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The carbon-saving behaviour of residential households

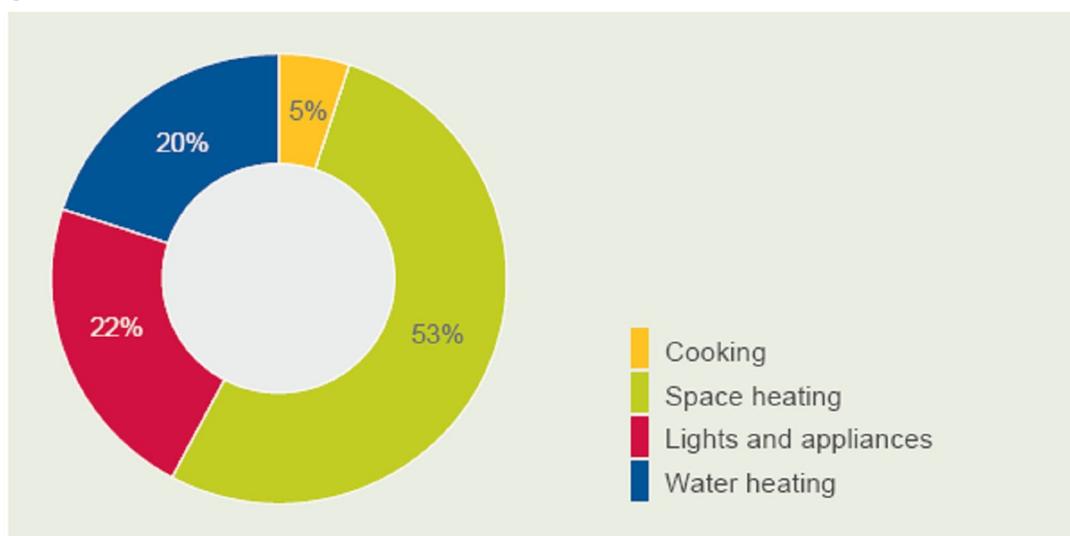
Giuseppe Pellegrini Masini, Department of Urban Studies, University of Glasgow; address: 25 Bute Gardens, Glasgow, GL12 8RS, United Kingdom; Email: gpm1x@udcf.gla.ac.uk

Household energy consumption in UK

Carbon emissions reduction in the British domestic sector is a necessary objective if the British target of 60% CO₂ abatement has to be met by 2050 (DTI, 2007). Households are responsible for just above 40 MtC per annum corresponding to around 30% of the UK total (HM Treasury et al., 2005).

Carbon emissions in the residential sector (2003) are presented in figure 1 (DTI, 2006, pag.38).

Fig 1



Source: Defra, *The 2006 Climate Change Programme*

Heating is therefore the major CO₂ emitting domestic activity accounting for 53% of the total domestic CO₂ emissions, followed by lights and appliances, 22%, water heating, 20%, and cooking 5% (DTI, 2006).

Proenvironmental behaviours and household energy behaviours

Despite the fact that some authors (see, for example, Poortinga et al., (2004, , 2003) consider transport as part of households energy consumption behaviours, we will take into consideration only behaviours related with house occupancy according to Barr et al. (2005). Nevertheless house occupancy behaviours and transport behaviours, like any other behaviour having an environmental impact can be labelled as 'environmentally significant behaviours' following the definition of Stern (2000, p.408): "Environmentally significant behavior can reasonably be defined by its impact: the extent to which it changes the availability of materials or energy from the environment or alters the structure and dynamics of ecosystems or the biosphere itself". Proenvironmental behaviour instead means according with Kollmuss and Agyeman (2002, p.240): "...behavior that consciously seeks to minimize the negative impact of one's actions on the natural and built world...".

Proenvironmental behaviour and to a lesser extent its subtype, household energy efficient behaviour, have been researched in the field of environmental psychology extensively as some review articles show (Abrahamse et al., 2005, Kollmuss and Agyeman, 2002, Stern, 2000). Research provides some evidence about what drives household energy consumption (see for example Barr et al., 2005, Parnell and Larsen, 2005, Poortinga et al., 2004, Poortinga et al., 2003).

