



# How to change attitudes and behaviours in the context of energy <sup>☆</sup>

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## ABSTRACT

It is commonly assumed that attitudes and behaviours need to be modified to secure a sustainable energy future. This paper examines insights from the social sciences in this extensive field. Alongside instruments such as regulation and economic measures, government campaigns have sought to 'educate' the public. However, such 'information deficit' models have been criticised on theoretical and pragmatic grounds. In the area of energy consumption, there is a need to take account of the physical, social, cultural and institutional contexts that shape and constrain people's choices, and for a richer understanding of opposition to energy facility siting, which has often been (inadequately) characterised as 'NIMBYism'. Recent work also points to the need for more deliberation and better communication between decision-makers, technical experts, other stakeholders and the public. Predicting future developments in the field is challenging but attention is likely to focus on aspects of policy learning, a more critical examination of the 'deliberative turn', and the need for a systemic approach to complex socio-economic and socio-technical systems. The consistency of government objectives across all policy spheres is likely to provide an important avenue for future research.

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## 1. Introduction

The question suggested by the title of this paper is a normative one. It implies that attitudes and behaviours in the context of energy need to change, and that there exist pre-determined goals around which modified attitudes and behaviours should be shaped. One important insight from social scientific research—to which we return below—is that such goals may not in fact be consensual. For now, however, we note the commonplace assumption that attitudes and behaviours need to be modified in order (i) to manage demand and achieve step-changes in energy efficiency, and (ii) to secure a sustainable energy supply for the future, involving the siting of new facilities. The object of this paper is to consider what social science can tell us about these issues and how current knowledge is most likely to evolve.

This is potentially a vast field. Social scientists have long been interested in attitudes and behaviours, and insights from across the social sciences have increasingly been applied to a range of energy and environmental issues. Given limited space, it is necessary to be selective. We therefore focus on public (rather

than corporate) attitudes and behaviours, and on two areas in which these are significant: that of energy consumption, drawing examples from both the domestic and personal transport sectors; and that of siting issues, considering both established and novel technologies. In looking to the future, we characterise eight themes around which social scientific work in this area is likely to develop.

## 2. Attitudes and behaviours in the context of energy: insights from social science

It is often offered as a paradox that apparently pro-environmental attitudes (expressed, for example, in surveys or in focus groups) are not reflected in significant shifts in behaviour; or that attitudes held by individuals are apparently inconsistent. This should not be surprising, given the complexity of attitudes, behaviours and the relationship between the two, as revealed by a substantial body of research in social psychology (for a review, see Jackson, 2005). Furthermore, behavioural change can sometimes be effected without an explicit change in attitudes, through regulation or through economic instruments such as pricing, taxation and incentives.<sup>1</sup> There are acknowledged political risks, however, in pursuing such strategies in isolation.

<sup>☆</sup> While the Government Office for Science commissioned this review, the views are those of the author(s), are independent of Government, and do not constitute Government policy.

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<sup>1</sup> Attitudinal change might follow from such measures, although coercion when not accompanied by public support or acceptance might have a hardening effect.

This probably explains the persistent emphasis in policy discourse on awareness-raising and education. Government campaigns in the energy and environmental fields have often been predicated on a rationalist ‘information deficit model’ (see Burgess et al., 1998), which assumes that “environmental education, drawing from scientific work, will lead to people making the link between policy and action, and acting in order to meet policy objectives” (Eden, 1996). This assumption has not been borne out in practice. Providing information may in some circumstances influence attitudes on issues like energy and the environment, but “often has little or no impact on behaviour” (McKenzie-Mohr, 2000). Attitudes themselves are influenced by a variety of social, political and cultural factors aside from information provision.<sup>2</sup>

The information deficit model has been widely criticised in the academic literature, both on epistemic grounds (the ‘facts’ may be contested and the problem framed<sup>3</sup> in different ways) and for its failure to take account of the social, cultural and institutional contexts in which attitudes and behaviours are formed.

