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Energy consumption behaviour: rational or habitual?

Simin Davoudi, Luke Dilley and Jenny Crawford

Abstract

Reducing energy demand is not simply about developing energy efficiency measures and technologies, but also changing behaviour and everyday practices. Although the over-emphasis on individual behaviour as the main driver of transition to low-carbon societies may be contested on the grounds that it distracts attention from the wider structural, economic and political factors, it is widely acknowledged that pro-environmental behaviours play an important part in such a transition. But, what constitutes such behaviour? Why do people behave in the way they do? What motivates them to change their behaviour? What are the key factors in behaviour formation and change? This paper aims to address these questions by drawing on three dominant perspectives on environmental behaviour and its drivers: the *rational economic*, the *psychological* and the *sociological* perspectives. The aim is to provide a conceptual understanding of behaviour, illustrated with example from energy consumption.

1. Introduction

In the United Kingdom (UK) households are responsible for around half of the national carbon emissions through energy consumption in the home and personal transport (DECC, 2013). While residential energy consumption has been falling

per household this is more than offset by growing population and household formation (Committee on Climate Change, 2013). It is argued that reductions in household energy use could be much greater if improved domestic technologies and products were to be more rapidly adopted and used more effectively. Individual energy behaviour is perceived as a significant barrier to achieving a major step change in energy efficiency. This barrier exists in spite of growing environmental awareness and the financial and environmental benefits of energy efficiency measures (Christie, et al., 2011; Crosbie & Baker, 2010; Gram-Hanssen et. al., 2007). In addition, when such measures are adopted their benefits may be negated by poor use (Gill, et. al., 2010) or changes in other household characteristics such as increase in the number of appliances in the home (Vale & Vale, 2010), preferred temperature (Lomas, 2010) or the floor area of the house (Summerfield, et. al., 2010). This offsetting of increased efficiency by increased consumption is known as ‘the rebound’, or ‘take back’ effect. The terms suggest that household energy efficiency measures can encourage more profligate use of energy because energy users feel they do not have to be as ‘miserly’ with energy usage (Jenkins, 2010; Greening et al., 2000). For example, it has been shown that instalment of efficient washing machines correlates with an increase in the amount of washing done (Sorrel et al., 2009). This has led to a growing argument that reducing energy demand is not simply about developing energy efficiency measures and technologies, but also changing behaviour and everyday practices. Indeed, there is a commonly held assumption that changes in individual behaviour can achieve a step change in global energy use, as indicated in the following statement from the Stern Review:

“In the case of climate change, individual preferences play a particularly important role. Dangerous climate change cannot be avoided through high level international agreements; it will take behavioural change by individuals and communities, particularly in relation to their housing, transport and food consumption decisions”
(Stern, 2007:395)

Similar assumptions are made by the UK government (DECC / Defra, 2009) which consider behavioural change to be central in ‘pulling’ society towards the development of alternatives to carbon intensive forms of living (Parag & Darby, 2009: 3985).

Although the over-emphasis on individual behaviour as the main driver of transition to low-carbon societies may be contested on the grounds that it distracts attention from the wider structural, economic and political factors, it is widely acknowledged that pro-environmental behaviours play an important part in such a transition (Defra, 2008). The question, however, remains: what constitutes such behaviour? Why do people behave in the way they do? What motivates them to change their behaviour? What are the key factors in behaviour formation and change?

One response to these questions has been to bundle everything in what may be called Attitudes-Behaviours-Context (ABC) models (Stern 2010) in which a multitude of factors are considered as ‘contextual factors’ including:

“interpersonal influences (...); community expectations; advertising; government regulations; other legal and institutional factors (...); monetary incentives and costs; the physical difficulty of specific actions; capabilities and constraints provided by technology and the built environment (...); the availability of public policies to support behaviour (...); and various features of the broad social, economic and political context (...)” (Stern 2000: 417)

However, as Shove (2010: 1275) argues, the more factors are added to ABC models “the more muddled the picture becomes”¹. At the same time, the more complex the models become the less their empirical applicability (Jackson, 2005).

This paper aims to shed some light on this complex picture by presenting a clearer grouping of the factors that drive behaviour. We draw on the broader literature on decision making which cuts across several disciplines to frame specific discussion about environmental behaviour with a focus on energy consumption. A large part of the decision making literature is normative and prescribes how decisions *ought to* be made. The focus of this paper, however, is on how decisions are *actually* made by individuals. It aims to provide a conceptual understanding of behaviour. We believe that such an insight is crucial for policies aimed at encouraging pro-environmental behaviour. The following sections focus on three broad perspectives on behaviour and review the

¹ Drawing on practice theories, Shove (2010) also suggests that to make progress in energy reduction, we should focus on the practices that lead to the demand for energy (such as cooking, showering, etc.) and not just on energy *per se*.

discussions on values and norms which play a critical role in the environmental behaviour literature. The concluding section highlights a major shift in understanding energy consumption behaviour in terms of the interplay of individual and social drivers.