Despite these research efforts either with regards to proenvironmental behaviours or specifically with energy household behaviours, no common agreement has been reached in the literature about what drives these behaviours and how competing factors interact. Stern (2000, p.421) concludes: "Different kinds of environmentally significant behavior have different causes. Because the important causal factors may vary greatly across behaviors and individuals, each target behavior should be theorized separately." Despite that, Stern (2000) himself identifies four clusters of major factors which influence proenvironmental behaviours: 1. 'attitudinal', like general environmentalist predisposition; 2. 'personal

capabilities' as literacy or social status; 3. 'contextual factors' as material costs and rewards and 4. 'habit and routine' (see table.1).

Table 1; (Stern, 2000)

Causal variables	Environmentally significant behaviors
<i>Attitudinal</i>	<i>Environmental activism</i>
General environmentalist predisposition ^a	<i>Nonactivist public-sphere behaviors</i>
Behavior-specific norms and beliefs ^b	Environmental citizenship
Nonenvironmental attitudes	(e.g., petitioning, joining groups)
(e.g., about product attributes)	Policy support
Perceived costs and benefits of action	
<i>Personal capabilities</i>	<i>Private-sphere environmentalism</i>
Literacy	Consumer purchase behaviors
Social status	Maintenance of household equipment
Financial resources	Changes in equipment use, lifestyle (curtailment)
Behavior-specific knowledge and skills	Waste disposal behaviors
	"Green consumerism"
<i>Contextual factors</i>	<i>Other</i>
Material costs and rewards	Behaviors affecting organizational decisions
Laws and regulations	
Available technology	
Social norms and expectations	
Supportive policies	
Advertising	
<i>Habit and routine</i>	

^aThe VBN theory incorporates various attitudinal variables believed to create this predisposition.

^bThese norms and beliefs figure prominently in applications of norm-activation theory and the theory of planned behavior to specific proenvironmental behaviors.

Nevertheless, in the literature no model of proenvironmental behaviour emerges that could explain how these classes of factors interact. Recently Lindenberg and Steg (2007) proposed a goal-framing theory to explain proenvironmental behaviour. This theoretical approach considers proenvironmental behaviours as influenced by three different motivational clusters: hedonistic goals, normative goals and gain goals. This motivational approach seems to go in the right direction recognizing the coexistence of different motivations influencing people's behavioural choices and hence shifting the research focus from factors or antecedents of proenvironmental behaviours to the motivations that give salience to such factors. For example if an individual acts under the prevalence of a gain frame when doing shopping in a supermarket, he will likely avoid organic food which is much more expensive. Hence, the material cost (financial in this example) of the proenvironmental behaviour will become a salient factor influencing an environmentally significant behaviour.

Lindenberg and Steg (2007) do not appear as adopting theoretical criteria which could enable to establish within which goal frame an actor is acting in different situations but they recognize that (p. 132): "The significance of each type of motivation differs across situations and individuals." For example Lindenberg and Steg (2007) according with Diekmann and Preisendörfer (2003) hold that in financially (but not only) high cost situations, normative motivations become secondary i.e. if a proenvironmental behaviour is too expensive to afford this won't be carried out despite an individual holds strong proenvironmental attitudes.

Needs, motivations and proenvironmental behaviours.

The effectiveness of proenvironmental attitudes in shaping behaviour only in low cost situations is indicative of the presence of a hierarchy of motivations likely reflecting a hierarchy of needs of human agency. We ought to recognize that environmentally significant behaviours are just a subset of human behaviours and that understanding proenvironmental behaviours means to embed this process in the established wider research domain looking at human motivations.

Humans act in the pursuit of their subjective well being. This might appear as an obvious consideration as humans obey to the instinct of survival through adaptation as any other species. In recent years

research (Sheldon et al., 2001, Oishi et al., 1999) confirmed the fundamental concept of the theory of needs of Maslow (1987), which is the presence of a hierarchy of needs that motivate individuals to act for seeking needs' satisfaction. Individuals first perceive the needs of satisfying basic physiological and safety needs such as nutrition, clothing, shelter and physical security and once these are met they act in the pursuit of psychological needs such as love and belonging, self-esteem, cultural needs and self actualization (Maslow, 1987). We are not interested here in arguing the actual presence of a rigid hierarchy of needs such as the one conceived by Maslow, which has been criticized in its actual structure (Wahba and Bridwell, 1976). Nevertheless research has confirmed along the years (Sheldon et al., 2001, Oishi et al., 1999, Inglehart, 1977) the presence of a hierarchy of needs which could broadly separate basic needs at the bottom, which need to be satisfied prior the pursuing of higher needs such as relational (affective) and cultural (self-actualization).

