Who adopts microheating technologies?

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Low and zero carbon technology pioneers: Expanding the UK household market for microgeneration heat – Robin Roy and Sally Caird

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Despite the increasing emphasis on the importance of microgeneration heat, such as solar thermal and biomass stoves, adoption by UK householders has been very slow. Surveys by the Open University and the Energy Saving Trust have examined the reasons why householders do and don't install these technologies, exploring what can be done to encourage more widespread adoption.

Increasing the UK's proportion of energy sourced from renewables is a key element of the Government's energy and climate strategies. In January 2008 the European Commission set the UK a target that 15% of its energy should come from renewables by 2020. Subsequently the Government's renewable energy strategy consultation document proposed that by 2020 a worthwhile proportion of renewable electricity and heat could come from low or zero carbon microgeneration systems installed in homes and community buildings [(1)].

A rash of recent reports on the potential of local or distributed energy stressed the need for a much greater emphasis on microgeneration *heat* technologies – the small-scale production of heat from a low carbon source – to achieve the country's renewables and carbon emission reductions targets [(2, 3, 4)]. But household adoption in the UK of microgeneration heat has been very slow compared to other countries, despite UK government support through grant schemes such as Clear Skies and the Low Carbon Buildings Programme (LCBP). The latest very detailed report on microgeneration estimated that in 2007 there were only 95,000-98,000 installations in UK households, with solar thermal water heating accounting for over 92% of them. But the report calculated that the UK market for microgeneration could reach 2-3 million units by 2020 and 9 million by 2030 given sufficient support, such as a subsidy of 2p/kWh for microgeneration heat and prohibiting all off-site electricity for zero-carbon homes except for running heat pumps [(5).]

Microgeneration heat surveys

Before such policies can be effective, more needs to be known about the microgeneration heat market and why currently very few UK householders are installing the technologies.

To explore these questions, the Open University (OU) and the Energy Saving Trust (EST) conducted one of the largest surveys to date of UK householders in the process of considering or purchasing microgeneration heat technologies [(6)]. These online surveys, with over 900 responses, revealed why householders do and don't purchase these technologies. And, for those who do adopt them, their experience of using microgeneration for space and/or water heating. The surveys covered four technologies, all eligible for grants under the householder Phase 1 of the LCBP:

solar thermal hot water systems;
ground source heat pumps;
wood-fuelled boilers (logs, chips or pellets);
automatic pellet feed biomass stoves.

The surveys covered 546 householders who had been awarded a LCBP grant to install a microgeneration heat technology (called 'adopters') of whom 285 had user experience; 314 who were considering getting one of these technologies (named 'considerers'); and 134 who had seriously considered but decided against a particular microgeneration heat system ('non-adopters').

Who buys microgeneration heat?

Our surveys found very clearly that existing UK consumer demand for microgeneration heat technologies is largely confined to a niche market of environmentally concerned, older, middle-class householders, mainly living in larger rural properties off the mains gas network (Tables 1 and 2). This niche applies especially to ground source heat pumps (GSHPs), wood-fuelled boilers and biomass stoves. This is not surprising given that GSHPs, wood boilers and pellet stoves are expensive, are only cost effective in properties previously heated by oil, electricity or solid fuel and are better suited to larger properties with space for the equipment, ground loops or wood fuel stores. Solar thermal hot water (STHW) has a wider appeal, with about a third of adopters surveyed living in smaller suburban properties. This reflects the fact that it is a lower cost, more compact and familiar technology worthwhile for properties with or without mains gas.

Table 1

Who adopts microgeneration heat technologies?	Adopters [1] (per cent)
Two person households (adults aged 18+) with no children normally resident	46
Households with 1-3 children < 18 years	34
Main householder aged 45+	71
Main householder retired	25
Total annual household income (of all earners, before tax) <£60,000	63 [2]
Total annual household income (of all earners, before tax) >£60,000	28 [2]
Professional or senior managerial occupations	69 [3]
Actively involved with a pressure group, charity or political party to address environmental issues.	20

Notes (1) n = 546 adopters. (2) 8% adopters did not provide their household income.
(3) 4% adopters did not provide occupational information.

Table2

Where are microgeneration heat technologies installed?	Adopters [1] (per cent)
Detached house or bungalow	73
4+ bedroom house	62
House built before 1919	38
New-build house built post 2006	10
With a medium or large garden or land (over 300m^2)	65
Rural location	65
Suburban location	25
South East or South West England	51
Main heating fuel displaced: Mains gas	42
Oil	29
Electricity (on and off – peak)	8
Other fuels (coal, wood, LPG, etc.)	19

(1) n = 546 adopters

Why people do and don't buy microgeneration heat

The main reasons why the UK householders in our surveys decided to adopt microgeneration heat are clear: they wish to reduce their carbon emissions and fuel bills, but they also expect to get satisfaction from using a low or zero carbon energy source and are typically environmentally concerned people interested in and desiring the technologies themselves.

