Climate Change: the citizen's agenda Evidence to Environment, Food and Rural Affairs Committee

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Executive summary

i). This paper summarises some results of research by the Open University of the key influences on the adoption – and non-adoption – by mainly environmentally-concerned UK citizens of low and zero carbon (LZC) technologies. These include energy efficiency measures (such as loft insulation, condensing boilers and compact fluorescent lamps covered by the Energy Efficiency Commitment) and micro-generation energy technologies (such as solar water heating, photovoltaics and micro-wind turbines included in the DTI's Clear Skies scheme and Low Carbon Buildings Programme). The research also includes the benefits and problems experienced by the citizens who adopted these LZC technologies, plus ideas and policies for overcoming the barriers to their adoption and their effective use in reducing carbon emissions.
The tables in the paper show that each LZC technology has different drivers, barriers, benefits and problems and hence ideas and policies for improvements, but there are some common factors that affect the different technologies.

ii) The main driver for citizen adoption of LZC technologies is reducing fuel bills and/or saving energy in the context of rising fuel prices. Another key driver for adoption of LZC technologies is environmental concern (esp. climate change and nature conservation), at least for the mainly 'greener' citizens we surveyed.

iii) The barriers to adoption vary widely depending on the technology concerned and go beyond the well-known financial issues. Examples of significant barriers to the adoption of energy efficiency measures include peoples' concerns about irritant fibres in loft insulation materials, needing to clear the loft, and loss of loft storage space when installing the recommended thickness of insulation; the reputation of condensing boilers among installers and consumers for unreliability and shorter life; and the size and perceived ugliness of compact fluorescent lamps, and a failure to communicate improvements in CFL design and technology since their introduction. However, even for environmentally concerned citizens, capital cost is a major barrier to adoption of micro-generation technologies, together with the uncertain performance and reliability of innovative technologies.

iv) The benefits of insulation are reported (even by non fuel-poor citizens) largely in terms of warmer homes rather than in reduced energy consumption, i.e. the 'rebound effect' of insulation could be higher than the figure assumed for the Energy Efficiency Commitment. In contrast, improved heating controls when used properly and condensing boilers appear to have little rebound effect and so should help more directly to reduce carbon emissions. Energy efficient lighting appears to involve a relatively small rebound effect, as some users choose to leave CFLs switched on longer and/or may install additional CFL lighting.

(v) The micro-generation technologies as well as reducing carbon emissions, offer citizens who can afford to install them (for whom grants were only a relatively minor driver) great pleasure in using renewable energy as well as focusing their attention on saving energy.

vi) To encourage the widespread adoption and effective use of these LZC technologies requires different actions and policies tailored to the specific technologies: e.g. allowing use of eco-friendly materials in subsidised loft insulation schemes; designing and installing user-friendly controls that provide feedback on energy used or saved; energy companies offering financing packages to install micro-generation systems; and regulations and standards guaranteeing the performance, reliability and durability of micro-generation technologies.

Introduction

1. The Open University, Design Innovation Group (DIG) has surveyed the factors influencing consumer (i.e. citizen) adoption – and non-adoption – of conventional energy efficiency measures (such as those covered by the Energy Efficiency Commitment) and of innovative micro-generation energy technologies (such as those included in the DTI's Clear Skies scheme and Low Carbon Buildings Programme). In addition, for the citizens who adopted these measures or technologies, we have surveyed their practical experience of installation and use. The research was conducted in three ways:
a) in-depth telephone interviews of people who had sought advice between 2004 and 2006 from one of the Energy Efficiency Advisory Centres (EEACs) operated by Milton Keynes Energy Agency, or from the National Energy Foundation (NEF) an organisation that provides information and assistance to the public on renewable energy;
(b) via on-line questionnaires for the general public posted in Spring/Summer 2006 on the website of the Energy saving Trust (EST) and on a website linked to the BBC/Open University *Climate Chaos* TV series.
(c) We also obtained the views of energy professionals, such as local authority housing officers, architects and energy consultants, via an on-line energy newsletter.

2. We have conducted some ninety in-depth telephone interviews of people who adopted, or considered getting, one or more established technologies of loft insulation, heating controls, condensing boilers, energy efficient lighting and solar water heating. The on-line survey produced nearly 400 responses from people who had adopted – or seriously considered but rejected – one or more of the above established technologies and/or innovative micro-generation technologies, including micro-CHP, domestic photovoltaics (PV) and micro-wind turbines, plus biomass (wood-fuelled) stoves.

