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Retrofitting social housing : reflections by tenants on adopting and living with retrofit technology

Brown, P, Swan, W and Chahal, S

<http://dx.doi.org/10.1007/s12053-013-9245-3>

Title	Retrofitting social housing : reflections by tenants on adopting and living with retrofit technology
Authors	Brown, P, Swan, W and Chahal, S
Type	Article
URL	This version is available at: http://usir.salford.ac.uk/id/eprint/34913/
Published Date	2014

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1	Article Title	Retrofitting social housing: reflections by tenants on adopting and living with retrofit technology		
2	Article Sub- Title			
3	Article Copyright - Year	Springer Science+Business Media Dordrecht 2013 (This will be the copyright line in the final PDF)		
4	Journal Name	Energy Efficiency		
5	Corresponding Author	Family Name	Brown	
6		Particle		
7		Given Name	Philip	
8		Suffix		
9		Organization	University of Salford	
10		Division	Salford Housing & Urban Studies Unit, Joule House	
11		Address	Salford M5 4WT, UK	
12	e-mail	p.brown@salford.ac.uk		
13	Author	Family Name	Swan	
14		Particle		
15		Given Name	Will	
16		Suffix		
17		Organization	University of Salford	
18		Division	School of the Built Environment, Joule House	
19		Address	Salford M5 4WT, UK	
20	e-mail			
21	Author	Family Name	Chahal	
22		Particle		
23		Given Name	Sharon	
24		Suffix		
25		Organization	Places for People	
26		Division		
27		Address	18 South Rings Business Park, Craven Drive, Bamber Bridge PR5 6BZ, Preston, UK	
28	e-mail			
29	Schedule	Received	22 August 2012	

30		Revised
31		Accepted 17 December 2013
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33	Keywords separated by ' - '	Retrofit - Adoption - In-use - Social housing - Tenants
34	Foot note information	

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2

ORIGINAL ARTICLE

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5

Retrofitting social housing: reflections by tenants on adopting and living with retrofit technology

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Philip Brown · Will Swan · Sharon Chahal

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Received: 22 August 2012 / Accepted: 17 December 2013
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Abstract Retrofit has been described as one of the major engineering challenges of the twenty-first century (Kelly 2009). However, the industry needs to look beyond regarding the problem as restricted to the physical upgrade of properties. Asset managers, engineers and installers work on and in people’s homes and, in many cases, are subsequently changing the way householders use their homes to meet their comfort and wider energy needs. Here we consider how the twin issues of adopting and living with retrofit technologies have affected groups of residents in social housing. We discuss issues of trust, social norms, engagement and concern that have shaped the adoption process, as well as investigating the everyday experience of living with new configurations of energy consumption. The findings have relevance not only for the social housing sector but also raise questions as to how to effectively deliver programmes such as the Green Deal and the Energy Company Obligation within the UK.

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Keywords Retrofit · Adoption · In-use · Social housing · Tenants 32
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Introduction 34

The domestic sector accounts for more than 25 % of carbon dioxide emissions generated by more than 26 million homes in the UK (Swan et al. 2010). In addition, rising energy costs have led to increasing levels of fuel poverty in the UK (Hills 2012), with energy prices predicted to rise by 34 % for gas and 54 % for electricity over the next 10 years (Ofgem 2009). Given these twin issues of greenhouse gas emissions and fuel poverty, the sustainable retrofit of the existing domestic stock is predicted to play a central part of the UK’s strategy to reduce carbon dioxide emissions (Boardman 2012; Ravetz 2008). Sustainable retrofit can be defined as the upgrading of the building fabric, systems or controls to improve the energy performance of the property.

There have been a wide number of programmes put in place over the years with the aim of delivering this improvement: the Carbon Emissions Reduction Tariff (CERT) (Druckman and Jackson 2008), Warm Front (Gilbertson et al. 2006) and the Community Energy Savings Programme (CESP) (Reeves et al. 2010), for example. The new Green Deal (DECC 2010) and Energy Company Obligation (DECC 2010) programmes continue the UK’s policy commitment to domestic retrofit. However, it has become recognised that understanding behaviour, in terms of both adoption and in use issues, represents a vital component of the

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P. Brown (✉)
Salford Housing & Urban Studies Unit, Joule House,
University of Salford, Salford M5 4WT, UK
e-mail: p.brown@salford.ac.uk

W. Swan
School of the Built Environment, Joule House, University of
Salford, Salford M5 4WT, UK

S. Chahal
Places for People, 18 South Rings Business Park, Craven
Drive, Bamber Bridge, Preston PR5 6BZ, UK

61 success of sustainable retrofit programmes (Chahal et al.
 62 2012). Adoption is concerned with how to encourage
 63 households to take up retrofit measures and is a major
 64 issue, particularly with reference to the UK's Green Deal
 65 programme. A MORI poll undertaken for the UK gov-
 66 ernment, which investigated the decisions related to the
 67 adoption of cavity wall insulation with householders,
 68 highlighted a wide range of reasons for non-adoption
 69 (HM Government 2010) ranging from a lack of under-
 70 standing and knowledge to sheer apathy, highlighting
 71 the challenge faced by policy makers.

72 Once the difficult issue of adoption has been ad-
 73 dressed, we are then confronted with how behaviours,
 74 social norms, habits and values all interact to influence
 75 energy use. The role of behaviour can be seen to have a
 76 huge influence on the consumption of energy
 77 (Summerfield 2010), driven by a number of demographic,
 78 lifestyle and cultural differences (McMakin 2002),
 79 but this is only part of the problem. New technologies
 80 often conflict with deeply engrained energy practices
 81 and contribute to a gap between designed and actual
 82 performance (Wingfield et al. 2008). The majority of
 83 energy consumed in the domestic sector is used for
 84 space heating (Palmer and Cooper 2011), and as such
 85 this plays a major part of the issues addressed within the
 86 study reported here. However, we do include observa-
 87 tions on both hot water, electrical and ventilation sys-
 88 tems, which are often installed as part of a retrofit
 89 package and often interact with changes made to heating
 90 systems.

91 **The adoption of energy efficient measures**

92 Under sociotechnical models, such as those proposed by
 93 Geels (2005), there can be a number of reasons as to
 94 why energy efficient measures are not adopted. Weber
 95 (1997) also identifies institutional, regulatory, market
 96 and social barriers that influence adoption. Here we will
 97 consider those barriers that are specifically encountered
 98 by the occupants of residential dwellings, something
 99 Geels may define as 'market and user practices'.
 100 Currently, the market for energy efficient measures can
 101 best be described as 'emergent' (van Sandick and Oostra
 102 2010). There has been widespread adoption of basic
 103 measures in social housing, such as loft and cavity wall
 104 insulation, driven by incentives such as the CERT and
 105 CESP programmes. However, more sophisticated or
 106 'deep' retrofits (Kelly 2009) are still in the stage of early

107 adoption (Fawcett 2011). Two successive UK govern-
 108 ments have identified the social sector as a test bed for
 109 the sustainable retrofit market (HM Government 2010;
 110 2010). The suitability of the UK's social housing
 111 for has been largely supported by the availability of
 112 professional decision makers, asset managers, building
 113 surveyors and project managers, who can address many
 114 of the knowledge issues that were identified in the
 115 MORI poll (HM Government 2010). They may have
 116 the skills to effectively identify potential energy efficien-
 117 cy measures, identify supply chains that can deliver
 118 them and have available capital to fund the measures,
 119 overcoming many of the issues that might prevent
 120 owner-occupiers or small-scale landlords from adopting
 121 sustainable retrofit technologies (Jenkins 2010).