2. Three perspectives on environmental behaviour

There are three dominant perspectives for understanding environmental behaviour and its drivers. We call them the *rational economic*, the *psychological* and the *sociological* perspectives (Tetlock, 1991). Below, we elaborate on these in turn.

2.1 The rational economic perspective

The rational economic perspective suggests that people are utility maximisers and their decisions are based on rationally ordered preferences, which in turn are based on the level of utility attached to, and probability of securing, each choice. In doing so, they follow a number of logical steps: define the problem, identify the decision criteria, weight each criterion, assess risk, generate options, rate options on each criterion, compute the optimum option, and monitor and evaluate (Bazerman, 2001:3-4). This model suggests that people's choices are based on rationally calculating the costs and benefits of a particular course of action and taking the one which maximises their net benefit. Access to information is crucial for making optimal decisions with highest benefit and lowest cost. This implies that people will reduce their energy use, invest in energy efficient measures, or retrofit their houses, if they possess the requisite information and if

their self-interested benefits outweigh costs (Wilson & Dowlatabadi, 2007; Jackson, 2005). According to the model, a key role of intervention is therefore to provide information. This has led to a myriad of policy initiatives based on giving feedback to households on their use of energy and providing them with “new, actionable information on consumption that could be clearly understood” Darby (2008: 450). The idea is that having the information about energy use of different appliances and different patterns of use, people will be motivated to reduce their consumption (Hargreaves et al., 2010; Thaler & Sunstein, 2009; Gronhoj & Thogerson, 2011; Gyberg & Palm 2009).

Another role of policy intervention, according to this model, is to ensure that the market allows people to make optimal choices by correcting price signals through internalisation of social and environmental ‘externalities’. This is the basis of a growing number of environmental taxes and levies (such as carbon tax) that are aimed at incorporating environmental costs into economic cost-benefit calculations.

Critics point to key complicating factors such as: the influence of variable future discount rates and the non-linear way in which the value of costs and benefits changes over time; the significance of framing and how preference is depended on a reference point (Lindenberg & Steg, 2007), and the importance of various forms of heuristic, habit and emotion (Wilson & Dowlatabadi, 2007; Jackson, 2005). These latter will be discussed in more details below. Empirical studies have also demonstrated that people do not always behave as utility maximisers. For example, Christie, et al. (2011) highlight that adoption of energy-efficiency technologies are assessed by potential users not only in terms of utility

maximisation but also, and more significantly, in terms of risks to, among other things, perceptions of social belonging and other aspects of personal identity and ‘safety’.

At the same time, the rational model suggests that besides cost-benefit calculation, the probability of achieving the preferred outcome also plays a part in decision-making. Perceived behavioural control (PBC), as advocated by Ajzen (1991), describes the individuals’ *perception* of the ease or difficulty with which they can adopt behaviour (Turaga et al., 2010: 216). ‘Self-efficacy’ is defined as the perception of “how well one can execute a course of action required to deal with prospective situations” (Jackson, 2005: 49). The implicit assumption within notions of PBC and self-efficacy is that if a behaviour is perceived as being impossible within a particular context it will not be adopted “despite the motivation being present” (Darnton, 2008: 19). It is, however, suggested that encouragement and “emotional arousal” can increase feelings of self-efficacy (Darnton, 2008: 20). Again, information plays a key part because it is argued that feelings of self-efficacy can be strengthened through positive feedback (Grohoj & Thogersen, 2011) on, for example, the level of reduction in energy use. However, if the feedback is negative (no reduction), it may act as a deterrent for those with low perceptions of self-efficacy. Wilson & Dowlatabadi (2007) argue that it is crucial for interventions to enhance individuals’ perceptions of self-efficacy through feedback mechanisms as well as education and training.

The rational economic model was dominant in the spatial planning field in the 1960s and 1970s in Europe and America. Since then, it has been subject to

criticism by planning theorists who argue that it fails to match the seemingly disjointed and incremental processes of decision making by individuals and institutions (including planning systems) alike. However, despite a great deal of research indicating the limitations of the rational model, its assumptions have crept into the debate about ‘attitude’ and its assumed determining role in environmental behaviour. People’s behaviour is understood to be preceded by their attitude towards that behaviour. This attitude is in turn informed by a rational evaluation of the characteristics of that behaviour (Jackson, 2005). For example, the attitude towards purchasing and installing a low energy light bulb might be based upon an evaluation of its environmental impact, money saving potential, its aesthetic qualities, the quality of the light and so on (Crosbie & Baker, 2010). Such assumptions imply that if we modify attitudes, we can modify behaviour and this can be done primarily through education, information provision and awareness raising (Stern, 2000; Hargreaves, 2008).