A novel model of proenvironmental behaviour

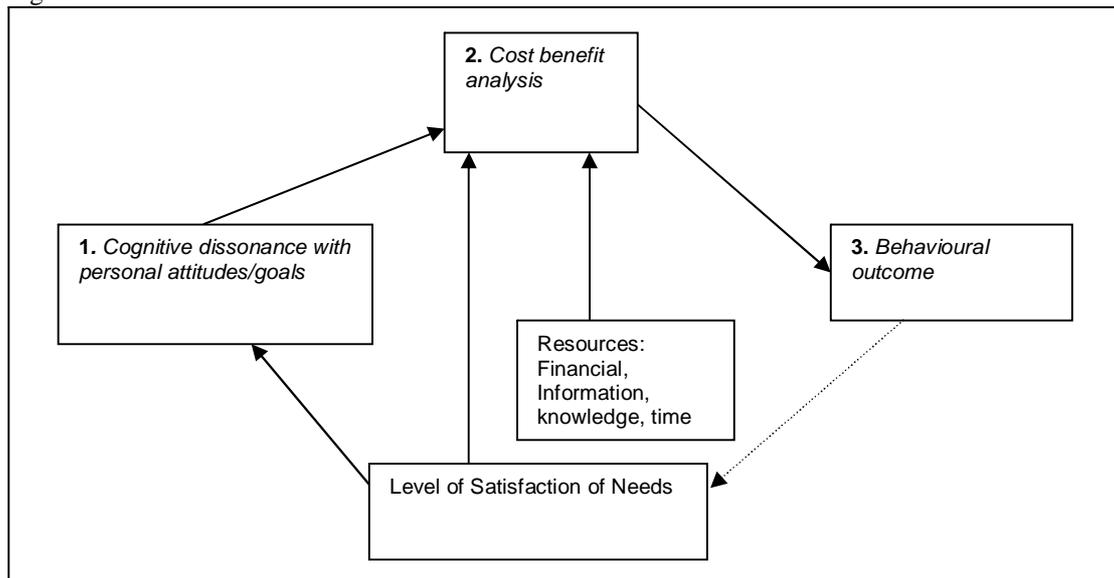
The hierarchy of needs could hence explain why proenvironmental attitudes might be lacking of effectiveness in driving proenvironmental behaviours in presence of high costs. This is commonly referred as the low cost hypothesis (Diekmann and Preisendorfer, 2003). Although high costs might be easily thought as financial in their nature, this is not the only case for Diekmann and Preisendorfer (2003). In fact pursuing behavioural consistency with proenvironmental attitudes in order to avoid cognitive dissonance, which is considered a motive to engage in proenvironmental behaviours (Thøgersen, 2004), could be considered as an action satisfying self-actualization needs rather than more urgent basic needs. Hence, in a low income household situation, it might be more urgent to satisfy basic needs as nutrition and shelter than the inner pleasure of feeling consistent with somebody's own proenvironmental values.

We argue that acting a proenvironmental behaviour is the result of an individual choice which follows a subjective cost benefit analysis. This cost benefit analysis is influenced primarily by the goal orientation of an individual at a certain point in time, which is in turn ultimately determined by the level of satisfaction of their needs. Secondly by the availability of financial resources and the level of knowledge and information that an individual holds about the best course of action to achieve their main goal(s).

Knowledge and information are necessary to understand the most efficient course of action to secure the subjective achievement of a goal. For example, a subject might want to pursue a green lifestyle but could fail to do so for his lack of knowledge of the relation between carbon emissions and activities such as flying by plane or buying a car with a large engine.

We would represent this model of proenvironmental behaviour as follows (fig2):

Fig .2



In fig.2 we have represented an hypothetical model in which an individual would pass through different cognitive phases: 1.focusing attention on a certain contextual object on which to act as a result of the cognitive dissonance that such object causes. For example an individual could consider switching off the light in a room which is not used because he feels that this is inconsistent with his proenvironmental attitudes or because is inconsistent with his goal of economizing financial resources or for both reasons. Then he would pass through a second phase in which he would balance different