122 However, removing these knowledge and capital-
 123 based barriers does not mean that adoption is guaran-
 124 teed. Within the UK social housing, tenants do have the
 125 right to refuse improvements that are proposed by their
 126 landlords, as they appear to fall outside the legal repair
 127 framework for social housing. However, as our research
 128 indicates, this is not always fully understood by resi-
 129 dents and may be clouded by the approach that the
 130 social landlords take in engaging with residents. A ma-
 131 jor improvement works programme undertaken by
 132 Affinity Sutton (a large social housing landlord) includ-
 133 ed packages of sustainable retrofit, ranging in value
 134 from £6,500 to £25,000, offered to residents on the basis
 135 of their house types. This programme experienced a
 136 refusal rate of more than 50 % with the reasons of
 137 disruption and inconvenience cited as the most common
 138 responses (Willey 2012). The nature and complexity of
 139 sustainable retrofit packages make it a more complex
 140 market to transform. The success of regulatory changes
 141 has had some success in appliances (Killip 2012), but it
 142 is clear that the application of this model is not as
 143 straightforward, when applied to more disruptive and
 144 complex products and processes. A better understanding
 145 of the market behaviours for these kinds of products is
 146 essential if regulation and market-making is to be used
 147 in this way (Boardman 2012).

148 This study focuses very specifically on the adoption
 149 of sustainable retrofit within UK social housing. Within
 150 the UK, social housing represents some 18 % of total
 151 housing stock (CLG 2011). The triggers and barriers
 152 involved in adoption, as highlighted by Jenkins (2010),
 153 differ when compared to the owner-occupier and private
 154 rented market (Mallaband et al. 2012), where financial
 155 decisions become a major part of the adoption decision.

- 156 Studies from Sweden (Nair et al. 2010), the USA
 Qd 157 (Niemeyer 2010) and Germany (Achtchnitt 2011) repli-
 158 cate this perspective, although Achtchnitt highlights the
 159 potential importance for climate change as a driving
 160 factor. Given that climate change awareness as a factor
 161 for adoption is partially driven by income and education
 162 (Semenza et al. 2008), it seems that Chahal's (2012)
 163 assertion that it does not drive adoption in UK social
 164 housing is potentially supported. However, issues of
 165 knowledge, access to information and supply chains
 166 appeared to be universal between tenures and countries.
 167 We can see that the grouping can be cut in a number of
 168 ways that will give us different adoption drivers and
 169 barriers; tenure, environmental values and individual
 170 countries will all have slightly different issues and ap-
 171 proaches that will change the potential weightings of the
 172 adoption issue. This can make specific studies highly
 173 context sensitive.
- 174 Understanding why some households adopt and why
 175 their neighbours refuse offers an opportunity to under-
 176 stand this set of complex decisions. McMakin et al.
 177 (2002) state that individuals tend to identify energy
 178 efficiency strongly with their own personal circum-
 179 stances, such as their health or comfort. In an earlier
 180 paper, Mills and Rosenfeld (1996) recognise the non-
 181 energy-related reasons for improving the energy effi-
 182 ciency of homes, identifying a wide number of environ-
 183 mental, financial and health benefits that can be brought
 184 about by sustainable retrofit. They recommend adoption
 185 might be improved by marketing these benefits, rather
 186 than pure energy efficiency. These ideas are concerned
 187 with the rational side of energy efficiency adoption.
 188 However, social norms and changing values also have
 189 a part to play. The social norms (McKenzie-Mohr 2000)
 190 and value-driven (Lovell 2004) aspects of energy use
 191 should be seen as a 'moveable feast'; patterns of use and
 192 the reasons behind them will change over time, so
 193 studies concerning this aspect are both time and geo-
 194 graphically sensitive.
- 195 **Using and living with retrofit measures**
- 196 The gap between as-designed and as-performed energy
 197 efficiency of properties is well documented in new build
 198 homes (Wingfield et al. 2008). Factors such as installa-
 199 tion and build quality, specification and, specific to our
 200 question, behaviour are all contributing factors. The
 201 issues can be logically extended to substantially
 refurbished homes (Wetherell and Hawkes 2011).
 202 Focusing on behaviour, there are a wide range of issues
 203 that can impact our understanding of how people use
 204 energy (Economic and Social Research Council 2009).
 205 Q7 There are large variations in energy use (Summerfield
 206 2010), with higher levels of use often being driven by
 207 wealth, and commensurate differences in property size,
 208 as identified in the National Energy Efficiency Database
 209 Framework Report (Department for Energy and Climate
 210 Q8 Change 2011). At the other end of the spectrum, comfort
 211 taking or the rebound effect can undermine predicted
 212 energy use (Chahal et al. 2012). Another key factor that
 213 influences how and the amount of energy consumed is
 214 the inability of individuals to effectively manage energy
 215 within their homes. The use of controls is highlighted as
 216 a significant part of energy consumption, yet their de-
 217 sign and ultimately their interface with operators create
 218 problems for people (Peffer et al. 2011). New ventilation
 219 and heating systems may require different approaches.
 220 Moving from a gas fired heating system with radiators
 221 requires a different pattern of use when compared with
 222 air-source heat pumps and under floor heating. These
 223 changes need to be both effectively communicated and
 224 reinforced. For certain groups of householders, such as
 225 older people, new technology often presents additional
 226 challenges in the way they are understood, programmed
 227 and accessed, all of which compromise the predicted
 228 efficiency of retrofit measures (Lusambili et al. 2011).
 229 For technologies, such as photovoltaic micro-
 230 generation, benefits are maximised if people can change
 231 consumption behaviours to shift in line with the de-
 232 mands of the technology. This, combined with unpre-
 233 dictable weather (a major issue in the UK when consid-
 234 ering renewable energy), can lead to expectations not
 235 being met (Bahaj and James 2007).
 236 The shift from using one sort of heating system to
 237 another, requiring new energy practices, is further com-
 238 plicated as a result of apathy or apparent resistance from
 239 householders in changing the way they use their homes.
 240 People, for the most part, appear largely unaware of how
 241 much energy they use and research suggests that they
 242 are rarely interested or engaged in the subject (Retallack
 243 et al. 2007; Whitmarsh et al. 2011; Yohanis 2012).
 244 Although we know there is a performance gap between
 245 predicted to actual use, we know comparatively little
 246 about what meaning and significance the presence of
 247 retrofit measures have for households. As such we still
 248 do not have adequate feedback from householders about
 249 what aspects appear to close the performance gap and
 250

251 how this can be used to improve the roll out of these
 252 technologies. Often this longer-term engagement is not
 253 resourced as part of the retrofit project. It is often part of
 254 other resident liaison activities, and as such, data regard-
 255 ing levels of support to occupants in newly retrofitted
 Q256 properties is difficult to evidence. Affinity Sutton (2011)
 257 identified that from survey to completion, the number of
 258 visits to 102 homes within their retrofit programme
 259 ranged from 6 to 20, although this includes a certain
 260 degree of pre-adoption engagement.