2.2 The psychological perspective

The psychological perspective does not consider people as irrational, but it argues that their rationality is bounded by certain limiting cognitive characteristics and patterns. It draws on an evolutionary perspective, in which the human species has developed to respond to complex, changing environments by developing mental shortcuts or heuristics (Gigerenzer et al., 1999; Calne, 1999). These ‘rules of thumb’ are simplifying mechanisms that allow us to make quick decisions whenever full analysis is either not possible or not wise due to the urgency of action (such as escaping from imminent danger) (Nicholson, 2000). While these mechanisms have proved useful and practical, they lead to a

number of biases which run counter to some of the fundamental assumptions of the rational model. Some key biases are outlined below, following Kahneman and Tversky (1979).

Firstly, we tend to treat choices differently depending on the manner in which they are described or ‘framed’, not what they actually are. If they are framed in terms of losses, we attach more risk to them than if they are framed in terms of gains. This ‘cognitive illusion’ means that people are more risk averse in relation to potential losses than for potential gains; they are indeed loss averse. This has important implications for environmental policy in terms of, for example, choosing between policies that are based on people’s ‘willingness to pay’ (buying price) and those focusing on ‘willingness to accept’ (selling price). The latter is shown by Kahneman and Tversky (1979) to be up to 20 times the former. Layard (2005) provides an intriguing example, suggesting that most people would expect to be paid much more to mow their neighbour’s lawn than they would be prepared to pay to have their own lawn mowed by their neighbours. This implies that we tend to pay only a little to have something, and demand a lot to give it up (Dawnay and Shah, 2005: 17). Framing, therefore, is significant in economic cost-benefit analyses. More importantly, such analyses are not sufficient in assessing the potential for a given policy being accepted and taken up by people. For example, Christie et al. (2011) found that householders who were resistant to the installation of solar panels remained so even when they had to make no initial expense and were assured that their subsequent payments would not exceed the financial savings that the equipment generated. Clearly,

factors other than financial concerns have influenced their decisions, such as the trust in the reliability of panels or the level of disruptions involved.

Secondly, in assessing information we pay more attention to information that is easily available and to memories that are easily retrievable because they have personal relevance or are emotionally vivid. For example, we may put more weight on our own experience of a malfunctioning energy efficient device than on the published statistics about the probabilities of such defaults. We also tend to cherry pick evidence to support our chosen options (a self-serving bias) or the decisions that have already been made (a confirmation bias) (De Bondt, 1998).

Thirdly, in making judgements about which options to choose we use our intuition to filter the huge amount of information received, so that we can make decisions in the face of uncertainties and ambiguities. While this helps with the problem of so called ‘analysis paralysis’, it can also lead to over-confident estimates or unwillingness to acknowledge new information. In situations of repeated decision making (such as picking the right temperature for washing laundry) we tend to identify emotionally and cognitively with familiar options that have been tried and tested rather than rationally weigh alternative options. That may explain why a great majority of households wash at 40 degrees Centigrade despite the availability of several other temperature options and improved washing detergents that wash equally well at 30C.

Finally, in evaluating the decisions that have been made, two further biases may occur. The first one is a tendency to attribute any good outcomes to our own actions, and any bad outcomes to factors outside our control, often in the attempt

to maintain self-esteem. The second bias relates to the illusion that we have control over the risks of our actions. This then leads us to discount information that suggests otherwise (Fenton-O'Creevy et al., 2003).

In summary, the psychological perspective shows how people's rationality is bounded by their cognitive characteristics. However, while for some this perspective implies that people's judgments are always coloured by their biases and destined to systematic mismatch (Nisbett and Ross, 1980), for others, they are signs of strength indicating that people can use their tacit knowledge to arrive at timely decisions. In practice, people move between the two extremes, from simple heuristics to complex cognitive strategies, depending on the significance of the decision that they have to make (Fiske and Taylor, 1991). The psychological perspective stresses the habitual, ritual and conventional bases of human behaviour. It suggests that people are not always calculating rational beings; that, they may not know their costs and benefits; and that they may not act in their own self-interest.

Habit plays a vital role in people's lives (Darnton et al, 2011). Contrary to the rational choice models, people's behaviour is often habitual based on short cuts and routines rather than rational deliberation. Only when these routines are disrupted, do conscious deliberations come to play a part. It is in this context that feedback mechanisms, mentioned above, may work. By 're-materialising' energy which is abstract and by making what is hidden in people's mundane routines visible (Burgess & Nye, 2008; Thaler & Sunstein, 2009:82), entrenched habit can be disrupted and a space opened which may allow for new habit

formation. In other words, feedback may bring energy use back into people's economic and environmental consciousness.