costs and benefits prioritizing them dependently on the satisfaction of his needs at that point in time. So for example facing the choice of buying groceries, he could balance the benefit of getting organic food and hence being consistent with his proenvironmental attitudes versus the benefit of buying non-organic industrial food, which could allow the buyer to save money and hence being consistent with the goal of economizing financial resources. Phase 1 and phase 2 are both influenced by the individual's level of satisfaction of needs and his resources. For example, a wealthy subject who has satisfied fully all his material needs might not even think about the benefit of switching off lights as a way to economize financial resources so he could act under the wish of being consistent with proenvironmental attitudes. Nevertheless, if he lacks knowledge about environmental issues, he might not even think that saving electricity reduces CO₂ emissions. Resources that we consider as relevant for proenvironmental behaviours are: disposable income, knowledge and information and finally time. Disposable income and time are considered as relevant factors influencing the frequency of household proenvironmental behaviours (Anker-Nilssen, 2003): the reason is easily intuitable, disposable income makes easier to purchase energy efficient technology or switch consumption on more expensive green products. Time as Anker-Nilssen (2003) points out is considered a precious and limited resource to achieve a better quality of life. We would say here that, accordingly with Maslow's theory, (1987) quality of life is ultimately achieved through needs' satisfaction and to pursue this, individuals make use of their own resources such as time and skills. Knowledge and information appear to be as necessary resources: without them citizens could not choose a proper proenvironmental conduct even holding proenvironmental attitudes (Boardman, 2004).

Finally, the behavioural outcome in the long term might influence the presence of personal resources or the level of satisfaction of needs. A person that has been pursuing financial wealth for a large part of his life might re-frame his main goal once he has achieved a wealthier condition through actions intended to achieve this aim.

Proenvironmental behaviour in households research

Consistent with the theoretical model just outlined is recent research regarding household energy use. Low income households in Oslo, having electric heating, show a higher elasticity of demand for electricity in relation with temperatures contrarily to high income households which have a fairly stable demand in the winters between the years 1994 and 1996: Anker-Nilssen (2003) argues that low income households spend on energy costs an higher proportion of their total household budget and they have a marginal use of energy for needs which are not basic.

Poortinga et al. (2003) researched household preferences for energy saving measures in a study which involved 455 (n) respondents (sample N=2000) during the months of October and November 1999. The authors found that low income was relatively more correlated to the adoption of a strategy of different use of products in order to save energy, (for example reducing the consumption of electricity), rather than increasing energy efficiency through technical measures which would imply an investment, (like buying low energy bulbs or roof insulation). Conversely, high income households were much more prone to save energy through technical measure than reducing consumption.

Barr et al. (2005) carried out a study in 2002 in Devon on a sample of 1600 households with a response rate of 59%; cluster analysis was performed which grouped respondents in four categories having internal close behavioural patterns: committed environmentalists, mainstream environmentalists, occasional environmentalist and non-environmentalists. Looking at demographic variables in relation with these groups, they found that non-environmentalists had the highest proportion (35%) of low income (<7.5k GBP) and at the same time the highest proportion (18%) of higher income (>30K GBP); further they had the highest proportion (53%) of lack of formal education and the largest proportion (17%) of households having five or more members.

These findings allow us to hypothesize that low income households find harder to save energy, simply because they do not have disposable income to purchase energy efficient technological fixes and because their energy consumption is meant to satisfy mainly their basic needs (space and water eating in primis). If they are explicitly required about which strategy for energy saving they would prefer they would choose to reduce consumption through a different use of their current equipment (for example accepting a lower house temperature during the winter) rather than through the purchase of new equipment which would possibly be a problem in conditions of scarcity of financial resources.

High income households would instead prefer the energy saving strategy that goes through the purchase of energy efficient technology. At the same time they would not change their consumption easily with an increase of price unless this was substantial because their energy demand is relatively unelastic. On this a further confirmation comes from the Anker-Nilssen's (2003) research which reports that, for a sample of N=1440 Norwegian households responding to an attitudinal survey,

income was negatively correlated to 'importance of saving energy' (-0.118) and positively correlated to 'importance of time and comfort' (0.080)

Despite the availability of financial resources, nevertheless high income households do not feel inclined to save energy if not through buying energy efficient equipment while they seem to value their comfort. This picture appears to be consistent with the study of Poortinga et al. (2004) which found household consumption of energy positively correlated with 'Family, health and safety' (.11), 'Self-Enhancement' (.01), 'Income' (.27) and 'Household size' (.22). 'Family health and safety' and 'Self-Enhancement' were two of seven factors¹ to which 22 quality of life (QOL) aspects were reduced through factor analysis. 'Self-Enhancement' comprised the QOL variables of money/income, comfort, status recognition and material beauty; 'Family health and safety' loaded the variables of health, safety, partner and family.