The sample

3. While the EEAC clients are fairly typical UK citizens, albeit perhaps somewhat 'greener' than the general population (e.g. most recycled their household waste), the clients of the National Energy Foundation and the respondents to the EST/BBC/Open University on-line survey were generally more environmentally concerned and from higher socio-economic groups than the UK population as a whole. This is therefore a 'purposive' rather than a representative survey, as is required in order to include the early adopters of innovative products such as micro-generation systems.

4. Our surveys have nevertheless produced useful empirical evidence about the scope for tackling climate change by citizen action through increasing energy efficiency and adopting micro-generation technologies. The results are summarised in Tables 1-4 below. The tables include the drivers, barriers, benefits, problems and improvement ideas and policies that received a third or more of the responses in the EST/BBC/OU on-line survey of some 400 greener citizens. The reasons for non-adoption by these citizens represent significant barriers that need to be addressed before the less environmentally concerned general population are likely to adopt LZC technologies in sufficient numbers to help tackle climate change.

The scope for increasing energy efficiency

5. Table 1 summarises the main drivers for, and barriers to, citizen adoption of established household energy efficiency measures such as those covered by the Energy Efficiency Commitment, together with the main benefits and problems experienced by citizens who adopted the measures.
The information in Table 1 and subsequent tables is classified according to the frequency of responses in the relevant sub-sample from the EST/BBC/OU on-line survey as follows:
Bold = more than 66% responses *Italic* = more than 50% responses
Normal = more than 33% responses [Brackets] = Other responses/comments

Table 1 Main drivers for, and barriers to, citizen adoption of energy efficiency measures and main benefits and problems experienced during their use.

	Loft insulation (250 mm or more)	**Heating controls (programmers, TRVs)**	**Condensing boilers**	**Energy efficient lighting (CFLs)**
Drivers for adoption	***Saving money and/or energy*** ***Wanting a warmer home*** ***Environmental concern*** *Rising fuel prices*	***Saving money and/or energy*** *Environmental concern*	***Saving money and/ or energy*** *Environmental concern* *An existing boiler needs replacing* Wanting a warmer home Having funds to improve heating system	***Saving money and/or energy*** ***Environmental concern***
Barriers to adoption	*Concerns about irritant mineral wool insulation fibres* Need to clear loft before installation (esp. elderly) Loss of loft storage space following 250mm or more insulation	*Unwillingness to replace functioning existing heating controls with modern ones*	***High cost of replacing a still functioning conventional boiler*** Reputation of condensing boilers for unreliability/ shorter life	*Large size and perceived ugliness of CFLs* Higher cost Incompatibility with existing light fittings and/or dimmers CFLs that don't reach full brightness instantly
Benefits experienced in use	*Warmer home in winter* Greater concern about saving energy [Cooler home in summer]	*Reduced fuel consumption* Greater concern about saving energy	Reduced fuel consumption Greater concern about saving energy Warmer home	Reduced fuel consumption Greater concern about saving energy Long life of CFLs
Problems experienced in use/ Rebound effects	*Little or no reduction in fuel bills or energy consumption*	Minimal rebound effect [Controls difficult to understand esp. elderly] [Control buttons and displays too small] [Controls installed in inaccessible places]	Minimal rebound effect	[Leaving CFLs switched on longer] [Installing additional CFL lighting]

6. Table 2 lists technical, organisational and communication ideas and policies that would encourage citizens to adopt energy efficiency measures and address the problems experienced in use.

Table 2 Ideas and policies to encourage citizen adoption and effective use of established energy efficiency measures.

	Loft insulation	**Heating controls (programmers/ TRVs)**	**Condensing boilers**	**Energy efficient lighting**
Design improvements/ technical innovations	*DIY or professional systems to provide storage above insulation* *Thinner less bulky insulation materials*	*Controls designed for all users (incl. elderly, disabled)* *Intelligent controls that automatically optimise comfort and energy use* *Controls that give users feedback on energy costs & consumption* Instructions or computer program, to enable users to optimise comfort and energy use taking into account their dwelling, heating system and needs	*Boiler that displayed its working efficiency* *More reliable and durable condensing boilers* Easier to service condensing boilers	***CFLs compatible with existing fittings*** (especially halogen spotlights and dimmer switches) Different colour rendering e.g. less harsh light More powerful CFLs
Organisational changes	**Subsidised insulation schemes to include eco-friendly materials**	Better training for installers e.g. on the importance of locating controls in accessible places		Wider availability of CFLs in shops
Improved communications	[Publicise benefit of insulation for keeping homes cooler in summer]			Better publicity about improvements in CFL design and technology Avoid over-optimistic claims of CFL life

The potential for, and barriers to, micro-generation

7. Table 3 summarises the main drivers for, and barriers to, citizen adoption of domestic micro-generation systems, and the main benefits and problems experienced by those who adopted one or more of these technologies. This information came from respondents to the EST/BBC/OU on-line survey for all the micro-generation technologies listed in the Table, supplemented by telephone interviews with actual and potential adopters of solar water heating (by far the most common UK micro-generation technology).