A distinction, however, can be made between indirect and direct feedback. Indirect feedback occurs sometime after consumption has taken place (such as on households' energy bill), while direct feedback happens immediately at the time of consumption (such as energy monitors or smart meters). Direct feedback has been shown to be more effective at saving energy than indirect feedback. It has led to improved energy literacy and interest in purchasing energy efficient appliances or renewable energy technologies (Gronhoj & Thogerson, 2011; Hargreaves, Nye & Burgess, 2010). This underpins the UK government's plan for every household to have a 'smart meter' and energy monitor by 2020 in order to electronically display instant and detailed information about energy use. Research has shown that such devices can produce savings of around 5-15% (Gronhoj & Thogerson, 2011) by motivating a range of actions such as: turning off appliances, using energy more thoughtfully, replacing inefficient appliances, and so on (Darby, 2010). However, research has also shown that the positive effects of energy monitors often decrease overtime (Hargreaves et al. 2010; van Dam et al., 2010). Furthermore, rather than enhancing peoples' sense of self-efficacy, their use may lead to a sense of disempowerment as energy monitors can, on occasion, make the challenge of energy saving seem "larger and even more insurmountable" (Hargreaves et al., 2010: 6119). This has led to calls for more careful examination of their positive and potentially counter-productive effects (Pierce et. al. 2010).

2.3 The sociological perspective

What is common between the rational and the psychological perspectives is that both portray people as information-processors albeit often with highly biased (and limited) processing capacity and ‘bounded rationality’ (Simon, 1957). Both focus on individual behaviour rather than social and cultural processes that play crucial roles in habit formation, in providing categories within which we think, and in framing what is legitimate or normal.

In line with the psychological perspective outlined above, *the sociological perspective* also considers people’s rationality as bounded, not just by their cognitive capacity to process information, but also by the social context in which they operate. From this perspective, people are seen as being driven to control not just their environment (as is the case in psychological approaches), but also to respond to social pressures. Three types of social pressures are particularly influential in decision-making. The first is *coercive* and involves social sanctions if people do not act in socially legitimate ways. Legislation, regulations and rules are among this type of pressure. Non-conformity leads to punishments. A large part of pro-environmental behaviour emanates from the enforceable rules and regulations.

The second type of social pressure is *mimetic* and involves imitating what others do (Routledge, 1993). In order to reduce complexity and save time, we may either choose or be compelled to copy others without necessarily considering the potential contextual differences. We tend to do what our neighbours do especially if we trust their judgment. Research has shown that households are

motivated to take energy-saving action only after others have been seen to do so (GfK NOP Social Research 2012).

The third type of social pressure is *normative*, based on the values we hold and the acceptability of behaviours. It involves what we think we *should* do to not only avoid social censure but also maximise social reward. A great deal of the literature on environmental behaviour considers values and norms as central to the understanding of behaviour and the design of effective policies and programmes aimed at behavioural change (see for example: Stern, 2000; Barr, 2003; Gilg et al. , 2005; Turaga et al., 2010). It is, therefore, justified to dedicate a section to these and elaborate them further.

3. Values and norms

Values are considered to be higher level social constructs than attitudes or beliefs (Jackson, 2005). Some commentators have suggested that individuals hold general values that can be placed on continua ranging from ‘egoistic’ to ‘altruistic’, from ‘conservative’ to ‘open to change’, and from ‘bio-centric’ (nature has intrinsic value) to ‘anthropocentric’ (nature has instrumental value) (Barr, 2003: 229). In relation to environmental behaviour, Stern (2000) proposes a value-belief-norm model in which the above values are linked to beliefs about human relationship to nature (also see Davoudi, 2012 & 2014). It is argued that, altruistic and bio-centric value orientations are positively correlated to an ‘ecological worldview’ which considers nature as being in a delicate balance that can be offset by unchecked human actions and growth. This ecological

worldview, in turn, leads to a sense of moral obligation to engage in pro-environmental behaviour and to perform such behaviour. In contrast, egoistic values correlate negatively to the activation of a sense of responsibility towards the environment (Stern, 2000).

As Hargreaves (2008) argues, Stern's model implies that values are socially, rather than individually, constructed. Despite this, attempts to change values continue to rely on information provision and "moral suasion/education" aimed at individual consumption (Wilson & Dowlatabadi, 2007: 185; see also Stern, 2000:419) rather than steering the normative basis of society towards more altruistic and reflexive environmentalism (Jackson 2009). It is also important to note that while other studies support the link between altruistic and bio-centric values and environmental behaviours, they nevertheless emphasise that "values are not easily manipulated" (Gilg et al., 2005: 499) and that, there are other factors that determine pro-environmental behaviour.