### 2.1. Energy demand and energy efficiency

Interesting examples can be found in the field of domestic energy consumption where, in spite of successive campaigns,<sup>4</sup> the take-up of energy efficiency measures has been disappointing and behaviours have often become *more* energy-intensive. The most familiar explanations rely on variants of market failure, including lack of information, but disciplines such as sociology, social psychology, human geography and anthropology are increasingly providing insights into patterns of energy consumption. Behaviour is shown to be influenced in complex ways by factors such as price, awareness, trust and commitment, including a sense of moral obligation (Devine-Wright and Devine-Wright, 2004).<sup>5</sup> Recent work has also drawn attention to the important influence of cultural norms, routine habits and practices, social networks<sup>6</sup> and fashion (for example, in domestic lighting<sup>7</sup>), and to the dynamic interplay of human agents and technologies in socio-technical systems.<sup>8</sup> For example, energy consumption depends on an “established infrastructure of taken-for-granted hardware or technological systems”, such as washing machines and showers, which structure patterns of daily life (Shove and Warde, 1998).

<sup>2</sup> For example, in a study into the findings of opinion polls on UK public attitudes to energy technologies, McGowan and Sauter (2005) explore how attitudes may also be influenced by proximity to energy generation site, potential differences between regions, political differences, age, gender and social class.

<sup>3</sup> Framing can be seen as “a way of selecting, organising, interpreting and making sense of a complex reality so as to provide guideposts for knowing, analysing, persuading and acting” (Rein and Schön, 1991). The concept of framing has become increasingly influential.

<sup>4</sup> For example, the “Save It” campaign in the mid-1970s, “Helping the Earth Begins at Home” in 1991, and “Are You Doing Your Bit?” launched in 1998 (for further discussion, see Owens, 2000; Hinchliffe, 1996). An important premise of the Climate Change Communication Initiative (“Tomorrow’s Climate; Today’s Challenge”), 2005–07 and “Act on CO<sub>2</sub>” (2007–), has been that “[i]ncreasing awareness and understanding of climate change is important if ultimately we are going to be able to change behaviours to tackle the problem”: <http://www.defra.gov.uk/environment/climatechange/uk/individual/comms/index.htm> (accessed 10 June 2008).

<sup>5</sup> People may also frame the problem in different ways—for example, in terms of the morality of human interference with the planet, rather than as a scientific issue. For an interesting discussion, see Thompson and Rayner (1998) and Thompson et al. (1998).

<sup>6</sup> For example, one Swiss study found that variables like interpersonal rules and social networks had more impact on the likelihood that someone would take environmental action than the availability of detailed scientific information (Jaeger et al., 1993).

<sup>7</sup> Lighting is used for many purposes other than straightforward illumination (see, for example, Wilhite, 1997).

<sup>8</sup> For an interesting discussion, see Lovell (2005).

It is also influenced by dominant conceptions of comfort, cleanliness and convenience, which become embedded in the built environment (Shove, 2003).

Similarly, exhortations that individuals should change their travel behaviour have overlooked important contextual constraints on the capacity for effective action. The physical and social structures of modern life (spatial separation of activities, cultural norms of mobility and consumption, choice in public services) make it difficult to act on the message that driving contributes to climate change, especially when price signals provide a powerful counter-incentive (Owens and Cowell, 2002).

In both contexts—domestic energy consumption and transport—individuals may perceive that they have “neither the prime responsibility to take action, nor the agency to have much effect” (Owens, 2000).<sup>9</sup> Paradoxically, research suggests that people see governments as responsible for addressing environmental problems, yet have little faith that they will (see Burgess et al., 1998; Blake, 1999; Bulkeley, 1999; Darier and Schüle, 1999; Eden, 1993). This might in part be because the messages that people receive from government are inconsistent. While low fuel prices are emphasised, and increases resisted, people are exhorted to change their behaviour. Building and planning regulations seek to reinforce the second message, but struggle to contend with the first.<sup>10</sup>

### 2.2. Facility siting and the acceptability of energy technologies

Public attitudes have come to be seen as crucial in the choice of energy futures. Attitudes to particular technologies as well as responses to specific development proposals have been of interest. Public fear and suspicion of nuclear and nuclear waste facilities has long been documented, though recent work suggests that the British public’s attitude towards new nuclear power stations might best be characterised as one of ambivalence, with ‘reluctant acceptance’ only in the face of climate change (Bickerstaff et al., 2008; see also Poortinga et al., 2006). In the case of renewable energy, a generally favourable public attitude often co-exists with resistance to specific developments,<sup>11</sup> articulated through planning or related processes and typically regarded as ‘NIMBYism’ (see, for example, Upham and Shackley, 2006; Wolsink, 2006). These issues are now the subject of an extensive literature. Here, we note three (interrelated) ways in which our understanding has been enhanced through social scientific research.<sup>12</sup>

