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David Kreps[1], Vasughi Sundramoorthy[1], Grahame Cooper[2], Haifa Takruri-Rizk[2], Nigel Linge[2],
[1] Information Systems, Origanisations and Society Research Centre
[2] Computer Networking and Telecommunications Research Centre
University of Salford, Greater Manchester, M5 4WT, UK
See http://www.dehems.eu for more information. Poster by d.g.kreps@salford.ac.uk - http://snipr.com/davidkreps

Harnessing the Link between ICT Domestication and Behaviour Change for Carbon Footprint Reduction in the Home

This is a research-in-progress poster, outlining the issues pertinent to a unique EU FP7 Project entitled Digital Environment Home Energy Management System, including Living Labs in the UK and Bulgaria, which seeks to engender pro-environmental behaviour change in home environments, initially through direct awareness raising, and eventually through user-defined automated processes, using ICTs, in the hope of 'domesticating' energy efficiency technologies within the home. The poster seeks to contextualise the project in the theoretical backdrop of ICT domestication theory and notions of pro-environmental behaviour change.

Pro-Environmental Behaviour

The concept of 'pro-environmental behaviour,' has been defined as "behaviour that consciously seeks to minimize the negative impact of one's actions on the natural and built world (e.g. minimize resource and energy consumption, use of non-toxic substances, reduce waste production)." (Kollmuss & Agyeman 2002).

IPCC
Intergovernmental Panel on Climate Change
Scientific opinion overwhelmingly agrees that climate change is taking place, and that human activity is the primary cause of the increase in CO2 emissions that is its main cause (IPCC 2001). Analyses in the past decade suggest that CO2 emission reductions in excess of 60% across industrialised countries will be needed by 2050, if the level of CO2 in the atmosphere is to stabilise at current levels, and thereby at least mitigate the effects of climate change (Johnston et al. 2005). Action to cut emissions of the six main greenhouse gases, including CO2, continues apace.

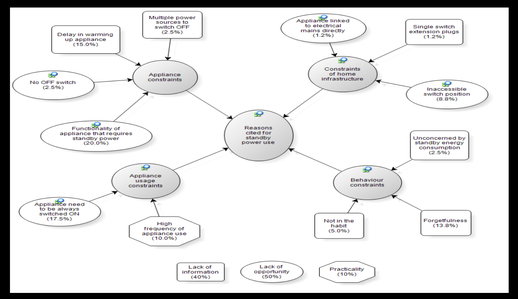
defra
Department for Environment, Food and Rural Affairs, UK
In the UK, where Government policy has been taking a global lead on these issues, housing is at present responsible for 26% of all CO2 emissions. As the DEFRA Report on the Effectiveness of Feedback on Energy Consumption (2006) makes clear: "Most domestic energy use, most of the time, is invisible to the user. Most people have only a vague idea of how much energy they are using for different purposes and what sort of difference they could make by changing day-to-day behaviour or investing in efficiency measures. Hence the importance of feedback in making energy more visible and more amenable to understanding and control." (DEFRA 2006).

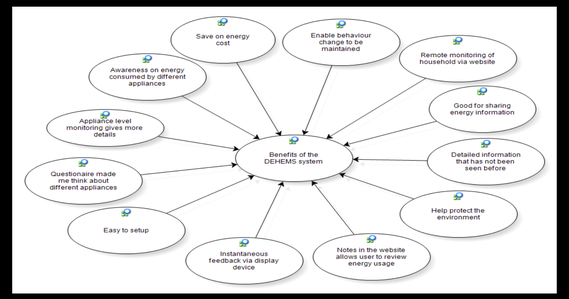
DEHEMS

The Digital Environment Home Energy Management System (DEHEMS) project is a European Union funded project looking at how technology can improve domestic energy efficiency. The project partnership includes a mix of European local authorities, private businesses and universities and is supported by the EU under Framework Programme 7. The intention is to develop and test a "Digital Environment Home Energy Management System" (DEHEMS) for the home market, aiming to improve the current monitoring approach to levels of energy being used by households. DEHEMS extends the current state of the art in intelligent meters, moving beyond energy 'input' models that monitor the levels of energy being used, to an 'energy performance model' that also looks at the way in which the energy is used. It brings together sensor data in areas such as household heat loss and appliance performance as well as energy usage monitoring to give real time information on emissions and the energy performance of appliances and services. It will enable changes to be made to those appliances/services remotely from the mobile phone or PC and provide specific energy efficiency recommendations, for the household.