261 **Methodology**

262 This paper reports on the findings from an initial explor-
 263 atory study that formed part of the work of a Knowledge
 264 Transfer Partnership between the University of Salford,
 265 UK and Fusion 21 (a large social enterprise specialising
 266 in public procurement). The overall aim of the KTP has
 267 been to produce guidance for social housing sector on
 268 how best to deliver retrofit measures in partnership with
 269 their tenants. As part of delivering this guidance, a
 270 number of research activities have taken place; these
 271 include a literature review, a survey of 253 tenants in
 272 the social housing sector, six focus groups with tenants
 273 involving a total of 34 participants and extensive con-
 274 sultations with social landlords. The findings arising
 275 from the survey and literature review have been
 276 discussed elsewhere (Chahal et al. 2012). This paper
 277 reports on an analysis from the focus group phase of
 278 the research.

279 Tenants from six different social housing landlords
 280 located in the North West of England were invited to
 281 participate in focus group discussions during early 2011.
 282 The focus groups aimed to consider what were the
 283 drivers and barriers for tenants when presented with a
 284 programme of retrofit and what their experience was of
 285 living with the measures. Focus groups were seen as a
 286 method of data collection well suited to this stage of the
 287 research as they allow for the discussion of differences
 288 of opinion and experience within groups and facilitate a
 289 collective understanding of the particular norms and
 290 values that a specific group brings to the research
 291 (Morgan 1988; Lewis 2003).

292 Individuals with recent experience of retrofit were
 293 invited to take part in the focus groups. Although it
 294 was not discussed in detail, it is thought these retrofits
 295 were made possible either through the Decent Homes
 296 programme, CESP or CERT. From the 34 people who

297 participated in the focus groups, there was an even
 298 gender split of 17 men and women across all groups.
 299 The majority of participants were older people, over the
 300 age of 55 years. The focus groups were guided by a
 301 question schedule devised by the research team devel-
 302 oped from the related literature review. The question
 303 schedule included issues relating to their housing type,
 304 energy consumption, their energy practices, their expe-
 305 rience of retrofit installation and how they use their
 306 home and the technology that was installed. However,
 307 in keeping with the apparent gap in the literature, the
 308 main focus of these discussions was on the meaning the
 309 retrofit measures had for the tenants and how they fitted
 310 within their everyday lives, as opposed to the effective-
 311 ness at increasing the energy efficiency of their homes.
 312 The main technologies that were discussed were gener-
 313 ally delivered in ‘packages’, specifically around insula-
 314 tion, heating and ventilation. Insulation will have in-
 315 cluded cavity wall insulation, loft insulation, windows
 316 and doors. In some cases, there was external wall insu-
 317 lation. Heating provided is predominately gas-fired
 318 combination boilers, while ventilation was provided by
 319 mechanical ventilation and heat recovery in cases where
 320 high levels of ventilation were provided. Also included
 321 were a number of photovoltaic installations.

322 The research team took ethical issues seriously and
 323 were guided by a number of principles, namely respect-
 324 ing the dignity, rights, welfare and safety of research
 325 participants; ensuring informed consent and voluntary
 326 participation; protecting anonymity and doing no harm.
 327 Information sheets were provided to participants which
 328 outlined the study and provided details of their rights as
 329 voluntary research participants and how the data gener-
 330 ated might be used; signed consent was obtained from
 331 those who took part. The study was subject to the
 332 procedures required by the appropriate Ethical
 333 Approval Panel within the university. The focus groups
 334 were recorded and transcribed verbatim. The qualitative
 335 software package, QSR Nvivo, was used to store, man-
 336 age and analyse the textual data. A sequential approach
 337 to thematic analysis was used following the guidelines
 338 of Braun and Clarke (2006) and King and Horrocks
 339 (2010). The analytical strategy involved a process of
 340 sustained reading and re-reading of the transcripts.
 341 Throughout this process the text was coded, sifted and
 342 sorted into key issues and themes. Although such a
 343 process shares characteristics with a grounded theory
 344 approach (Glaser 1992), the researchers significant pre-
 345 engagement with the literature and broader objectives



346 around the delivery of outputs meant that such a process
 347 was not possible. As a result, the objectives of the
 348 researchers to explore the issues that underpin the
 349 drivers and barriers to adopting retrofit measures, and
 350 using them efficiently, have an inevitable influence on
 351 the analysis of these accounts. However, it is thought
 352 that by adhering to the principles of rigorous qualitative
 353 analysis, such influence is made transparent in order to
 354 enhance the validity of the findings presented here.

355 **Findings and analysis**

356 The findings are explored following the processes that
 357 retrofit programmes are experienced by the households,
 358 from pre-installation to in-use. In particular, we look at
 359 the experiences arising around what people consider the
 360 drivers to adopting retrofit measures, as well as those
 361 aspects that are seen as barriers in some way. The
 362 installation process is explored before looking at the
 363 experience of learning and living with the new technol-
 364 ogy. While the main focus of this paper is concerned
 365 with the adoption and in-use factors, the installation
 366 process has been considered as it impacts on issues of
 367 trust between the landlord and resident. Additionally,
 368 handover processes on completion, where the property
 369 is completed and handed back to the resident, have a
 370 significant potential impact of how people might under-
 371 stand how to engage with their retrofitted home. The
 372 issue of handover processes and how they link to how
 373 occupiers use buildings cannot be ignored (Way and
 374 Bordass 2005), particularly in people's homes (Gupta
 375 and Chandiwala 2010). We then look at two of the main
 376 themes arising from our analysis which appear to have
 377 significant implications for delivering retrofit
 378 programmes at scale; these are issues around trust and
 379 the impact of shared knowledge, expressed in the form
 380 of community level stories, about retrofit, by residents.
 381 Quotations arising from the focus groups are presented
 382 below in order to illustrate the findings from the data.
 383 Two forms of quotation are used: one where an issue
 384 was raised by a single individual without the input of
 385 others in the group and the other where an issue was
 386 raised in discussion with other group members and
 387 possibly the facilitator. In the case of the latter instance,
 388 the speakers are distinguished by the prefix Int for the
 389 interviewer/facilitator and P (followed by a number) for
 390 each focus group participant.

