Appliances and home energy management: breaking habits and reducing consumption

Summary

This paper reports findings from a four-month study of energy consumption trends and use of appliances in five UK households. The main aim of the project was to provide some insights into the interrelationship between technology and education in driving more energy efficient consumer use of modern domestic electrical appliances. Selected appliances were monitored in all five homes, and in two, white 'cold and wet' appliances were replaced halfway. The study identified some disconnects between largely pro-environmental attitudes, and both stated behaviours and appliance usage - some of which were not maximising efficiency. It became apparent that some of those disconnects (or barriers) could be quite easily overcome when participants carried out a range of previously untried energy-efficient practices during a 'test week'. The results indicate that even greater savings are possible by combining some behavioural change with the purchase and effective use of new energy-efficient appliances.

Extended Abstract

This paper reports on the findings from a four-month study of energy consumption trends and use of appliances in five UK households. The main aim of the project was to provide some insights into interrelationship between technology and education in driving more energy efficient consumer use of modern domestic electrical appliances. The relevance of the household sector in contributing towards legally binding climate targets and enabling progress towards a low carbon economy in the UK is widely recognised [1, 2, 3]. Some of the key trends here include domestic energy use being responsible for approximately 31% of the nation's total primary energy consumption, and around 27% of total direct carbon dioxide emissions [4, 5]. It has been estimated that 82% of this total is accounted for by space and water heating with the remaining 18% attributable to energy used for lighting and appliances [5]. This poses a particular dilemma for the government as it strives to meet rising housing demand with increasingly stringent environmental targets. In addition, the greater prevalence of fuel poverty in the UK is concomitant with sharp electricity price rises during the last decade.

Whilst current policies such as the Green Deal and the Energy Company Obligation have been developed directly to address heat and energy waste through the UK's aging housing stock and infrastructure, the increase in energy using appliances continues prove problematic for policy makers. For example, whilst there have been considerable increases in the energy efficiency of domestic appliances over the last ten years, proponents of the economic phenomenon called the 'rebound effect' argue that this has not necessarily resulted in a decrease in the overall energy consumption of households, with much of the money and energy that is 'saved' being spent elsewhere [6].Furthermore, patterns and trends around energy use in the home are the result of a complex interplay between changing lifestyles and practices, growing prosperity and a tendency towards increased ownership of labour-saving devices; an increasing number of people and

households; and finally, a trend towards ignorance, misunderstanding, or misuse of the energy saving features of modern appliances, curtailing much of the potential for efficiency gains [7]. Additionally it is important to remember that the size and type of a domestic dwelling is not, in fact, a reliable indicator of energy consumption. For instance, as Firth *et al.* [1] point out, even dwellings in close geographical proximity and with comparable built form often display *"notably different annual electricity consumptions… [suggesting that] factors such as number of occupants, number and type of appliances, and occupancy patterns may be more relevant"* (p. 935).

In this study a sample of five separate households was assembled in the Borough of Woking representative of two principal categories: (a) single-occupant dwellings, and (b) family-occupant dwellings. The households representing these two categories were also chosen and roughly matched in terms of: location; size and type of home; age and relevance of appliances; number of occupants; age of occupants. Electricity consumption monitors were attached to 4 appliances in each home – dishwashers, washing machines, tumble dryers and fridge-freezers.

Initial interviews with the household owners revealed that the sample broadly reflected a high overall level of awareness of home energy efficiency, particularly in relation to the perceived importance of cost. However, as the study unfolded, it was apparent that this knowledge did not always equate to behaviour in practice. The confluence of factors from which daily routines ultimately transpire (as referred to, amongst others, by Shove and Walker [8]) are very pertinent in this regard. This is particularly the case in terms of a series of 'practical issues' that, from the point of view of some participants, rendered certain behaviour-oriented changes impractical. For instance physical disability and old age are potentially both inhibiting factors vis-à-vis certain behaviour changes that might, relatively easily, be adopted by other people.

Whilst all of the participants considered themselves to be 'green' and energy conscious and indeed three had recently had solar panels installed - in practice their actual energy usage and routines left significant scope for further efficiency savings. The analysis reveals that the highest household energy use per person for washing-machines and dishwashers was between double and treble that of the most energy efficient.

Energy-efficiency was a not a top priority when buying appliances - and understanding and attention paid to energy labelling was limited. In normal use participating households had rarely, if ever, tried the lowest temperature settings for their wet appliances. When challenged with trying a variety of potential energy-saving measures - such as untangling, and/or pre-sorting, washing before using the tumble dryer - convenience of not doing so for some participants overcame their desire to save energy or money. For one participant who did undertake these suggested changes to tumble dryer practice, the efficiency benefits (both in relation to drying time and energy usage) became unmistakably evident.

This small study suggests that in practice these groups' self-perception of their action on reducing their energy consumption is considerably ahead of their actual actions and willingness to act in certain areas of appliance use. In practice – and in all cases – substantial energy savings could be achieved: in the case of cold appliances and the tumble dryer predominantly by switching to newer more energy efficient models; in the wet appliances predominantly by reducing the temperature of the wash, but also by using newer technologies. Whilst the cold appliance and tumble dryer savings

only required a purchase with little further effort; behavioural changes were also necessary for the 'wet' appliances.

It was clearly demonstrated during the 'test week', when participants were asked to carry out a range of new energy-efficient practices, that some of the perceived barriers to behaviour change could be quite easily overcome with limited effort; and give rise to results that exceeded the expectations of some participants. The potential for considerable savings through behavioural and practice-oriented changes to the daily use of appliances appear not always to have been fully appreciated – even with more efficient appliances. A range of relatively 'simple' measures with less potential energy-saving impact (such as switching off mobile phone chargers at the wall overnight) were, however, routinely followed - reiterating the potential for additional savings through the adoption of further habitual changes, e.g. turning down the temperature of the wash.

New appliances offer substantial energy savings with the existing state of technology. However as the study demonstrates, there seems to be some disconnect between the promises of new technology and 'wrapping' consumer behaviour around the potential energy savings which might be expected. Disconnect between consumer behaviour and technology can probably most profitably be addressed through the following measures: (1) energy labelling to be far more visible on all communications on brochures, webpages and in-store; (2) clearer information linking the energy rating of new appliances to the cost saving potential; (3) more explicit requirements for manufacturers to provide transparent information to consumers on the most energy-efficient use of their new appliances; (4) a reinvigorated communication programme focusing on behaviour change, coupled with new technology; and (5) a mechanism to encourage consumers to trade-up old (especially) cold appliances for new high efficiency replacements.

References

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