'*to save money and do my part to help stop global warmin*g'
'I would like to help the environment and, as a physicist, I have an interest in low carbon technology systems.'
'Satisfaction in designing and installing my own system'
'a desire to be energy independent, given rising fuel prices'

Previous studies of the potential of microgeneration technologies have identified high upfront costs, long payback times, inadequate grants and subsidies and lack of information as the main barriers to widespread adoption [5, 7]. Our surveys also found that financial barriers – high cost, long or uncertain payback and relatively small grants – were major deterrents for the considerers and non-adopters. But microgeneration heat also has to overcome practical and perceptual barriers, especially lack of space and locations to install equipment, the frequent need to adapt existing properties and heating systems, and lack of confidence in the performance and reliability of unfamiliar technologies. In addition, choosing between microgeneration technologies, selecting a specific system and getting it installed typically involves much time and effort plus considerable technical knowledge and understanding (Table 3).

'The price says it all. Payback is extremely long term and so shelling out so much money is not worth the investment.'
'It is very difficult to find out what is the best system and who is a reputable installer.'
'Difficulties in finding wood burning central heating installer that could combine with the solar panel installation'
'To make a real impact, the grant should be increased'

Table 3

How important were the following issues in deciding against installing your preferred technology?	Per cent saying 'very or fairly important' [1]
Purchase price	86
Pay back is uncertain or long	68
Grant only covers 10-20% of purchase price	60
Performance & reliability uncertainties	58
More cost effective ways to reduce my carbon emissions	56
Possible major modifications to heating system	54
Difficulty finding space or suitable location	50
Time and effort required to investigate and install	47
Uncertainties on energy/$C0_2$ system will save	42
Won't provide all heating/HW requirements	42
Difficulties getting grant	40
Difficulties finding suitable installer	26
Unlikely to add/may reduce property value	23
Unattractive visual appearance	22
Installer quotes and visits required	22

(1) n = 134 non-adopters. There were minor variations in number of responses to each barrier, although all non-adopters responded to this question.

The experience of purchasers and users

It's clear from our surveys that householders who installed microgeneration heat are generally highly satisfied and over 90% say they get considerable pleasure from using their system. However, less than half of these adopters considered their fuel bill reductions were as great as expected (this was before the recent rapid fuel price rises). Adopters also reported problems during installation. For example, a majority, particularly of STHW systems, required unexpected modifications to their existing heating/hot water system; most GSHP adopters complained about the disruption to their property or garden; while a third mentioned poor quality work by installers. Once installed, the main complaint made by about half of STHW users, is not being able to use solar-heated water in their cold-fill washing machine and/or dishwasher. About a quarter of GSHP adopters complained about the slow warm-up of their heating and/or inability to heat rooms to the required temperature. GSHPs produce lower flow temperatures than a boiler and so response times, especially with under-floor heating, can be slow. For wood boiler adopters the main problem is obtaining supplies of good quality fuel. Such disappointments may explain why about one quarter of adopters were dissatisfied with their system's capability to meet their household demands for heating and/or hot water.

A problem that affected most users of microgeneration heat was understanding how to operate the controls to make most effective use of the system. Specifically nearly one third of GSHP adopters are very dissatisfied with the equipment's often sophisticated and computerised controls. The main improvements desired by these adopters are more user-friendly controls and displays that provide feedback on energy generated and carbon and money saved. More user-friendly designs could also encourage purchase by people who are less technically minded than the typical pioneers.

'I have difficulty understanding whether energy is saved and how to make best use of the system once installed'. (Solar thermal hot water system user)
'If I was not a building services engineer of sorts I would not have had a chance of understanding the control strategy – weather compensated heat slope' (GSHP user)
'Some rooms require additional heating' (GSHP user)
'The automated feed blocks up quite often then takes a long while to get back up to temperature I think this more a pellet quality problem than the system itself.'
(Biomass pellet stove user)

Table4

Problems experienced by users of microgeneration heat systems	Per cent mentioning this problem
Uncertain how best to operate the system and its controls to make most efficient use of the fuel or energy	37
Difficulties understanding the system's controls	28
Unreliability of system e.g. component breakdown, leaks	17
System provides less than expected of heating and or hot water requirements	12

n = 167 adopters with an installed microgeneration system

An interesting finding was that installing and using a microgeneration system often produces so-called 'double-dividend' energy and carbon saving actions. For example, about a quarter of adopters installed extra insulation measures (e.g. floor insulation, double glazing) and almost a fifth purchased additional heating controls beyond those required for the LCBP grant, while nearly three quarters said they made greater efforts to save energy than before.