Barriers to adopt  retrofit measures 391

Although familiar issues of cost, return on investment 392
 and information are effectively redundant for house- 393
 holds in the social rented sector, it was clear from the 394
 analysis that there were a number of significant barriers 395
 arising around the adoption of retrofit measures. In 396
 particular, the fear of the disruption caused by the in- 397
 stallation of measures played a significant role in peo- 398
 ple's decision-making process: 399

The thing is with loft insulation... we put it in 400
 ourselves and then we boarded it. When they 402
 came round and said we've only got 6 inches 403
 and it needs to be 8 inches, I was going to pull 404
 all my walls up and put it in again. There is no 405
 point.  406
 We don't  couldn't empty the loft when they 408
 came round to do it. Because I couldn't empty it 409
 they wouldn't do it so it never got done. 410
 411

Indeed, similar to previous research regarding the 412
 adoption of cavity wall insulation (HM Government 413
 2010), the disruption caused by installing insulation in 414
 the loft was a key barrier for some people. This is 415
 something that is well known, and some of the tenants 416
 reported no support in place from their landlords: 417



Int: I know for some housing associations or 418
 providers they provide loft-clearing services. 420
P1: They never offered. It never got done. 421
 422






Although the upfront cost of purchasing the equip- 424
 ment and technology was not an issue for people, the 425
 fear of a cost arising from the installation still concerned 426
 some residents. For example, for one tenant there was an 427
 assumption that there might be a liability on them to 428
 address the maintenance costs of the technology, particu- 429
 larly where this involves micro-generation: 430

Who carries their own cost where there will be 432
 maintenance on them and there will be transfer 433
 systems and you've got so many different things 434
 going on with these. Who looks after it? 435


Another tenant assumed that the installation of this 436
 technology would be followed by a subsequent increase 437
 in their rent levels to pay for it. 438


Another barrier identified was the apparent lack of 439
 engagement of residents in most aspects of community 440
 governance or, it seems, a lack of engagement with any 441
 issues at all. One resident, who also sat on the board of 442

443	their social landlord, described the apathy pervading	Drivers to adopting retrofit measures	499
444	tenants in their area:		
446	We do a satisfaction survey once a year. How	None of the participants reported having had a	500
447	many did we get back? A couple of hundred, three	choice in the adoption of retrofit measures and	501
448	or four hundred, five hundred if we are lucky. We	so it was difficult to understand fully what their	502
449	send out to three and a half thousand properties.	motivations were to consenting to the measures	503
450	We get a very low figure back. Anything like that,	being installed. However, when the groups started	504
451	people don't, they are not bothered. The only way,	discussing what they thought could be done to	505
452	I've said this loads of times and people have heard	encourage a greater take-up of retrofit measures,	506
453	me say, the only way is if you sent a letter out	these revolved around the provision of information	507
454	saying, 'A week on Monday we are knocking your	or making residents care in some way. When taken	508
455	house down and we are going to put you in a tent.'	with the comments of one participant above, the	509
456	You would have them outside within an hour.	provision of information could be seen to be both	510
457	They would be queuing to knock hell out of you.	a driver and a barrier. Although for people who	511
458		could possibly be seen as 'positive-greens'	512
459	Another participant in a different group framed their	(Government Office of Science 2008) there was	513
460	residents as mostly content but similarly apathetic to	an apparent need for specific and accredited infor-	514
461	change of any sort:	mation in the form of informative leaflets about	515
463	I think because with anything like that, people are	specific contacts, people could consult with for	516
464	quite happy. Nobody really, there is not many	more detailed information:	517
465	people that can say they are not happy in their	P1: Give a leaflet out telling you what is available.	519
466	homes.	Int: Do you think that would work?	520
467		P2: What we asked for was some advice on how	523
468	However, offering a more extreme observation, a	to do about energy efficiency. And also, which	524
469	number of people in one of the groups acknowledged	company is the best company for us in this area.	525
470	that some people would refuse measures because they	Another person noted that signposts to solutions need to	526
471	actively refuse to engage in any other issues:	be clearer and easier than is currently the case, 'People	527
473	P1: If they don't want to let you in they won't let	need to know where to get them from. You need to make	528
474	you in. I've known people on our estate, when	it easier for them' 	529
475	they do electrical checks which is for their benefit,	Another way that was seen to motivate people was by	530
476	they wouldn't even let them in.	making them care about the issue in hand, or by linking	531
478	P2: Gas as well.	it to something people did care about:	532
480	P1: They wouldn't answer the door.	It's like it's always been said and I totally agree	533
482	P3: There is some [people] you won't get any-	with it, ever since I've been involved, you will get	535
483	where with.	people round this table who want to be involved	536
484		and want to know and want to learn, but a very	537
485	One participant thought that more should be done, by	small minority. The only way you draw people out	538
486	their landlord, to be much more active in engaging with	is if you have an issue and it's got to be a burning	539
487	residents. This resident thought that the mere provision	issue.	540
488	of written information provided through the post was	Children were seen to have a role to play here,	541
489	not sufficient:	in the way they wielded 'pester power' or if the	542
490	The problem I think you would find is, the same as	adoption of energy efficiency measures was linked	543
492	we find with things like we ... we do things like	to other activities in and around their communities	544
493	energy efficiency. What happens to them? They	such as schools:	546
494	don't look at them they bin them. They are not	The kids are really big on it...If you set a target at	548
495	interested. Not because it doesn't impinge on their	the local schools in the area. They will get the	549
496	lives. Not bothered. So we bin them. It's some-	information and they are going to go back home	550
497	thing you send. It's like getting junk mail.		

551	and go, mum, mum you have go to do this. You've	minimal and, for some people, insubstantial for
552	got to do this. They will nag the older generations.	example: 603
553	It's not that scary, gran. It's not that scary. Come	604
554	and see this. I think that could possibly work.	Int: Were you shown how to use a new boiler. 606
555		P1: Only a one day effort. 608 609
556	The install  of retrofit measures	There was clearly a desire for more information about 610 how to use their new system effectively: 611
557	The people who took part in the focus groups appear to	Really, it would be better if people were asked if 613 they need advice. If a leaflet was sent out to your 614 household and for them to tick if they would like 615 someone to come round and chat to them. I think 616 that would be better. 617 618
558	have had a generally positive experience when their	In order to learn about the technology, people instead 619 opted to call upon their family members, friends and 620 neighbours. There was a sense of drawing upon the 621 knowledge of people who were in some way 'technical- 622 ly proficient': 623
559	technology was installed. One contractor provided a loft	 laughter is quite good, she's set it down and 624 advised me I know she's checked how it works. 626 I've got it on that little thing [points to room 627 thermostat], we had one on the wall.  628
560	clearance service that was seen as positive, whilst, in the	I'm lucky, I've got a son who is technical. He 630 teaches me these things and I can say to him, 631 because you can say, bloody well slow down. Just 632 show me and show me in plain English what I'm 633 doing and where I'm going wrong. That is how I 634 do my computer.  635
561	same group, another participant relied on a family mem-	My mother is 84. She quite often gets confused 636 with any new equipment at all. We do have to sit 638 down and explain everything to her. I think the 639 elderly do need more help. 640
562	ber to help rearrange their belongings that were stored in	Alternatively, people in the local area who were known 641 to take an interest in energy efficiency were often used 642 as key sources of knowledge, as one participant 643 recounted, 'a lot of people come with problems to me'. 644
563	their loft:	There was a sense of significant discomfort in having 645 to learn how to use their heating system. One person 646 talked about how learning technology, with which he 647 was not particularly engaged, was just 'aggravation': 648
564	Int: Did you have to clean your loft out for the loft	I'm 58...unless it's something I'm really interest- 649 ed in, I just don't want to know. I don't want the 651 aggravation of having to work it all out and see 652 how it works and then do it. Older people than me 653 think housing associations tend to have a higher 654 proportion of older people rather than younger 655 people who shy away from technology complete- 656 ly anyway. 657
565	insulation?	
566	P1: They did it...it was a contractor but I didn't	
567	have much stuff in the loft then.	
568	P2: My loft is very small. They moved my stuff	
569	from one end to the other. I had to have my son	
570	come in. I couldn't physically do it myself. I	
571	couldn't get in other than swinging on the top of	
572	my ladder.	
573		
574		
575		
576		
577	The tenants of one landlord, in particular, reported	
578	being impressed with the way in which the contractors	
579	worked during the installation. As was discussed be-	
580	tween them in one of the groups:	
581	P1: They were clean. They were really tidy ...	
582	even when they had finished the job they tidied up	
583	after themselves.	
584	P2: Mopped down the hall.	
585	P1: Mopped down the hall and everything. Give	
586	us your mop bucket. They did look after us that	
587	way. They did clean up.	
588	P3: They covered everything. They closed the	
589	door in the room when they were doing it. There	
590	was nothing coming out the room. They cleaned	
591	up after themselves and brushed up and mopped	
592	up.	
593		
594		
595		
596		
597		
598	Learning and living with  retrofit measures	
599	An area that dominated the discussion was how partic-	
600	ipants learnt to use the new technology that had been	
601	installed. For some the instruction they had been pro-	
602	vided with regards to how to use the new system was	

