



# FEATURES

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## 'Grey greens' go solar? Consumer adoption and use of renewables

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New **Open University** (OU) research reveals that in the UK consumer adoption of household renewables - solar water heating (SWH), photovoltaics (PV), micro-wind turbines and wood burning stoves - is most common among older middle class couples. Retired couples are often adopters, especially of SWH and PV systems, because they have the time and energy to overcome the hassles involved in installing renewables. They are concerned about protecting the environment for themselves, their children and grandchildren, as well as saving fuel bills while living on a pension. While families with children under 16 years, may be equally concerned about saving energy and the planet, many seem deterred by the time and effort it takes to get technical advice, planning permission and find a good installer of household solar and wind systems. Families wanting to adopt renewables are therefore more likely to buy a wood burning stove; a simpler, less costly technology, not involving planning permission.

This research on the reasons for consumer adoption - and non-adoption - of energy efficiency products and renewable energy systems was conducted by a team from the OU's Design Innovation Group led by Professor Robin Roy and Dr Sally Caird. Information came from nearly 400 on-line questionnaires accessed via the websites of the Energy Saving Trust and the BBC's 2006 Climate Chaos TV series. Further information came from 50 responses to an on-line questionnaire for energy professionals and from 28 in-depth telephone interviews with people who had sought advice on SWH via the National Energy Foundation. Overall nearly 500 responses were received, albeit from a sample that is largely self-selected and is wealthier and greener than the UK population as a whole.

The responses revealed that just 20% of those who considered getting a renewable energy system actually installed one. Half of these adopters bought a wood stove; a third SWH; 10% a PV system; and just 5% a micro-wind turbine. Interestingly half of those who seriously considered getting a wood stove actually installed one, compared to 20% for SWH, 8% for PV and 5% for micro-wind. These results reflect the cost and novelty of these items. Whereas a wood stove is an established product costing a few hundred pounds, SWH and micro-wind systems are more innovative and typically cost £2000-£5000, while PV panels might cost £10,000 or more. Wood burning stoves (as opposed to automated pellet stoves and wood boilers) are not eligible for government grants, although householders can apply for grants to recoup part of the cost of installing solar and wind systems.

### Implications for policy

In the UK there are some 83,000 domestic micro-generation and renewable energy systems, with SWH accounting over 95% of them. Although a typical flat plate or evacuated tube SWH system can provide about 50% of a household's hot water, they are still rare in Britain compared to other European countries. Even rarer are domestic micro-generation/renewable energy technologies, including micro-CHP, wood pellet stoves and boilers, PV and micro-wind - the DTI estimates there were only 3,700 such systems in 2005.

Whilst high capital cost, and hence long payback times, of micro-generation/renewable systems are the main barrier to adoption, we found that there were other major obstacles, even for those who could afford them. These include uncertainty about the performance and reliability of domestic solar and wind systems; getting planning permission; and compatibility with electrical or plumbing systems in the home. There were also concerns about maintaining often inaccessible components of solar thermal or PV systems in lofts or on roofs.

However, for the determined adopter, there is the lure of cutting rising fuel bills, saving energy and reducing carbon emissions. Another key driver, at least for the mainly green consumers we surveyed, is environmental concern, especially climate change and nature conservation. Having funds available to invest is crucial, and this is perhaps why retired people were more likely than other groups to adopt. They may have a retirement lump sum, and even a 20-year payback on a SWH system gives a better post-tax financial return than the money left in a building society at 5%. The household micro-generation/renewable energy grants available in the UK - which currently include up to £400 for SWH; 30% cost up to £5000 for wind; and 50% cost up to £15,000 for PV - were usually only a minor incentive for those who bothered to claim them. As one SWH adopter said "*The grant process is absolutely chock full of bureaucracy, and all for £400. Government needs to do a whole lot better here*".

As well as helping to save money, energy and the planet, people who had installed SWH, PV or a wood stove said that using renewable energy gave them great pleasure, and focused their attention on saving more energy. Many also saw it as a green status symbol: one user said of his solar panels "*it is like flying a flag saying 'we're green'.*" Whilst adopters of renewables typically installed energy efficiency measures, such as loft insulation and low energy lamps, only about 10% of adopters of energy efficiency measures adopted renewables, even though 40% of our respondents said they seriously considered doing so.

