agree / strongly agree)

**Q3.9** Installing insulation can compensate for not installing solar electricity panels (strongly disagree / disagree / neither agree nor disagree / agree / strongly agree)

**Q3.10** Installing solar electricity panels can compensate for not installing insulation (strongly disagree / disagree / neither agree nor disagree / agree / strongly agree)

**Q3.11** Installing insulation can compensate for not installing an energy efficient boiler (strongly disagree / disagree / neither agree nor disagree / agree / strongly agree)

**Q3.12** The efficient use of electricity in the home can compensate for not installing solar electricity panels (strongly disagree / disagree / neither agree nor disagree / agree / strongly agree)

**Q4.1** Please provide your address in the space provided (open-ended)

**Q4.2** What kind of house do you live in? (terraced house / semi-detached house / detached house / flat)

**Q4.3** How many people live in your house? (adults? children?)

**Q4.4** Do you own (or are you paying a mortgage on) your own home? (yes / no: rented / no: social housing / don't know)

**Q4.5** Do you claim any welfare benefits? (yes / no, please specify)

**Q4.6** What is your annual household income? (£0-£9,999 / £10,000-£19,999 / £20,000-£29,999 / £30,000-£39,999 / £40,000+)

**Q4.7** What is your highest overall educational qualification? (no formal qualifications / GCSE/ O-Level / A-Level/ higher / BTEC / vocational/ NVQ / degree or equivalent / postgraduate qualification / other)

**Q4.8** Are you a member of an environmental organisation (e.g., Greenpeace, WWF, Friends of the Earth)?

**Q4.9** Are you a member of a local community group or tenants' association? (yes / no)

**Q4.10a** Do you use a pre-payment meter for your gas? (yes / no / don't use Gas)

*If you answered 'don't use gas', please proceed to Question 4.11*

**Q4.10b** On average, how much do you spend a month on gas? (£)

**Q4.10c** Who is your current gas supplier? (EDF / nPower / Scottish & Southern / Scottish Power / E.ON / British Gas / other / don't know)

**Q4.10e** Have you switched your gas supplier in the last 6 months? (yes / no)

**Q4.10f** Do you intend to switch your gas supplier in the next 6 months? (yes / no)

**Q4.10f** Would you know how to switch your gas supplier if you wanted to do so? (yes / no)

**Q4.11a** Do you use a pre-payment meter for your electricity? (yes / no / don't use electricity)

*If you answered 'don't use electricity', please proceed to Question 4.12*

**Q4.11b** On average, how much do you spend a month on electricity? (£)

**Q4.11c** Who is your current electricity supplier? (EDF / nPower / Scottish & Southern / Scottish Power / E.ON / British Gas / other / don't know)

**Q4.11e** Have you switched your electricity supplier in the last 6 months? (Yes / No)

**Q4.11f** Do you intend to switch your electricity supplier in the next 6 months? (Yes / No)

**Q4.11f** Would you know how to switch your electricity supplier if you wanted to do so? (Yes / No)

**Q4.12** Do you currently do any of the following things? (Please tick ALL that apply):

Regularly drive a car/van for work (either to get to work, or for your job) / regularly drive a car/van outside work (e.g., to go to the shops) / walk or cycle to work on a regular basis / use public transport on a regular basis / recycle glass; recycle plastic / recycle paper / use energy-efficient light bulbs in your house / turn off lights that you're not using / only use a fully loaded washer or dryer / only boil as much water as needed in the kettle / control the heating to come on as required / put draught proofing around doors and windows / take a shower

instead of a bath to save energy / grow your own vegetables / have an allotment / compost your garden and kitchen waste / collect rainwater in a water butt / donate clothes and unwanted items to charity shops / take your own shopping bags to the supermarket.

**Q4.13** How concerned are you about climate change? (not at all concerned / not very concerned / fairly concerned / very concerned / don't know)

**Q4.14** Do you think that the world's climate is changing? (yes / no / don't know)

**Q4.15** Thinking about the causes of climate change, which of the following best describes your opinion? (Tick ONE answer): Climate change is entirely caused by natural processes / climate change is mainly caused by natural processes / climate change is partly caused by natural processes and partly caused by human activity / climate change is mainly caused by human activity / climate change is entirely caused by human activity / there is no such thing as climate change / don't know.

**Q4.16** Do you think that anything can be done to tackle climate change? (yes / no / don't know)

**Q4.17** Do you think that climate change is something that is currently affecting you or is going to affect you? (yes / no / don't know)

**Q4.18** Please state your voting preference (Please choose ONE): Conservative / Labour / Liberal Democrats / Green / UK Independence Party (UKIP) / British National Party (BNP) / other (please state) / none at present / don't intend to vote / I would prefer not to answer.

**Q4.19** Please choose the term below which you feel most accurately describes your ethnic origin: White – British / White – Irish / White – other background / Black/Black British – Caribbean / Black/Black British – African / Black – other background / Asian/Asian British – Indian / Asian/Asian British – Pakistani / Asian/Asian British – Bangladeshi / Asian/Asian British – Chinese / Asian – other background / Mixed – White & Black (Caribbean) / Mixed

– White & Black (African) / Mixed – White & Asian / Mixed – other background / other ethnic background / I would prefer not to answer.