In Ajzen's (1991) 'Theory of Planned Behaviour' a subjective norm is the perception of what (important) others think about a particular behaviour (Jackson, 2005: 46-47). If we perceive that others would see our behaviour in a positive light, we are more likely to perform that behaviour (Harland et al., 1999). Subjective norms are therefore social norms and as such they refer to what is perceived to be normal or legitimate in a given social context. Social norms can be powerful drivers for pro-environmental behaviours (Evans, 2007). This means that people are likely to engage in energy reduction behaviours if they are a member of a group in which such behaviour is normal (Dono et al.,

2010; McKenzie-Mohr, 2000). If switching off lights is normal in our workplace, we are more likely to do so. An individual's ability to observe social norms is important to how they are perceived and accepted by their peer group especially in relation to what is interpreted as socially (un)acceptable (smoking is a clear example).

It is in this context that *normative* feedback (i.e. comparing one household's energy use with that of other households) as opposed to informative feedback (i.e. providing households with information about their own energy use) is suggested to be more effective because it can activate a social norm and hence a change of behaviour (Fischer, 2008; De Young, 2000). However, empirical findings on this claim are mixed: some argue that normative feedback stimulates energy saving (Darby, 2010), others suggest that the effect is often under-detected (Nolan, et. al., 2008) and a third group find that none of the studies utilising normative feedback could "demonstrate an effect on consumption" (Fischer, 2008: 99). While, more research is needed in the exact effects of normative feedback, it is widely acknowledged that social norms refer to what is conceived of as 'appropriate' forms of behaviour in a given circumstance or a given social group (Jackson, 2005:60). Adjusting one's behaviour to the 'norm' can therefore have a positive or negative impact on their energy consumption. So, as Fischer (2008) suggests, low energy households could actually increase their energy consumption if comparative feedback suggests that their consumption is below the 'norm'. So, social norms can act both ways depending on the nature of the norm (pro, anti or neutral towards the environment) and the extent to which it is embedded in the social consciousness. Lorenzoni et al.

(2007) argue that a significant barrier to adopting pro-environmental behaviour in the UK is the perception that low-consumption 'green living' is both abnormal and undesirable.

Overall, it is important to note that a focus on values and norms in policy-making recognises that energy behaviour is an inherently political as well as a technical issue and requires the development of energy-sensitive politics as well as policy integration.

4. Conclusion

Reducing households' energy consumption is a significant part of strategies for transition to low carbon societies. Such reduction can take place through technological advances such as energy efficient building materials and appliances and physical interventions such as retrofitting of the built environment. However, problems of rebound effect, low levels of take up and acceptability have directed attention to behavioural issues. Changing behaviour has increasingly become the buzzword of public policy. However, as mentioned in the introduction to this paper, progression towards more sustainable forms of energy demand and supply requires "more than a shift in the attitudes and intentions of individuals" (Walker & Cass, 2007: 467). Attempts to steer society towards sustainable energy systems should go beyond a focus on influencing individual behaviour. It requires a radical re-working and re-alignment of "technologies, routines, forms of knowhow, markets and expectations" (Shove, 2012:1278) as well as institutional practices and systems of provision.

People's consumption of energy is based on a set of social practices which are influenced by both their lifestyle choices and by the institutions and structures of society, including those which determine the dynamics of energy systems. For policy to be effective, it needs to be developed with a sound understanding of the complexity of these relationships.

The need for systemic change does not mean an abandonment of attempts to promote pro-environmental behaviour. What we have demonstrated in this paper is the existence of at least three different conceptualisations of behaviour with each being rooted in different disciplinary traditions and presenting different views of 'individuals' and the drivers of behavioural change. In practice, what constitute our behaviour is far from the neat dividing lines presented above. As Jackson (2005) puts it, people's behaviour is a function of their attitude and intentions, their habitual responses and the situational constraints and conditions under which they operate. Their intentions are then influenced by social, normative, and affective factors as well as rational deliberations.

Effective policies have to take into account the importance of the social context of behaviour, while also renegotiating habits and encouraging new habit formation. An important element of changing habit is to 'unlock' existing behaviour or, in other words, raise the behaviour from the level of practical (everyday routine) to discursive (intentional, goal-oriented) consciousness (Jackson, 2005). This can be done more effectively with a focus on communities rather than individuals (Brulle, 2010; Bunt and Harries, 2010, Heiskanen et al

2010). Through both place-based and group-based communities, reducing energy consumption could become the new social norm, shaping both individual and systemic behaviour. Many of the current pro-environmental behaviour change approaches do recognize the importance of information, norms and attitudes and take a collective approach at the level of community. And yet, there appears to be a lack of stress on the facilitative structural conditions and institutional practices within which these community initiatives are situated. These structural conditions not only influence individual behaviours. They also affect energy providers and regulatory systems. The evidence in this paper suggests that a shift in energy behaviours requires a multi-level and cross-sectoral approach which addresses material, institutional, social and subjective determinants of behaviour simultaneously.