The DEHEMS pilot system was deployed in 77 households across the three UK cities, Manchester, Birmingham and Bristol, from March 2009 and was increased to 250 in March 2010, including households in Bulgaria. The in-house system has also been extended to include appliance level electricity monitoring and household wide gas consumption measurement. Quantitative and qualitative action research is being carried out via questionnaires and focus groups. The project has been broken down into three cycles. In Cycle 1, a total of 45 randomly selected participants were surveyed, from the UK cities, using open and closed questions to obtain an indication of the participants' attitudes towards the environment, energy behaviours and the constraints they face in adopting energy saving behaviours. The focus groups help in understanding the mental processes underlying energy behaviours, and also provide feedback on the usability and usefulness of the DEHEMS system. We conducted four separate focus groups in Bristol and Birmingham, each consisting of around 10 participants in an interactive setting where participants were free to talk on the DEHEMS system and energy behaviours. We used NVivo to code the interpretative analysis. An extensive report on the user study is available online [Sundramoorthy & Liu 2010]. Some of the key findings are set out below.

www.dehems.org participant dashboard





Participants of the four focus groups were unanimous in remarking that the DEHEMS system provides new and interesting information on their energy usage. We found an encouraging indication of behaviour change, such as stopping dishwasher usage, changing light fittings to fit energy efficient bulbs, boiling less water in the kettle, changing to a smaller sized freezer, and reducing temperature for the washing machine. Participants seem excited and enthusiastic on the potential impact the DEHEMS system may have on the environment, and on reducing their energy costs. There is evidence that, once the realization sets in of how the use of various appliances impacts on their energy footprint, behaviour change took place. Most seem surprised at how much energy their appliances consume, and discovered, through the DEHEMS website, information to which they have never before been exposed, while some went as far as performing their own research into energy saving techniques. Most found the system easy enough to use. There is almost an equal acceptance of the display unit as an excellent method for providing them with instantaneous feedback, while the DEHEMS website is found beneficial for finding out more information on their energy usage, appending notes for future review of their energy usage and for remotely monitoring their home. However, only if the system becomes quickly as ubiquitous and unremarkable as many of the other domestic technologies in our homes – and reveal the behaviour patterns associated with them - will it have the kind of impact on domestic carbon footprint reduction so greatly needed.

DEHEMS
The Digital Environment Home Energy Management System

SEVENTH FRAMEWORK PROGRAMME

ICT Domestication

Domestication theory offers an alternative to Social Shaping of Technology (SST) and Social Construction of Technology (SCOT) approaches, and Technology Adoption Models, (TAM), allowing specifically for an ability to place technology in everyday life (Richardson 2008). It deals with the cultural, social and technological networks of the everyday life of households and concentrates on "what the technologies and services mean to people" (Haddon 2006).

Mark Weiser
father of ubiquitous computing
"The most profound technologies are those that disappear. They weave themselves into the fabric of everyday life until they are indistinguishable from it." (Weiser 1991)

Cynthia Cockburn
Cockburn (1985; 1997) for example distinguishes between 'private' and 'public' technologies. She agrees that technology does exist in the domestic sphere – in food preparation, home organisation and maintenance, in caring activities, entertainment and leisure. She also argues that such domestic technologies are rarely defined as 'technology' in the most commonly understood sense. "White goods are equated with family consumption and hence a female user, and this is what in part confers low value" [Cockburn, 1997, p. 363].

Mobile phones
The mobile was launched in the UK in 1985 yet it took fourteen years for the technology to achieve 50% penetration levels, and then only a further five years for those levels to reach 100% (ITU-T statistics). The reasons for this are many fold and inter-related. Technology in the form of the mobile handset had to become usable in terms of size and convenience, the underlying communication networks had to evolve to ensure national coverage, the services available had to mature, moving from telephone calls only to SMS text messaging and now internet access and web-browsing, and the economics had to become attractive and cost effective. Once all of these pieces were in place, the technology achieved its status as an essential part of modern living.