First, this is another area in which the ‘information deficit’ model has demonstrably failed. Providing more information about the need for, or characteristics of, controversial developments has not notably delivered acquiescence on the part of local communities. On the contrary, it can fuel distrust (especially if information comes from developers) and further polarise

<sup>9</sup> Eden (1993) observes that responsibility is very much linked to likelihood of efficacy. Consequently, behaviour may be restricted by a sense of the futility of individual action. Jackson (2005) cites a study by Levin (1993) on the reaction to increasing levels of information about environmental problems, which “concluded that more information led to greater concern, but paradoxically also to greater helplessness”.

<sup>10</sup> For an analysis of mixed messages in the transport field, see Owens (1995, 1996).

<sup>11</sup> See, for example, Hagggett (2004), whose research specifically sought to bring together different social science disciplines to explore the nature and conceptualisations of the so-called ‘gap’. See also Department for Business and Enterprise and Regulatory Reform (2007). For an analysis of opposition to windfarms from different methodological perspectives, see Hagggett and Toke (2006).

<sup>12</sup> These issues are not new. Energy-related siting conflicts in the 1960s were among those documented in Gregory (1971). Pressure to develop Britain’s indigenous energy resources in the 1970s and 1980s resulted in many planning conflicts; see Owens (1985a, b).

opinions. When key considerations such as need, impacts, risks and economics are genuinely contested, 'providing the facts' is problematic. Instead, information will be interpreted in the light of pre-existing frames.<sup>13</sup> A lack of timely communication and consultation, however, is likely to make matters even worse.<sup>14</sup>

Second, what is often dismissed as NIMBYism has been shown in much recent research to be a more complex and multi-faceted phenomenon, of which 'pure' NIMBYism forms only one component.<sup>15</sup> According to one study on the nature of resistance to wind power in the UK, the term "is an opinion poll perpetuated myth, unhelpful in understanding the wider environmental debate, derogatory to those who are labelled by it and misleading in its simplistic stereotyping" (Ellis et al., 2006). In the case of nuclear facilities, similar findings have been reinforced by increasingly sophisticated understandings of risk, in which the old dichotomy between 'objective' and 'perceived' risk has been substantially discredited.<sup>16</sup>

Third, the familiar characterisation of siting controversies as conflicts between national need and local interests has been shown to be misleading. Rather, questions about the desirability of technologies *in principle* become entangled with issues that relate to specific localities. This calls into question the assumption that 'generic' and 'local' issues can readily be separated, and suggests that institutions like public inquiries, rather than being 'streamlined' should be seen as important arenas for public deliberation and for scrutiny of energy policy. These arguments are set out in more detail in Owens (2002, 2004).

These new understandings have had some influence, for example, in the recent consultative and deliberative exercises run by the Committee on Radioactive Waste Management ([www.corwm.org.uk/](http://www.corwm.org.uk/)). Research also suggests that a degree of 'ownership' of energy facilities in local communities may positively influence people's attitudes towards them (Devine-Wright, 2005a, b; see also Haggett, 2004; and the findings from an ESRC project on community energy initiatives: <http://geography.lancs.ac.uk/cej/CommunityEnergyKeyPublications.htm> (accessed 11 June 2008)), though support can still co-exist with opposition and distrust (Upham and Shackley, 2006). The interesting question, then, is not "how can we change public attitudes", but how we can plan and move forward in the face of what are likely to remain intractable controversies (Schön and Rein, 1994).

It should be noted that some emergent technologies have not yet been manifest in developments 'on the ground'; their implications may still seem remote, and public acceptability is less well researched. One project working with citizen panels found a marginally positive attitude developing towards carbon capture and storage, with several provisos. Support was dependent on concern about climate change and a conviction that CO<sub>2</sub>

emissions needed to be reduced. And, as with nuclear power, carbon sequestration found favour only as part of a wider strategy including renewables, efficiency improvements and lifestyle changes (Shackley et al., 2005).<sup>17</sup> In other cases—for example, hydrogen energy—relatively little is known about public attitudes and how they are likely to develop (for a discussion of public attitudes and risk in this context, see Flynn et al., 2006).