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References

- Ajzen, I. (1991) The Theory of Planned Behaviour, *Organization Decision and Human Decision Process*, 50, 179-211.
- Barr, S. (2003) Strategies for sustainability: citizens and responsible environmental behaviour, *Area*, 35(3), 227-240.
- Barr, S., Gilg, A. & Shaw, G. (2011) 'Helping People Make Better Choices': Exploring the behaviour change agenda for environmental sustainability, *Applied Geography*, 31, 712-720.
- Bazerman, M. (1998) *Judgement in Managerial Decision Making*, New York, John Wiley.
- Brulle, R. J. (2010) From Environmental Campaigns to Advancing the Public Dialog: Environmental Communication for Civic Engagement, *Environmental Communication A Journal of Nature and Culture*, 4(1), 82-98.
- Bunt, L. & Harries, M. (2010) *Mass Localism: A way to help small communities solve big social challenges*, NESTA Discussion Paper, Available at: http://www.nesta.org.uk/library/documents/MassLocalism_Feb2010.pdf, Accessed on 27.02.12
- Burgess, J. & Nye, M. (2008) Re-materialising energy use through transparent monitoring systems, *Energy Policy*, 36, 4454-4459.
- Calne, D.B. (1999) *Within Reason: rationality and human behaviour*, Toronto, Pantheon

- Christensen, T. H., Godsekesen, M., Gram-Hanssen, K., Quitzau, M. & Ropke, I. (2007) Greening the Danes? Experience with consumption and environmental policies, *Journal of Consumer Policy*, 30, 91-116.
- Christie, L., Donn, M. & Walton, D. (2011) The 'apparent disconnect' towards the adoption of energy-efficiency technologies, *Building Research & Information*, 39(5), 450-458.
- Committee on Climate Change (2013) *Meeting Carbon Budgets - 2013 Progress Report to Parliament*. http://www.theccc.org.uk/wp-content/uploads/2013/06/CCC-Prog-Rep-Book_singles_web_1.pdf. Accessed on 28 August 2013
- Crosbie, T. & Baker, K. (2010) Energy-efficiency interventions in housing: learning from the inhabitants, *Building Research & Information*, 38(1), 70-79.
- Darby, S. (2010) Smart Metering: what potential for householder engagement? *Building Research and Information*, 38(5), 442-457.
- Darnton, A. (2008) *A Overview of Behaviour Change Models and their Uses*, GSR Behaviour Change Knowledge Review, Available at: http://www.civilservice.gov.uk/wpcontent/uploads/2011/09/Behaviour_change_reference_report_tcm6-9697.pdf Accessed on: 27.02.12
- Darnton, A, Verplanken, B, White, P and Whitmarsh, L (2011). *Habits, Routines and Sustainable Lifestyles: A summary report to the Department for Environment, Food and Rural Affairs*. AD Research & Analysis for Defra, London. Available at <http://randd.defra.gov.uk/Default.aspx?Menu=Menu&Module=More&Location=None&Completed=0&ProjectID=16189> Accessed 28/08/13.

- Davoudi, S. (2012) Climate risk and security; New meanings of 'the environment' in the English planning system, *European Planning Studies*, 20(1): 49-69
- Davoudi, S. (2014) Climate Change, securitisation of nature and resilient urbanism, *Environment and Planning C*, 32(2):360-375
- Dawney, E. and Shah, H. (2005) *Extending the 'rational man' model of behaviour: seven key principles*, Briefing note for the Environment Agency by nef (New Economic Foundation), Bristol: The Environment Agency
- De Bondt, W.F.M (1998) 'A portrait of the individual investor', *European Economic Review*, 42 (3-5), pp.831-44.
- DECC (Department of Energy and Climate Change) (2013) *Energy Consumption in the UK*, <https://www.gov.uk/government/publications/energy-consumption-in-the-uk> Accessed 28 August 2013
- Defra (Department of Environment, Food and Rural Affairs) (2008) *A Framework for Pro-Environmental Behaviours: Report*, London: Defra, Available at: <http://www.defra.gov.uk/publications/files/pb13574-behaviours-report-080110.pdf> Accessed on 27.02.12
- DECC/Defra (2009) *Making the Right Choices for Our Future*, Available at: <http://archive.defra.gov.uk/evidence/series/documents/economicframework-0309.pdf> Accessed: 05.02.12
- De Young, R. (2000) Expanding and Evaluating Motives for Environmentally Responsible Behaviour, *Journal of Social Issues*, 56(3), 509-526.
- Dono, L. & Webb, J. & Richardson, B. (2010) The relationship between environmental activism, pro-environmental behaviour and social identity, *Journal of Environmental Psychology*, 30, 178-186.