658	For a number of people, the technology, specifically	Mechanical ventilation and heat recovery systems	711
660	the way the technology was controlled, was seen as	prompted the most animated discussions. These were	712
661	mysterious. For example, one person who had a heat	framed mostly negatively in that they made their home	713
662	pump and a mechanical ventilation and heat recovery	cold:	714
663	system installed was unable to understand what the		
664	warning lights and instructions were telling her and	We've got one in the loft. It makes it cold.	716
665	whether the signals were things she should be acting	For the first 3 years that we lived in the property it	718
666	upon:	didn't work. We didn't know that, because when	719
		you used to talk to somebody you could actually	720
		see your own breath come out. It got fixed.	721
668	[The landlord] do know about this. I am not		722
669	complaining... But it is three o'clock in the morn-	They were also concerned about circulating dust and	723
670	ing and this is a horrible time to wake up. I don't	dirt around their home:	724
671	know what's causing it [respondent referring to		
672	warning lights] and I don't honestly think it should	Mine's made all my ceiling black. It gets all like	726
673	be causing it. It's something I think maybe wrong	black dust. The landing is quite cold.	727
674	and I put it in the loft, presumably. It's a bit		728
675	frightening. Everything about it doesn't sound	Other respondents talked about how the new system	729
676	right. The other thing is this emersion heater. Is	was located in inconvenient locations within their home:	730
677	that connected with this system? Is the immersion		
678	heater part of that system or is that completely	Int: Did they not show you how to use it?	732
679	separate? I found to my horror and for the first	P1: There are no controls. It's just fused. It's in the	733
680	10 days I was in, I got this thing—there was a red	loft.	735
681	switch that goes to the right panel and two red	P2: We had a switch on our one, a little switch.	736
682	switches on the side. That was turned off. The red	P3: We've got nothing.	739
683	one underneath is still.	P1: It's up in the loft. If the fuse blows you have to	740
684		go up in the loft. It means we've got to climb up	742
685	This resident, in particular, objected to being made to	into the loft.	743
686	feel like a novice—and powerless—whilst living in their		744
687	own home:	The role of trust and the relationships with key	745
		practitioners	746
688	If I start turning off switches ... I'm not an idiot.		
690	Obviously these switches are to do with the im-	Across the focus groups, it became increasingly clear	747
691	mersion but is it all right to turn them off or	that trust plays a multi-faceted role in the way in which	748
692	something?...I don't know what the one switch	residents within social housing view and experience the	749
693	is doing. It hasn't stopped the water from coming	installation of retrofit measures. The issue of trust was	750
694	out boiling.	discussed in relation to their landlord, the contractors,	751
695		'experts' and, perhaps inevitably, the technology and	752
696	A number of people openly acknowledged that they	measures themselves. In terms of their landlords, it	753
697	did not understand how their systems worked and im-	was clear that for a number of tenants how their land-	754
698	plied that they realise they are probably not using them	lords, and the contractors they have appointed, have	755
699	efficiently:	approached repairs and demonstrated an apparent lack	756
700	I can't say I fully understand. But I understand	of expertise in the past helped frame their landlords as	757
702	enough to work them, I think	potentially incompetent in the installation of retrofit	758
703	I'd understand it if mine worked efficiently or	measures:	759
705	properly, but it doesn't.		
706	Interestingly, the focus group setting obviously allowed	Getting the repairs done and draughts, that's the	760
707	people the space and opportunity to seek the advice	worst. I applied for the wall insulation and a chap	762
708	from people like them on how best to operate their	came out and said, it's been done. I said, funny	763
709	new heating systems, to ask questions and to share	that mate, I had a repair done in the cavity wall and	764
710	knowledge and experiences.	the chap took a couple of bricks out of one end of	765
		the wall and a couple of bricks out the other and	766

767	we both put our heads through and there was	inspections. Apparently no resident in the focus	821
768	nothing there.	groups had experienced an inspection:	822
769	What you should have is a proper surveyor that's		
771	got nothing to do with [the landlord] come out and	You know when you are in the building trade, you	823
772	say, that's needs doing.	can't do anything without an inspection. He in-	825
		spects everything you do. He gets something 6	826
773		inches out of place. If you had somebody follow-	827
774	Although most people in the groups had had a	ing these guys around and you've got a bit more	828
775	positive experience of retrofit installation in the	power than them and saying, you are not leaving	829
776	recent past, by far the most suspicion was directed	this property until it's right. That would be a better	830
777	at those who undertook the installation of mea-	idea. You need somebody who knows all the	831
778	sures. Most tenants were able to recall some inci-	specs, all the modifications	832
779	dent that illustrated a lack of sufficient attention to		
780	detail:	P1: I've just had that done from the gas checks. I	833
		had an inspector come round to check that the	835
781	I had a problem with the boiler. It was wired	check had been done.	836
782	in wrongly by somebody from a contracting	P2: Set up a bit more regular it would be better for us.	838
783	team. It worked for about 4 h after they	P3: They are supposed to come round and inspect	830
784	went. After they'd installed it they'd gone	the properties aren't they every now and again?	841
785	and then it just conked out. It was all be-	No-one has ever been round to inspect me.	842
786	cause it was wired wrongly. Luckily, there		
787	was a number that I could ring from the		
788	contractor. They came back out with fan	Such findings offer an insight into tenants' reasoning	843
789	heaters for us to have some form of heating.	when they are considering the value of adopting retrofit	844
790	They just put these windows in...when I moved	measures and engaging with those practitioners who	846
792	in, the day we moved in they were putting them in	work in the retrofit industry. The accounts above suggest	847
793	while we were there. They put them in, but the	that the installation of retrofit cannot be separated from	848
794	strip of plastic they had was the wrong strip. It's	the experience the vast majority of tenants have had with	849
795	short. I'm getting a draught in the back kitchen.	housing repairs and modernisation programmes of the	850
796	I've got one of the largest windows on the landing.	past. There appears a lack of confidence in the quality of	851
797	Being on the end I've got at least an 8 foot win-	the workmanship and expertise available which is per-	852
798	dow and you might as well not having it in. The	haps compounded by the relative novelty of some of the	853
799	draught comes through terrible.	measures being installed.	854
800			
802	Our loft, they just threw the insulation in. It's not	Sharing experie  of sustainable retrofit	855
803	even put down properly.		
		An emerging finding from this study indicates that the	856
804	With 'experts', who were supposed to provide a level	reason trust takes on a central role in the discussion of	857
805	of diagnostic help and analysis, similarly offering very	retrofit is because it forms a key barrier to adoption and	858
806	little comfort at all:	efficient use as a result of the way it is transmitted	859
807		through the stories residents tell themselves and each	860
808	They reckon it's [installation of cavity wall insu-	other about the work being undertaken. The stories	861
810	lation] been done. They didn't actually look at my	people tell about their lives are important to consider	862
811	property. It doesn't appear as if it's been done. If I	as they are strategies we all use to bring order to what	863
812	go away, even just for a few days, as I do every	can be seen as disorder (Murray 2003). Stories serve as a	864
813	other week and you can smell the mustiness in my	way for transmitting knowledge to others, as well as	865
814	hallway and that shouldn't be. It shouldn't be in	making sense of things to ourselves, about our beliefs	866
815	any home.	about who, what, when, why and how things are done.	867
816		Therefore, in the case of energy efficiency—and the	868
817	A potential solution to improve performance and	refurbishment of homes—such stories offer a useful	869
818	confidence, noted by some respondents, was the need	insight as to how this knowledge is being understood.	870
819	to embed transparent quality assurance processes in		
820	the retrofit works in the form of post-installation		