Therefore it seems plausible that issues related with comfort, status, health, safety and family relationships are considered a priority versus energy saving. This could be interpreted as a confirmation of the hierarchy of needs of Maslow which holds a motivational drive to satisfy first basic needs then safety, relational needs, self-esteem and just ultimately cultural and self-actualization needs.

Concluding, low income households are held back from a further effort to save energy by lack of financial resources, lack of knowledge and marginal use of energy beyond the satisfaction of basic needs. High income are more likely to invest in energy efficiency thanks to their availability of financial means, but are reluctant to reduce consumption through behavioural change in order to maintain high levels of comfort.

Policy implications

Policies aiming to foster household energy efficiency and conservation should bear in mind that information and educational campaigns might not be enough (Abrahamse et al., 2005). In fact, despite informing and educating might strengthen proenvironmental attitudes and enabling people to understand the environmental consequences of their behaviour, this would not lead immediately to behavioural change. Individuals might like to avoid cognitive dissonance with the proenvironmental attitudes (Thøgersen, 2004) that they might hold, but these might not be salient if contextual barriers (Corraliza and Berenguer, 2000) or other perceived high costs (Diekmann and Preisendorfer, 2003) are in conflict with contingent motivational priorities oriented by an innate or culturally learnt hierarchy of needs.

Therefore, policymakers should adopt a strategy of behavioural change that does not conflict with the motivational drive to pursue the satisfaction of the most urgent needs. For example, it would not be productive to require energy efficient or conservation behaviour which obstacle the satisfaction of basic or safety needs. It is unrealistic to think that low income households could sacrifice their finances to improve technically the energy efficiency of their homes through investments. First, they may not well be owners but just tenants, in which case they would not perceive the advantage of improving physically a building which they are possibly going to leave at some point in the future. Secondly, an investment in energy efficiency would divert financial resources from the satisfaction of more urgent needs such as basic needs (food, clothing, rent), transport, when needed to commute to the workplace, healthcare etc. It seems therefore that low income households should be put in the condition to invest in energy efficiency through specific grant schemes which could cover all or a substantial part of the investment required for technical improvements. While middle or high income households might instead be induced to invest in energy efficiency through educational campaigns which would strength environmental attitudes, knowledge and information about the financial return deriving from energy savings. Knowledge would help the subjects to understand the relevance of technical improvements in reducing CO₂ emissions, which importance would be perceived as significative once the possible threats of climate change were further explained. Ultimately, a possible growth in proenvironmental attitudes, consequence of educational campaigns, could lead to the choice of investing in household technical solutions to improve energy efficiency: this would have the double benefit of maintaining cognitive consistency with proenvironmental attitudes and delivering financial savings.

On the behavioural side of household energy savings, it seems that the interventions should be aimed at a) providing information about the actual amount of potential energy savings and CO₂ emissions related with specific behaviours and b) shaping perceptions of comfort. Lack of information might reduce the prevalence of energy saving behaviour because of lack of knowledge of the presence or relevance of energy savings related with specific behaviours. Perceptions of comfort instead although being just marginally manipulable, (nobody could find very low or high temperatures comfortable), nevertheless are suitable to be shaped by educational campaigns as they appear in some extent

¹ The others were: Environmental quality, Self-Direction, Openness to change, Maturity, Achievement.

psychologically dependent (Heijns and Stringer, 1988). Educational campaigns might address the use of energy consuming recreational appliances in households. PCs, televisions, Hi-Fis are often used widely in domestic settings and they are perceived as an essential part of nowadays lifestyle. Educational campaigns might expose the public to the risks of an over consumption of products related with home entertainment and the consequent development of a bedroom culture (Bovill and Livingstone, 2001) which might diminish the interaction between family members and ultimately the quality of family life.

Nutrition also could be object of educational campaigns aimed at stressing the importance of eating fresh unprocessed food richer in nutrients, rather than ready-prepared frozen meals or anyway home cooked.

In conclusion, it is more likely to achieve energy savings through campaigns if these highlight benefits other than just environmental and particularly if such benefits would be relevant for actors in meeting their priority needs.

If educational campaigns would fail to deliver or proved to be too costly than rising the costs of energy through taxation might be considered although as Anker-Nilssen (2003) points out, this solution would be unfair and inefficient if price rises were uniform across different household income levels. Energy cost rises would produce a useful result, i.e. energy savings without socially negative consequences, only if income related.

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