- Evans, D. (2007) *Attitudes, Values and Culture: Qualitative Approaches to 'Values' as an Empirical Category*, RESOLVE Working Paper 04-07.
- Fenton-O'Creevy, M., Nicholson, N., Soane, E. and Willman, P. (2003) 'Trading on illusions: Unrealistic perceptions of control and trading performance', *Journal of Occupational and Organisational Psychology*, 76, 53–68.
- Fischer, C. (2008) Feedback on household electricity consumption: a tool for saving energy, *Energy Efficiency*, 1, 79-104.
- Fiske, S. and Taylor, S. (1991) *Social Cognition*, 2nd edn, Columbus, OH, McGraw-Hill.
- GfK NOP Social Research (2012) *Low Carbon Communities Challenge Baseline Research Mini Report, Totnes*. Available at <http://www.transitiontogether.org.uk/wpcontent/uploads/2012/07/LCCCBaselineResearchMiniReport%E2%80%93Totnes.pdf>. Accessed 05/09/13.
- Gigerenzer, G., Todd, P.M. and the ABC Research Group (1999) *Simple Heuristics that Make Us Smart*, Oxford, Oxford University Press.
- Gilg, A., Barr, S. & Ford, N. (2005) Green consumption or sustainable lifestyles? Identifying the sustainable consumer, *Futures*, 37, 481-504.
- Gill, Z. M., Tierney, M. J., Pegg, I. M. & Allan, N. (2010) Low-energy dwellings: the contribution of behaviours to actual performance, *Building Research & Information*, 38(5), 491-508.
- Gram-Hanssen, K., Bartiaux, F., Jesen, O. M. & Cantaert, M. (2007) Do homeowners use energy labels? A comparison between Denmark and Belgium, *Energy Policy*, 35, 2879-2888.
- Greening, L. A., Greene, D. L. & Difiglio, C. (2000) Energy efficiency and consumption – the rebound effect – a survey, *Energy Policy*, 28, 389-401.

- Gronhoj, A. & Thøgersen, J. (2011) Feedback on household electricity consumption: learning and social influence processes, *International Journal of Consumer Studies*, 35, 138-145.
- Gyberg, P. & Palm, J. (2009) Influencing households' energy behaviour-how is it done and on what premise?, *Energy Policy*, 37, 2807-2813.
- Hargreaves, T., Nye, M. & Burgess, J. (2010) Making Energy Visible: A qualitative field study of how householders interact with feedback from smart energy monitors, *Energy Policy*, 38, 6111-6119.
- Harland, P., Staats, H. & Wilkie, H.A.M. (1999) Explaining Pro-environmental Intention and Behaviour by Personal Norms and Theory of Planned Behaviour, *Journal of Applied Psychology*, 29(12), 2505-2528.
- Heiskanen, E., Johnson, M., Robinson, S., Vadovics, E. & Saastamoinen, M. (2010) Low-carbon communities as a context for individual behaviour change, *Energy Policy*, 38, 7586-7595.
- Jackson, T. (2005) *Motivating Sustainable Consumption: a review of evidence on consumer behaviour and behavioural change*, Report to the Sustainable Development Research Network, Available at: http://www.sd-research.org.uk/wp-content/uploads/motivatingfinal_000.pdf
Accessed: 27.02.12
- Jackson, T. (2009) *Prosperity without growth? The Transition to a sustainable economy*, London: Sustainable Development Commission
- Jenkins, D.P. (2010) The value of retro-fitting carbon-saving measures into fuel poor social housing, *Energy Policy*, 38: 832-839.
- Kahneman, D. and Tversky, A. (1979) 'Prospect theory: an analysis of decision under risk', *Econometrica*, 47: 263-91.