### 3. The current 'state of science': key themes

The following key messages can be drawn from the above review:

1. Attitudes and behaviours are complex. A thorough, interdisciplinary, understanding is a pre-requisite for any strategy aimed at change.
2. Regulation, economic instruments and provision of information have all been used in attempts to modify attitudes and/or behaviours.
3. Physical, social, cultural and institutional contexts shape and constrain people's choices and options. Recent work has contributed significantly towards an understanding of these influences.
4. Technical infrastructures and social norms interact to affect behaviour over time. Both may be resistant to change.
5. The instinct to target attitudes and behaviours through education and awareness-raising remains strong. But information is unlikely to be effective if it runs counter to other powerful influences, such as social norms or prices. This is not to suggest that information is dispensable, but that it should be part of a wider strategy, will not necessarily be neutral, and should flow in more than one direction (see 7 below).
6. Conflicts over energy facilities are often of the kind that cannot be resolved simply by recourse to 'the facts'. Opposition to particular technologies, or specific sites, is not necessarily irrational, and is not adequately characterised as NIMBYism.
7. Much recent work concerned with attitudes and behaviours points to the need for more interactive, deliberative communication between decision-makers, technical experts, other stakeholders and the public.<sup>18</sup> This has considerable significance both for demand management (which, according to some commentators, should evolve into 'demand side participation' (Devine-Wright and Devine-Wright, 2004)) and for ways in which energy is supplied.

### 4. Future developments

Looking towards future developments across such a broad field is immensely challenging. One important observation is that the evolution of social scientific understanding of attitudes and behaviours in the energy context (and in relation to the environment and sustainable development more generally) has been rapid over the past few years, and this is reflected in substantial investment in research, which we might expect to bear fruit in the coming decades. The appendix outlines some

<sup>13</sup> So, for example, some opponents of a biomass plant in Devon, UK simply refused to accept information (based on life-cycle analysis) about the plant's CO<sub>2</sub> mitigation benefits, suggesting "a mindset in which many of the developer's technical claims have come to be seen as dubious" (see Upham and Shackley, 2006). On the issue of trust, see also Sinclair and Löfstedt (2001).

<sup>14</sup> As has been recognised in guidance to local planning authorities (Office of the Deputy Prime Minister (ODPM), 2004). For an interesting discussion, see Upham and Shackley (2006).

<sup>15</sup> Devine-Wright (2005a) provides a critical overview of research into so-called NIMBYism in the context of wind energy. See also Wolsink (2006), Freudenburg and Pastor (1992), and Kemp (1990). An ESRC-funded Priority Network has explored public responses and resistance to a range of new energy technologies: "Beyond NIMBYism: A Multi-disciplinary Investigation of Public Engagement with Renewable Energy Technologies" (Award no.: RES-152-25-1008; award holder P. Devine-Wright; [http://www.sed.manchester.ac.uk/research/beyond\\_nimbyism/](http://www.sed.manchester.ac.uk/research/beyond_nimbyism/) (accessed 9 June 2008)).

<sup>16</sup> There is an extensive literature on this issue. See, for example, Adams (1995), Jasanoff (2006), Slovic (1993), and Thompson and Dean (1996).

<sup>17</sup> Interestingly, slightly negative attitudes changed into slightly positive ones after people had had the opportunity to cross-examine an expert in the field. The project also involved a survey.

<sup>18</sup> A variety of rationales lies behind the advocacy of public participation. Stirling (2004), for example, suggests a three-fold typology: normative (participation in itself is right); instrumental (it is a more effective way of achieving particular outcomes); and substantive (it leads to 'better' ends). See also Pelletier et al. (1999).

relevant UK Research Council initiatives. Bearing this in mind, we now consider potentially important developments, and in doing so highlight a number of tensions.