871	For some participants, their learning about how to be	falling off the wall. So we contacted the landlord	924
872	efficient in their consumption of energy and their use of	and through their agents we'd had all new heating	925
873	technology was transmitted through their discussions	put in, you know, storage heaters. Ours are work-	926
874	with others. One person talked about how they use lights	ing perfect. But in saying that, there is a rumour	927
875	in their home based on information she had obtained	that even though these are only just over 12	928
876	from some unknown source:	months old, they have been coming out and a	929
		better system again put in. Whether they do it that	930
878	I tend to leave mine on in the evening when I'm in.	way or not I can't really say until I see what they	931
879	Leave my hall light on. If I should walk just into	are doing. 	932
880	the bathroom, I don't put the bathroom light on or	Not my problem. I've heard negative stories, be-	933
881	if I just go into the bedroom for something, I don't	cause I mean I know what it's like when one	935
882	need to put the bedroom light on. I don't bother to	person will hear something, 'Oh well, that's	936
883	switch—we are told that it takes more electricity	it—I'm not having that'. By the time that story	937
884	to switch them on and off.	has got back to the landlord it's gone so far round	938
885		and got so convoluted	939
886	Some people recounted reasons for inaction by ten-		940
887	ants towards initiatives because they appear 'too good to	Or the negative financial implications such changes	941
888	be true' for social housing tenants, for instance:	to their homes could have:	942
890	None of this applies to us and we can't—every	When, I've just told you that our bungalows are	943
891	time we have these things coming through the post	terraced. The first person to have gas central	945
892	and it says, do you want loft insulation and do you	heating put in she reckoned that her account dou-	946
893	want this and do you want that. You can send them	bled, immediately and have stayed that way since.	947
894	all off and I've often done it, just as a joke,		948
895	because I know quite well it's just going to come	Looking at the stories people tell about why they do	949
896	back and say, you are with a landlord in social	or do not do something offers an interesting starting	950
897	housing. You don't qualify.	point in order to begin to unpick how decision making	951
898		is constructed within everyday life. As the findings	952
		above suggest, rumours, myths and misinformation	953
899	Here their status as tenants was seen to locate them as	transmitted by unknown and non-specific sources can	954
900	'undeserving' of initiatives. This narrative shares similar	have serious impacts on the ability of practitioners to	955
901	characteristics with the assertion by another participant	introduce new programmes in local areas. This, howev-	956
902	outlined above who thought that the acceptance of ret-	er, offers a new way of looking at how occupants can be	957
903	rofit measures would lead to them having to pay more in	engaged in order to work towards a more successful	958
904	rent to their landlord as a direct result. Another example	programme of retrofit. Offering information, comprising	959
905	of this would be another participant who thought that if a	of facts and figures but also positive descriptive ac-	960
906	utility company were installing 'free' insulation the	counts grounded in experiences within the	961
907	householder would end up paying for it anyway through	neighbourhood, transmitted by trusted sources in ways	962
908	a hidden charge attached to their utility bill:	in which people can easily absorb, may help to provide	963
		reassurance within community settings.	964
909	I heard somewhere that when they undertake cav-		
910	ity wall insulation say it was your gas company or	Conclusions	965
911	electric company on the bill they take a small fee. I		
912	don't know whether that's correct or not. I've	The findings discussed here throw new light on some of	966
913	heard that.	the issues arising when households are asked to adopt	967
914		and use measures and technologies that aim to make	968
915		homes more energy efficient. As a result of the lack of	969
916	Finally, one of the most damaging aspects of stories	empirical research into the everyday experiences of	970
917	when discussing the retrofit of properties is the rumours	households adopting retrofit measures, the participants	971
918	that emerge about the process or the technology not	in these groups help us to better understand what some	972
919	working correctly:		
920	We are lucky in this respect as when we moved in		
921	we had under floor heating that wasn't working		
922	properly. We had heaters, storage heaters that were		
923			

973 of the barriers to adoption are, what it is like living with
974 these measures as well as some of the factors that
975 underpin this area.

976 Although the participants in these groups were not
977 exclusively older people, these findings build on the
978 research of Lusambili et al. (2011) into how older people
979 respond to technology in the home. In their paper,
980 Lusambili et al. talked about the apparent disconnect
981 between the ways in which technologies were designed
982 and the requirements of the end user. Our findings
983 would tend to support this as it was clear that the
984 technologies and interfaces were often mysterious to
985 the end user. Many people appeared to lack a ‘concept-
986 tual model’ (Norman 2011) of how their system worked
987 and their role within it. People often sought the advice of
988 those who they already trusted and relied upon, regard-
989 less of their familiarity with the specific technology, to
990 help them navigate the controls for their heating
991 system. Again Lusambili et al. (2011) had a similar
992 finding where, in their sample, the vast majority of
993 older people tended to rely on friends and family for
994 advice and assistance. Those who were most exclud-
995 ed, lacking in connections in their social networks,
996 often did not know how their system worked.
997 However, Lusambili et al. point out that even those
998 who relied on their social networks to understand
999 how their system worked did not necessarily use the
1000 technology efficiently. It simply meant that there
1001 were other people who were able to understand the
1002 principles of the control interface, not how the
1003 heating system as a whole worked.

1004 Such findings provide worrying conclusions in that
1005 although the homes of some of the most vulnerable and
1006 those on the lowest incomes are being retrofitted, the
1007 process of handover from an installer and landlord to the
1008 resident appears inadequate. However, there was evi-
1009 dence of a certain amount of identity work by house-
1010 holders who refused to be seen as novices in their own
1011 homes for not being able to use the system efficiently
1012 and who railed quietly against being forced to develop
1013 technical operating skills they did not feel comfortable
1014 with. It is unknown what was being done by the land-
1015 lords to counter such crucial issues, but it could be
1016 suspected that with the scale of the task required to
1017 retrofit and upgrade the social housing stock, coupled
1018 with the general reduction in public spending, staffing
1019 resources to re-visit properties and spend time
1020 [re]training tenants in ‘best practice’ in using their do-
1021 mestic heating systems is unlikely.