Thus, the first step to installing SWH or other renewables may be getting some CFLs and insulating the house, then installing new heating controls. Such measures, our respondents said, increased energy awareness. It is then interest in renewables may be translated into action. So the message is: sell energy efficiency first, then renewables. An exception seems to be wood stoves, often bought as a relatively low-cost and efficient real fire that provides an attractive addition to room decor.

So, different household renewables have similarities and differences in the drivers for, and barriers to, adoption and in their benefits and problems in use. Therefore we next consider the technologies we investigated in more detail.

# FEATURES FEATURES FEATURES

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## Solar water heating

In our on-line survey SWH was the most commonly adopted renewable with 39 installations (10% of the sample, compared to approximately 0.3% of UK households with SWH). Our findings for SWH come both from this survey plus additional information from our 28 in-depth interviews.

The major hurdle after deciding to adopt SWH is finding a good installer. Many asked their local authority and were recommended installers in their area either directly or via the National Energy Foundation's 'Energy for Good' scheme. In general the recommended installers gave quotations for installing one model of SWH system. Most accepted the advice of installers, usually without understanding much about the technology. The issue of trust in the installer is crucial. One adopter recounted how the Council put him in contact with two local installers, who quoted similar prices, so he chose the one who inspired trust for advice, installation and maintenance.

Only 20% of people we interviewed chose the installer offering the cheapest quote and accepted the SWH system that they recommended. About a third of adopters approached friends or neighbours who already owned a system for advice. About two thirds of people chose evacuated tube, with the rest going for flat plate SWH. Only one person, an electrician, did not accept the installer's recommendation. Instead he bought a flat plate DIY kit because it was a simple and well designed, efficient, at a good price and he had the expertise to fit it himself.

Overall two-thirds of all adopters were satisfied with their SHW system. One said *'It is early days, but I'm quite impressed. Doesn't seem to provide enough oomph on its own but makes a valuable contribution'* while another enthused, *'Fantastic - every home should have one - Government regulations should incorporate solar water heating in all new homes.'*

However, about 80% of interviewed adopters reported problems with leaks, pumps and valves sometimes leading to several installer recalls for repairs. A bigger issue was whether solar heated water could be used in their dishwasher or washing machine. Often it could not due to plumbing constraints or because most new appliances are cold-fill only, a disappointment for some. As one adopter complained *'I cannot find a dishwasher that will take the high temperature of water supplied by the solar system'*. This was also a deterrent for nearly 20% of SWH non-adopters. There was also the problem of insufficient solar hot water because of a too small storage tank leading to rapid cooling of the water, especially overnight, or no separate solar tank to allow collection of all available solar energy both winter and summer.

Two thirds of adopters in the on-line survey mentioned their pleasure in using solar heated water. Half tried to use solar hot water when it was available, giving examples of showering or using their (hot-fill) washing machine in the afternoon or evening when the water is hot, rather than the morning. But the other half had made no changes to their habits, with a fifth reporting they were less concerned about using hot water and 8% admitted they used more. The need to change habits to make best use of SWH systems is seldom explained. One potential adopter said that it was difficult to get good advice about the system and how to use it efficiently. He commented *'I think that if you move to solar you need to rethink your use of hot water; you need to change your washing habits to the evening and reset the boiler so you are not heating the water. As a household you will need to think about soaking dishes used during the day for washing in the evening'*.

A problem for some is the lack of a suitable and discreet location for the system. One adopter had a house with dormer windows leaving little space on the roof, so had the collector installed on the wall. She finds it ugly, and one visitor to the house even asked *'What is that monstrosity on the wall?'* and a neighbour complained that it reflected into her kitchen. Another adopter said that she didn't want anything that *'looked foul'* on their beautiful Georgian house or for neighbours to complain about, so they chose an evacuated tube collector which was smaller for same output.