'much more aware of energy usage and waste. Actively trying to reduce use of energy'
'It is a bit of a game to see how little electricity/water I can use!'
'we would certainly look to add more low carbon technology'

Additional quotes from users (if photographs are used)

Jill Chandler is a self-employed book distributor and keen environmentalist. Having already installed solar water heating she replaced her oil-fired heating system with a wood-burning boiler to provide hot water and central heating in her eighteenth-century cottage in the Pembrokeshire National Park. It cost just over £6,000, minus a grant via the Energy Saving Trust.

"Mine is a Rika stove and boiler which uses pellets made from waste sawdust…. It is so easy to use it is unbelievable, it takes me less than five minutes a day. I fetch the bag from the shed, open it up, open the top of the boiler and put the pellets in. They cost £1.65 for a 10-kilo bag, which I can now buy from my local garage, and I use one or two bags a day.

"It burns very, very efficiently"
"It looks very attractive, people always comment on it. I clean the glass every day,… because I like to see the flame.
"I am absolutely delighted with it, I love it. The place is warmer, and with the solar panels as well, my bills are half what they were."

Ken Brock is a retired building surveyor living with his wife in a bungalow just outside Ipswich. They have a flat-panel Genersys solar water heating system, installed 2004 at a cost of nearly £3000 (including a new larger hot water cylinder), minus a £400 grant.

"In summer, it produces more hot water than we need. If we were a family with two young children having baths every day, we would get a lot more benefit from it, and the payback time would be considerably less.

"It is easy to operate, we don't have to touch the system. Close to the hot water cylinder is a little control panel which tells us the temperature on the panel, the temperature in the tank and whether the system is pumping. If we don't get hot water from the solar system, we switch on the gas boiler."

Expanding the market for microgeneration heat

What do these surveys suggest could expand the market beyond the pioneers to a larger group of more cost-conscious and less innovative consumers?

Efficient targeting of a niche market

There is considerable potential to widen the appeal of microgeneration heat systems beyond the small niche of technology pioneers. The EST's segmentation of applicants to the LCBP shows that there are 4.8 million households (20% of the UK total) that could potentially be targeted; namely affluent, well educated, middle aged and professional couples, all relatively high fossil fuel users, many who live in rural off-gas areas.
Another potentially large UK market for microgeneration heat, not considered in our surveys, is for low and zero carbon new build developments, and social housing.

Addressing barriers to adoption

Reducing installed price of microgeneration heat systems is probably the main way of widening their appeal of. Our surveys found price thresholds (e.g. £2500-£3000, rather than an average £4000, for a retrofit STHW system and £11,000 for a complete GSHP heating system) below which many more considerers and non-adopters said they would purchase. Microgeneration has already benefitted from a reduced 5% VAT rate and prices could be brought down further by larger grants, lower-cost production or by energy supplier subsidies under the Carbon Emissions Reduction Target (CERT). But the most popular financial support measure in our surveys was Council Tax relief for those who installed a microgeneration heat system.
Increasing consumer understanding and confidence is also needed for wider acceptance. Householders would welcome *Which?*-style tests comparing different manufacturers' equipment. Such independent test information does not exist for UK consumers, or is scattered and inaccessible, although may be partly addressed in 2008

with the Microgeneration Certification Scheme. Online information to assess their property's suitability for microgeneration heat would be welcomed by most considerers and non-adopters. Multi-skilled installers able to advise on and install the different technologies are also wanted, as is more opportunity to see working systems in action. Respondents cited difficulties finding trustworthy installers, underlining the importance of accreditation and the value of a 'one-stop shop' for independent advice and information – something that the Energy Saving Trust is rolling out through its Green Homes Service (also called the ActOnCO2 advice service).
While there will always be properties that are unsuited to microgeneration heat, improving the technology could widen its appeal. For example, greater use of borehole GSHPs (which need less space) and designing more efficient air source heat pumps (which need no ground loop) would allow more systems to be installed in urban and suburban homes. Similarly, more compact wood boilers and pellet stoves with a network of local fuel suppliers should encourage wider uptake.

'It's very difficult to find reliable impartial information on the cost and carbon-reduction effectiveness of different technologies. The whole field desperately needs a series of "Which?" reports' (Solar thermal hot water system adopter)

Conclusion

Microgeneration heat technologies could make a significant contribution to achieving the UK's renewables and carbon reduction targets. However, there are a number of barriers to overcome before these technologies begin to be taken up by a significant number of UK householders. Although the adopters are generally highly satisfied, for microgeneration heat to expand beyond its market niches, the following issues need to be addressed:

Price reductions – these could be reduced with a range of measures including council tax relief, and subsidies from energy suppliers;
Better advice – consumers want 'one-stop', independent, trustworthy advice that offers information on the suitability, performance and payback of the different technologies and equipment.
Design for system compatibility –GSHPs and biomass boilers and stoves do not generally suit smaller properties, and neither are all homes compatible with solar thermal systems.
Design for better usability – more user-friendly and informative controls should make the technologies more appealing to a wider range of non-technical consumers, and help them to achieve most effective use.

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