1022 What emerges from this analysis is the centrality of
1023 trust in the retrofit process. Tenants appear suspicious
1024 about apparently ‘getting something for nothing’ and
1025 assume there to be some kind of catch, either that they
1026 will pay additional rental charges or that their utility bills
1027 will increase. Similarly, although most participants had
1028 had positive experiences with the contractors installing
1029 retrofit measures in the recent past, there was a theme of
1030 distrust about the quality of installation that they could
1031 expect from contractors appointed by social landlords.
1032 This draws upon a broader cultural narrative of ‘shoddy
1033 workmanship’ of public sector maintenance workers.
1034 These findings indicate the need for more research into
1035 how trust can be developed and maintained between the
1036 different actors in the retrofit supply chain, particularly
1037 the tenant–installer–landlord relationship. This may
1038 though be only one part of a multi-faceted solution as
1039 it emerges as crucial to work with tenants to enhance
1040 their confidence in the retrofit endeavour as the biggest
1041 advocate and driver for the broader public acceptance of
1042 retrofit technologies will be people themselves. If we are
1043 to succeed in the mass deployment of retrofit across the
1044 UK, we will need to support the narration of positive
1045 stories about the technologies that will be re-told from
1046 home to home.
1047

Acknowledgments The research was undertaken as part of the
1048 UK’s Knowledge Transfer Partnership Programme with Fusion21,
1049 to whom we extend our thanks. We would also like to thank all of
1050 the social housing providers and their residents who gave up so
1051 much time to help with this research.
1052
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References 1054

Achtnicht, M. (2011). Do environmental benefits matter? Evidence from a choice experiment among owners in Germany. *Ecological Economics*, 70, 2191–2200. 1056Q10
1057
1058
Affinity Sutton. (2011). *FutureFit—installation in-depth findings*. London: Affinity Sutton. 1059
1060
Bahaj, A. S., & James, P. A. B. (2007). Urban energy generation: the added value of photovoltaics in social housing. *Renewable and Sustainable Energy Reviews*, 11, 2121–2136. 1061
1062
1063
Boardman, B. (2012). *Achieving zero: delivering future friendly buildings*. Oxford: Environmental Change Institute. 1064
1065
Braun, V., & Clarke, V. (2006). Using thematic analysis in psychology. *Qualitative Research in Psychology*, 3, 77–101. 1066
1067
Caird, S., Robin, R., & Herring, H. (2008). Improving the energy performance of UK households: results from surveys of consumer adoption and use of low- and zero carbon technologies. *Energy Efficiency*, 1(2), 149–166. 1068
1069
1070
1071

1072 Chahal, S., Swan, W., and Brown, P. (2012). Tenant perceptions
1073 and experiences of retrofit. *Retrofit 2012*, Lowry, Salford,
1074 January 24th–26th. 1133

1075 Chappels, J., & Shove, E. (2004). Debating the future of comfort:
1076 environmental sustainability, energy consumption and the
1077 indoor environment. *Building Research and Information*,
1078 33(1), 32–40. 1134

1079 Communities and Local Government. (2011). *English House*
1080 *Condition Survey*. London: CLG. 1135

1081 DCLG. (2006). *A decent home: definition and guidance for im-*
1082 *plementation*. London: DCLG. 1136

1083 DECC (2010). *Warm homes, greener homes: a strategy for*
1084 *household energy management*. London: DECC. 1137

1085 DECC. (2011a). *Research report: evaluation synthesis of energy*
1086 *supplier obligation policies*. London: DECC. 1138

1087 DECC (2011b) *The green deal and energy company obligation:*
1088 *consultation document*. London: DECC. [http://www.decc.gov.](http://www.decc.gov.uk/assets/decc/11/consultation/green-deal/3607-green-deal-energy-company-ob-cons.pdf)
1089 [uk/assets/decc/11/consultation/green-deal/3607-green-deal-](http://www.decc.gov.uk/assets/decc/11/consultation/green-deal/3607-green-deal-energy-company-ob-cons.pdf)
1090 [energy-company-ob-cons.pdf](http://www.decc.gov.uk/assets/decc/11/consultation/green-deal/3607-green-deal-energy-company-ob-cons.pdf). Accessed 21 Aug 2012. 1139

1091 DEFRA. (2009). *Sustainable development indicators in your*
1092 *pocket*. London: DEFRA. 1140

1093 Department for Business, Innovation and Skills. (2010). *Low*
1094 *carbon construction innovation and growth team final re-*
1095 *port*. London: HM Government. 1141

1096 Department for Energy and Climate Change. (2011). *National Energy*
1097 *Efficiency Data Framework: report on the development of the*
1098 *data—framework and initial analysis*. London: DECC. 1142

1099 Druckman, A., & Jackson, T. (2008). Household energy consump-
1100 tion in the UK: a highly geographically and socio-
1101 economically disaggregated model. *Energy Policy*, 36,
1102 3177–3192. 1143

1103 Economic and Social Research Council. (2009). *ESRC seminar*
1104 *series: mapping the public policy landscape—how people*
1105 *use and ‘misuse’ buildings*. Swindon: ESRC. 1144

1106 Fawcett, T. (2011) *The future role of heat pumps in the domestic*
1107 *sector*. ECEEE Summer Study. 1145

1108 Geels, F. W. (2005). *Technical transitions and systems innova-*
1109 *tions: a co-evolutionary and socio-technical analysis*.
1110 Cheltenham: Edward Elgar. 1146

1111 Gilbertson, J., Stevens, M., Stiell, B., & Thorogood, N. (2006).
1112 Home is where the hearth is: grant recipient’s views of
1113 England’s Home Energy Efficiency Scheme. *Social Science*
1114 *and Medicine*, 63, 946–956. 1147

1115 Glaser, B. (1992). *Basics of grounded theory analysis*. Mill Valley:
1116 Sociology. 1148

1117 Government Office for Science. (2008). *Powering our lives: sus-*
1118 *tainable energy management and the built environment*.
1119 London: GoFS. 1149

1120 Gupta, R., & Chandiwala, S. (2010). Understanding occupants:
1121 feedback techniques for large-scale low-carbon domestic
1122 refurbishments. *Building Research & Information*, 38(5),
1123 530–548. 1150

1124 HM Government. (2010). *Warm homes, greener homes: a strategy*
1125 *for household energy management*. London: DECC. 1151

1126 Jenkins, D. P. (2010). The value of retrofitting carbon-saving
1127 measures into fuel poor social housing. *Energy Policy*, 38,
1128 832–839. 1152

1129 Kelly, M. J. (2009). Retrofitting the existing UK building stock.
1130 *Building Research and Information*, 37(2), 196–200. 1153

1131 Killip, G. (2012). Innovation in service markets for a low-carbon
1132 future and the privileged status of policy in shaping socio-
1133 technical change: lessons from housing refurbishment in the
1134 UK. *Retrofit 2012*, Lowry, Salford, January 24th–26th. 1134