## Micro-wind

Only seven people in our on-line survey (2% of respondents) had installed a micro-wind turbine, mainly to save energy and/or the environment, but a third had seriously considered this technology but decided against it. The main barriers to installation is cost (mentioned by 53% of non-adopters) and payback; one non-adopter stating *'I checked wind levels for my postcode to work out a payback period of over 15 years'*. The other main obstacles are getting planning permission (37%); finding a suitable location for the unit (33%), or a good installer (25%); and this new technology's uncertain performance and reliability (21%). Towns and cities are considered unsuitable for wind because of worries about noise and visual intrusion, with one non-adopter saying *'I live in a suburban area: imagine if everyone had one! Chaotic visual impacts and noise pollution.'*

Four micro-wind adopters reported their difficulty in gaining planning permission. Other problems mentioned by individual adopters were the difficulty in finding a good installer, insufficient electricity from the system and the experience that wind-generated electricity is not available when required. However, three reported being fairly or very satisfied with their system and only one was dissatisfied; even the person whose turbine was destroyed in a lightning strike would still recommend micro-wind to anyone living in a suitable area.

## Photovoltaics

Only 12 people in our on-line survey (3%) had installed a domestic PV system, mainly for environmental reasons or because they had the funds but, as for micro-wind, a third had seriously considered this technology but decided against it. The main barriers to the installation of PV is capital cost (85% non-adopters) and/or too long payback (40%), but other deterrents included insufficient output (28%), connecting to the grid or finding an installer (both 24%) and finding a suitable location (16%). One stated that the *'cost per kWh is hideously expensive; smaller systems would barely charge a car battery and to be useful would need to have a larger system integrated with 230V mains, with all the expense and issues with connecting to the grid. This type would require far too much roof space for me to consider.'* Another remarked *'We need more information about how to do it and how to connect the electricity generated to our electrical supply'*. The perceived inequities of the feed-in tariff from grid were off-putting. One stated *'apparently you have to sell all your electricity to your supplier for say 3p per unit and buy back for 9p per unit, you cannot use your own electricity first then top up from supplier'*, while another stated *'The ROC tariff is currently set at only 4.5p per kWh generated, far below the standard / daytime cost of grid power.'*

The satisfaction with PV is mixed and below that for SWH. Only a third of our 12 adopters were fairly or very well satisfied, with about half unsure. This lack of satisfaction is probably due to not enough electricity being produced, or available when required, and the poor feed-in tariffs available. However, installing PV can have a beneficial influence on energy consumption. A half said they were more concerned about saving energy after installing PV, while a quarter tried to use their own solar electricity when available, getting considerable satisfaction from doing so. One adopter reported a 40% energy saving *'Installation caused me to monitor the daily electricity, which when I started was an average 25 units a day. With a combination of the solar PV and energy saving actions...the average electrical usage has reduced to 15 units a day.'*

# FEATURES FEATURES FEATURES

## Wood stoves

Wood burning stoves are the most widely adopted renewable energy device in our on-line survey (63 installations, 16% total). We did not distinguish simple wood stoves from automatic pellet stoves and boilers, but it is unlikely that (m)any of the automatic type were included. Wood stoves' popularity is due to their relatively modest cost, but also due to fitting existing fireplaces and offering pleasures other than using renewable fuel. However, not all fireplaces or houses are suitable. One non-adopter stated '*We were replacing an open fire and considered a stove, but that required a flue liner and substantial remodelling to the hearth and chimney breast area - which made it several times the cost of a coal-effect gas fire*'. Another said with regret '*I used a wood burner in my previous home. It was very practical, and gave out plenty of heat. But I have a small terraced house now, with limited room to install one...and very little storage space.*' Also wood stoves do involve physical work, the storage and carrying of fuel, the removal of ashes, and extra house cleaning. This can be a drawback for older or disabled people. As one stated '*As you get older you don't want the downside of this form of heating - or for an automatic system the cost is too high*'.

However, most wood stove adopters are very satisfied. One stated that '*the wood stove/boiler has exceeded expectations in regards to the amount of heat generated, I'm also finding it a godsend to cook on as we have a lot of power cuts in this area and I have four under 5's to feed and keep warm.*' The main problems cited were; more dust and dirt in the home (35% adopters), connecting the stove to radiators and/or the hot water system (28%) and controlling heat output (13%) leading to high room temperatures (60%).