- Layard, R. (2005) *Happiness: Lessons from a New Science*, Penguin Press, HC
- Lindenberg, S. & Steg, L. (2007) Normative, Gain and Hedonic Goal Frames Guiding Environmental Behaviour, *Journal of Social Issues*, 63(1): 117-137.
- Lomas, K.J. (2010) Carbon reduction in existing buildings: a transdisciplinary approach, *Building Research & Information*, 38(1): 1-11.
- Lorenzoni, I., Nicholson-Cole, S. & Whitmarsh, L. (2007) Barriers perceived to engaging with climate change among the UK public and their policy implications, *Global Environmental Change*, 17: 445-459.
- Lucas, K., Brooks, M., Darnton, A. & Jones, J. E. (2008) Promoting pro-environmental behaviour: existing evidence and policy implications, *Environmental Science & Policy*, 11: 456-466.
- McKenzie-Mohr, D. (2000) Promoting Sustainable Behaviour: An Introduction to Community-Based Social Marketing. *Journal of Social Issues*, 56(3), 543-554.
- Nicholson, N. (2000) *Managing the Human Animal*, London: Texere
- Nisbett, R.E. and Ross, L. (1980) *Human inference: strategies and shortcomings of social judgement*, Prentice Hall: Englewood Cliffs, NJ
- Nolan, J. M., Schultz, P. W., Ciadini, R. B., Goldstein, N. J. & Griskevicius, V. (2008) Normative Social Influence is Under-detected, *Personality and Social Psychology Bulletin*, 34(7): 913-923.
- Nye, M. & Burgess, J. (2008) *Promoting Durable Change in Household Waste and Energy Use Behaviour: A technical Report for the Department for Environment, Food and Rural Affairs*, University of East Anglia, London Defra

- Parag, Y. & Darby, S. (2009) Consumer-supplier-government triangular relations: Rethinking the UK policy path for carbon emissions reduction from the UK, *Energy Policy*, 37: 3894-3992.
- Pierce, J., Fan, C., Lomas, D., Marcu, G. & Paulos, E. (2010) *Some considerations on the (in)effectiveness of residential energy feedback systems*, DIS 2010, August 16-20, 2010, Aarhus, Denmark, Available at: http://www.jamesjpierce.com/publications/pierce-ineffectiveness_of_energy_feedback.pdf Accessed on: 27.02.12
- Rutledge, R.W. (1993) 'The effects of group decisions and group-shifts on use of the anchoring and adjustment heuristic', *Social Behavior and Personality*, 21, 215-26
- Shove, E. (2010) Beyond the ABC: climate change policies and theories of social change, *Environment and Planning A*, 42, 1273-1285.
- Simon, H. (1957) *Models of Man*, New York, Wiley.
- Sorrel, S., Dimitropoulos, J. & Sommerville, M. (2009) Empirical estimates of the direct rebound effect: A review, *Energy Policy*, 37, 1356-1371.
- Staats, H., Harland, P. & Wilkie, H. A. M. (2004) Effecting Durable Change: A Team Approach to Improve Environmental Behaviour in the Household, *Environment and Behaviour*, 36(3), 341-367.
- Stephenson, J., Barton, B., Carrington, G. Gnoth, D., Lawson, R. & Thorsnes, P. (2010) Energy cultures: A framework for understanding energy behaviours, *Energy Policy*, 38, 6120-6129.
- Stern, N. (2000) Towards a Coherent Theory of Environmentally Significant Behaviour, *Journal of Social Issues*, 56(3), 407-424.

- Stern, N. (2007) *The Economics of Climate Change: Report to The Treasury*, Cambridge University Press: Cambridge. Available at: http://webarchive.nationalarchives.gov.uk/+http://www.hm-treasury.gov.uk/stern_review_report.htm Accessed: 27.02.12
- Summerfield, A. J. Pathan, A., Lowe, R. J. & Oreszczyn, T. (2010) Changes in energy demand from low-energy homes, *Building Research & Information*, 38(5), 42-49.
- Tetlock, P.E. (1991) 'An alternative metaphor in the study of judgement and choice: people as politicians', *Theory and Psychology*, 1 (4): 451-75.
- Thaler, R. H. & Sunstein, C. R. (2008) *Nudge: Improving decisions about health, wealth and happiness*, London: Penguin Books.
- Turaga, R. M. R., Howarth, R. B. & Borsuk, M. (2010) Pro-Environmental Behaviour: Rational Choice meets moral motivation, *Annals of the New York Academy of Sciences*, 1185, 211-224.
- Vale B. & Vale, R. (2010) Domestic energy use, lifestyles and POE: past lessons for current problems, *Building Research & Information*, 38(5), 578-588.
- van Dam, S.S., Bakker, C.A. & van Hall, J.D.M. (2010) Home energy monitors: impact over the medium-term, *Building Research & Information*, 38(5), 458-469.
- Walker, G. & Cass, N. (2007) Carbon Reduction, 'the public' and renewable energy: engaging with socio-technical configurations, *Area*, 39(4), 458-469.
- Whitmarsh, L. Seyfang, G. & O'Neil, S. (2011) Public Engagement with carbon and climate change: To what extent is the public 'carbon capable'?, *Global Environmental Change*, 21, 56-65.

Wilson, C. & Dowlatabi, H. (2007) Models of Decision Making and Residential Energy Use, *The Annual Review of Environment and Resources*, 32, 169-203.