1135 King, N., & Horrocks, C. (2010). *Interviews in qualitative re-*
1136 *search*. London: Sage. 1135

1137 Lewis, J. (2003) ‘Design issues’. In Ritchie, J. and Lewis, J. (eds.)
1138 *Qualitative research practice*. London: Sage. 1136

1139 Lovell, H. (2004). Framing sustainable housing as a solution to
1140 climate change. *Journal of Environmental Policy &*
1141 *Planning*, 6(1), 35–55. 1137

1142 Lusambili, A., Tod, A., Homer, C., Abbott, J., Cooke, J., &
1143 McDaid, K. (2011). Keeping warm: social connectedness
1144 and technology (a case study of Rotherham (England): tech-
1145 nology and health in the elderly. *The International Journal of*
1146 *Health, Wellness and Society*, 1(3), 27–42. 1138

1147 Mallaband, B. Haynes, V. and Mitchell, V. (2012) Barriers to
1148 domestic retrofit—learning from past home improvement
1149 experiences. In Swan, W and Brown, P. (Ed.) *Proceedings*
1150 *of Retrofit 2012 January 24th–26th 2012*. University of
1151 Salford, Salford. 1139

1152 McKenzie-Mohr, D. (2000). Promoting sustainable behaviour: an
1153 introduction to community-based social marketing. *Journal*
1154 *of Social Issues*, 56(3), 543–554. 1140

1155 McMakin, A. H., Malone, E. L., & Lundgren, R. E. (2002).
1156 Motivating residents to conserve energy without financial
1157 incentives. *Environment and Behaviour*, 34, 848–863. 1141

1158 Mills, E., & Rosenfeld, A. (1996). Consumer non-energy benefits
1159 as a motivation for making energy efficient improvements.
1160 *Energy*, 21(7/8), 707–720. 1142

1161 Morgan, D. L. (1988). *Focus groups as qualitative research*.
1162 London: Sage. 1143

1163 Murray, M. (2003). Narrative Psychology. In J. A. Smith (Ed.),
1164 *Qualitative psychology: a practical guide to research*
1165 *methods* (pp. 111–131). London: Sage. 1144

1166 Nair, G., Gustavsson, L., & Mahapatra, K. (2010). Owners percep-
1167 tion on the adoption of building envelope energy efficiency
1168 measures in Swedish detached houses. *Applied Energy*, 87,
1169 2411–2419. 1145

1170 National Audit Office. (2009). *The warm front scheme. Report by*
1171 *the Comptroller and Auditor General, HC 126 Session 2008–*
1172 *2009*. London: NAO. 1146

1173 Niemeyer, S. (2010). Consumer voices: adoption of residential
1174 energy efficient practices. *International Journal of*
1175 *Consumer Studies*, 34, 140–145. 1147

1176 Norman, D. A. (2011). *Living with complexity*. London: MIT. 1148

1177 Office of Gas and Electricity Markets (2009) *Project discovery*
1178 *energy market scenarios*. London: Office of Gas and
1179 Electricity Markets. 1149

1180 Palmer, J., & Cooper, I. (2011). *Great Britain’s housing energy fact*
1181 *file 2011*. London: DECC. 1150

1182 Peffer, T., Pritoni, M., Meier, A., Aragon, C., & Perry, D. (2011).
1183 How people use thermostats in their homes: a review.
1184 *Building and Environment*, 46, 2529–2541. 1151

1185 Ravetz, J. (2008). State of the stock—what do we know about
1186 existing buildings and their future prospects? *Energy Policy*,
1187 36, 4462–4470. 1152

1188 Reeves, A., Taylor, S., & Fleming, P. (2010). Modelling the
1189 potential to achieve deep carbon emission cuts in existing
1190 UK social housing: the case of Peabody. *Energy Policy*, 36,
1191 4241–4251. 1153

1192 Retallack, S., Lawrence, T., & Lockwood, M. (2007). *Positive*
1193 *energy*. London: IPPR. 1154

- 1194 Semenza, J. C., Hall, D. E., Wilson, D. J., Bontempo, B. D., Sailor,
1195 D. J., & George, L. A. (2008). Public perception of climate
1196 change: voluntary mitigation and barriers to behaviour
1197 change. *American Journal of Preventive Medicine*, 35(5),
1198 479–487. 1218
- 1199 Summerfield, A. J., Pathan, A., Lowe, R. J., & Oreszczyn, T.
1200 (2010). Changes in energy demand from low energy homes.
1201 *Building Research and Information*, 38(1), 42–49. 1219
- 1202 Swan, W., Wetherill, M., & Abbott, C. (2010). *A review of the*
1203 *domestic energy system*. Salford: University of Salford. 1220
- 1204 Van Sandick, E. and Oostra, M. (2010) Upscaling energy related
1205 innovations. CIB World Building Congress Task Group 66,
1206 CIB, 10th–13th May 2010, 95–114. 1221
- 1207 Walker, G. (2008). Decentralised systems and fuel poverty: are
1208 there any links or risks? *Energy Policy*, 36(12), 4514–4517. 1222
- 1209 Way, M., & Bordass, B. (2005). Making feedback and post-
1210 occupancy evaluation routine 2: soft landings—involving
1211 design and building teams in improving performance.
1212 *Building Research & Information*, 33(4), 353–360. 1223
- 1213 Weber, L. (1997). Some reflections on barriers to the efficient use
1214 of energy. *Energy Policy*, 25(10), 833–835. 1224
- 1215 Wetherell, S., Hawkes, J. (2011) Are SAP based assessments an
1216 accurate way of predicting the energy savings made through
1217 refurbishment? In Chiang, T. and Moran, F. (eds.) *Buildings*
1242 *don't use energy, people do? Research Students' Conference* 1218
on Domestic Energy Use and CO2 Emissions in Existing 1219
Dwellings (pp. 43–54). Bath: EDEn, University of Bath. 1220
- Whitmarsh, L., Upham, P., Poortinga, W., McLachlan, C.,
Darnton, A., Devine-Wright, P., Demski, C. and Sherry-
Brennan, F. (2011) *Public attitudes, understanding, and en-*
gagement in relation to low-carbon energy: a selective re-
view of academic and non-academic literatures. Report for
RCUK Energy Programme. 1221
1222
1223
1224
1225
1226
- Willey, A. (2012) FutureFit part one: a unique insight into how the
green deal might work in social housing. Retrofit 2012,
Lowry, Salford, January 24th–26th, 2012. 1227
1228
1229
- Wingfield, J. and Bell, M. and Miles-Shenton, D., South, T. and
Lowe, R.J. (2008) Lessons from Stamford Brook: under-
standing the gap between designed and real performance
(Partners in Innovation Project: CI 39/3/663: Evaluating the
impact of an enhanced energy performance standard on load-
bearing masonry domestic construction 8—final report).
Leeds: Leeds Metropolitan University. 1230
1231
1232
1233
1234
1235
1236
- Wright, F. (2004). Old and cold: older people and policies failing
to address fuel poverty. *Social Policy & Administration*,
38(5), 488–503. 1237
1238
1239
- Yohanis, Y. G. (2012). Domestic energy use and householders'
energy behaviour. *Energy Policy*, 41, 654–665. 1240
1241

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