Table 3 Main drivers for and barriers to citizen adoption of micro-generation technologies and main benefits and problems experienced during their use.

	Solar water heating	**micro-CHP**	**Photovoltaics (PV)**	**micro-wind turbine**	**Biomass (wood) stove**
Drivers for adoption	***Saving money and/or energy*** ***Environment-al concern*** Having the funds to invest in a green, money saving technology (esp. retired people) Received a special offer or grant	Sub-sample too small	***Environmental concern*** Saving energy Having the funds to invest in a green, money saving technology	Saving energy Environment-al concern	***Saving money and/or energy*** ***Attractive appearance of stove/real fire*** *Access to low cost supply of wood fuel* *Environment-al concern* Alternative heating fuel to gas or electricity Having the funds to invest
Barriers to adoption	***Capital cost*** Payback period too long, given uncertain reliability and system life [Unregulated industry with some firms using high pressure sales techniques]	*Capital cost* Uncertain performance and reliability of new technology Integrating with existing electricity and/or heating systems	***Capital cost*** Payback period too long Uncertain performance and reliability of new technology Integrating with existing electricity systems	***Capital cost*** Uncertain performance and reliability of new technology Planning objections No suitable location for the turbine [Noise & visual intrusion]	Lack of space to store fuel Dust and dirt in the home Capital cost No suitable location for stove or storage for fuel Poor control of heat output; Frequent refuelling

	SWH	micro-CHP	PV	micro-wind	Wood stove
Benefits experienced in use	***Pleasure in using solar heated water*** *Reduced fuel consumption* Greater concern about saving energy	Sub- sample too small	Greater concern about saving energy Pleasure at using own generated electricity	Sub- sample too small	***Pleasure at using renewable fuel*** Lower fuel bills
Problems experienced in use/ Rebound effects	Unable to use solar heated water in dishwasher or washing m/c *Using solar hot water when it is available* (not necessarily a problem)	Sub- sample too small	None	Sub- sample too small	*Rooms heated to higher temperature*

8. Table 4 lists technical, organisational and communication ideas and policies for promoting citizen adoption of micro-generation and tackling the problems of installation and use.

Table 4 Ideas to encourage citizen adoption and effective use of renewable/micro-generation technologies.

	Solar water heating	micro-CHP	Photovoltaics (PV)	micro-wind	Wood stove
Design improvements/ technical innovations	*Lower cost systems, perhaps using simpler technology* *Roof integrated systems* *Systems to give feedback on money and energy saved* Installation from inside building	Proven reliability and durability Smaller designs of micro-CHP unit Micro-CHP systems to use fuels other than mains gas Reduced noise from unit	***Lower cost systems*** *Systems to give feedback on money and energy saved* Installation from inside building	***Lower cost systems*** *Roof integrated systems* Systems to give feedback on money and energy saved Attractive visual appearance	*Lower cost systems* *Less smoke/ pollution* More controllable heat output Less dust and dirt Less frequent refuelling

	SWH	micro-CHP	PV	micro-wind	Wood stove
Organisational/ regulatory changes	Packaged systems e.g. SWH+ condensing boiler Standards for reliability and durability [Guaranteed long-term maintenance]	Proven environmental and economic benefits Improved support for installation and maintenance	Standards/ regulations for reliability and durability	Standards/ regulations for reliability and durability	
Financial measures	*Systems financed by energy supplier and paid back via fuel bills*	Better price for grid exported electricity	*Systems financed by energy supplier and paid back via fuel bills* *Better price for exported electricity*	Systems financed by energy supplier and paid back via fuel bills	
Improved communications		***Better consumer information about micro-CHP***			

Conclusions

Promoting the widespread citizen adoption and carbon-saving use of energy efficiency measures and micro-generation systems requires a multiple approach that needs to be tailored to the different technologies concerned. Policies and actions need to go beyond addressing the financial barriers to adoption, important as these are. Policies and actions should include improving the design and technology of some existing products and systems; better user-centred training of installers; improved communications about improvements to established energy efficiency measures; detailed practical advice about the installation and use of micro-generation systems and guarantees regarding their performance, reliability and maintenance.

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