However, not everybody considered wood stoves as a desirable or renewable system. A few respondents remarked that they are not environmentally friendly, as they pollute the atmosphere. One stated that '*Surely a wood-burner emits carbon-dioxide and particulates. Hardly clean!*' One respondent remarked that in New Zealand the local council is giving grants to remove wood stoves because of pollution. '*We are busy taking woodstoves OUT, because of intense pollution in Christchurch City. The Council gives grants to remove them, and a good thing too, as they are very old and inefficient. I've had mine removed, and replaced by a heat pump*'. However, in this case the person is referring to old types of wood stove rather than modern smokeless designs.

## Improving the uptake of renewables

An aim of this research was to get the views of both adopters and non-adopters on how designers, manufacturers, service providers and government could promote the more widespread adoption, acceptance and effective use of renewables.

Technical and design ideas most frequently proposed by consumers to improve the uptake of renewables included:

- o Lower-cost systems;
- o Building-integrated solar and wind;
- o Intelligent controls with feedback on savings;
- o Packaged systems e.g. SWH and condensing boiler.

Several people suggested better methods of financing to move renewables beyond the niche market of the environmentally concerned middle classes. Current grants in the UK (although fairly generous for wind and PV) are insufficient to make much difference to adoption, where the ability and willingness to buy depends crucially on disposable income and environmental attitudes. There is a need for innovative financing schemes e.g.

- o Council tax rebates
- o Repayment loans via energy suppliers
- o Better feed-in tariff to the Grid.

Some wanted a stronger government role such as current proposals for relaxation of planning permissions for renewables and standards for reliability and durability.

Wider adoption should be achieved if renewables were required in all new housing and displayed on public buildings. This would inspire consumer confidence in technologies still regarded as innovative and untried.

A one-stop-shop to help consumers install, and effectively use, renewables is also urgently needed. Given the confusing number of UK government, local authority and other renewables support schemes, consumers still want more independent information and advice, allowing comparisons of manufacturers' claims. Perhaps there needs to be a single body to guide people through all the details of technical choice, planning, finance, grants, installation, use and maintenance.

Overall our research supports capital cost as a major barrier preventing widespread adoption of renewables in UK homes. However this is only one factor. The time and effort involved in choosing, purchasing, installing and

using renewables are significant barriers. Nevertheless, the results of this research are hopeful because some 40% of the mainly green consumers in our on line survey said that they seriously considered adopting a renewable technology, although with the exception of wood stoves and SWH, relatively few actually did so. There seems to be considerable interest in household renewables, but so far only pioneer adopters, including a niche market of relatively well off 'grey greens' have managed to overcome the obstacles to installing and using them.

\* For more details contact Robin Roy (r.roy@open.ac.uk) or Sally Caird (s.caird@open.ac.uk) or see <http://design.open.ac.uk> click on Research Groups then Design Innovation Group.

## Warwick Micro-wind trial

In addition to the OU project described above, there is an interesting 'hands-on' **Warwick Microwind Trial** which aims to evaluate the contribution rooftop-mounted wind turbines may make to improving the energy performance of existing homes in the UK. It is collecting objective data on performance when the systems are used by real families and homeowners. It's also exploring how easy it is to get systems installed on houses and what the barriers and real costs are. Most importantly, it aims '*to discover what impact installing these systems has on awareness of energy efficiency in the households with the systems and amongst members of the local community*'. Working with two manufacturers of rooftop systems, Ampair and Windsave, the initial aim was to install 20 systems (10 from each company) on different sites, and monitor 5 of each - subject to planning. All the sites will be in a limited geographical area covered by Warwick District Council's, which includes 4 towns (Warwick, Leamington, Whitnash and Kenilworth) a large rural area and a number of villages. Public opinion surveys will be conducted before and after the project to establish whether the installations have any impact on attitudes to energy efficiency and climate change. A publicly-accessible system will be installed at Princes Drive Recycle Warehouse in Leamington Spa (subject to planning permission) along with educational materials and a feedback facility. This will enable all members of the community to see a system close up, and to provide comments to the project.

The capital cost of the project is funded by the home and property owners who are participating, supported by government grants from the DTI where applicable. The research element of the project is funded by the Pilkington Energy Efficiency Trust, and the project is being co-ordinated and run by Encraft, working in partnership with Action21, Warwick District Council and Warwickshire County Council. The project is supported by the DTI, BWEA and Micropower Council. For updates see: <http://www.warwickwindtrials.org.uk/index.html>