#### 4.1. *Knowing about attitudes and behaviours*

We might expect techniques for eliciting and understanding public attitudes and behaviours to become more sophisticated. For example, the traditional opinion poll and other forms of survey could be transformed by technological developments, while more deliberative approaches may be refined and less familiar methodologies such as Q-methodology<sup>19</sup> further developed. Overall, we might expect to get a better picture of both attitudes and behaviours.

#### 4.2. *New disciplinary insights and more sophisticated concepts of interdisciplinarity*

Within the social sciences, important insights into attitudes and behaviours are emerging from such areas as anthropology, economics, human geography, politics, social psychology, and sociology. These insights are likely to be further developed, with the potential to make a substantial contribution to policy formulation and implementation. The concept of interdisciplinarity—much invoked in the energy and environmental fields—is itself likely to be subjected to more critical analysis and scrutiny. The division of labour implicit in many calls for interdisciplinary work—in which the natural and technical sciences define the problems and potential solutions and the social sciences (sometimes with the exception of economics) are treated as an ‘add on’—might give way to more genuine and productive dialogue and learning between disciplines (Petts et al., 2008). Socio-technical systems are likely to become a more important category for analysis.

#### 4.3. *Dealing with complexity*

More nuanced understandings emerging from new disciplinary and interdisciplinary contributions will present policy makers with greater complexity in their attempts to influence attitudes and behaviours. The virtue of traditional approaches, such as the ‘information deficit’ model, was that they pointed to relatively simple solutions (public education campaigns, for example) which, to borrow Fisher’s term, were ‘yesable’ (Fisher, 1971). Recognising the complexity of factors involved, on the other hand, makes it harder to identify appropriate policy levers. More attention is likely to be focused on aspects of policy learning.

#### 4.4. *Reconceiving the role of the public and consumers*

One of the most substantive shifts across the social sciences over the past two decades has been the growing emphasis on deliberation, often associated with more inclusive participation. Public engagement, involving (at least) a two-way flow of knowledge, has been held to be more fruitful than top-down communication, which treats the public as passive recipients. Roles and responsibilities of the public and consumers might also be reconceived in the light of demand- and

supply-side developments such as ‘smart metering’ and micro- or community-scale generation (Devine-Wright and Devine-Wright, 2004, 2006; see also Marvin et al., 1999<sup>20</sup>). We may start to think, for example, in terms of ‘energy citizens’ (Devine-Wright, 2006) or ‘energy co-providers’ (Van Vliet, 2004).

#### 4.5. *The deliberative turn challenged?*

It is ironic that, just as numerous organisations are acknowledging the importance of deliberation and seeking to put it into practice, a critique of the ‘deliberative turn’ is emerging.<sup>21</sup> This critical literature is likely to develop rapidly, exploring issues of democracy, discursive competence (Foster, 1997) and practicality. The result may be more targeted approaches, which depend on the specific issue in question, and which do not assume that deliberation will resolve all conflicts. Questions of citizenship and democratic accountability in complex, technological societies are likely to command increasing attention in both research and policy.

#### 4.6. *Avoiding mixed messages*

A significant contribution of much recent work has been a better understanding of the social context for individual behaviour and a recognition that changing both attitudes and behaviours requires much more than exhortation and the provision of information. We also know that mixed messages—as when people are urged to do one thing but price signals and the constraints of everyday life point to another—can lead to confusion, resentment or hostility. This points to the need for coherence and consistency in policy instruments because “the greatest degree of behaviour change occurs when different strategies combine” (Gardner and Stern, 1996; these authors provide a useful discussion, with North American examples, of what they call ‘combining the solution strategies’). The combination of incentives, regulation, information and public engagement should be sensitive to the (often context-specific) factors that inhibit behavioural change.<sup>22</sup> Further interdisciplinary works, together with experiments in practice, are likely to improve our understanding of the ways in which different instruments can work together to achieve particular objectives.

#### 4.7. *The need for a systemic approach*

Policy levers applied to complex socio-economic systems often have less impact than anticipated, and sometimes they have unintended or even perverse consequences. So, for example, energy efficiency improvements may not be reflected in energy conservation because people consume more of the goods concerned (bigger cars and fridges, for example); or savings in one area might be spent in another (perhaps on cheap flights). This so-called ‘rebound effect’ has been the subject of much discussion and dispute (Cambridge Centre for Climate Change Mitigation Research (4CMR) with Cambridge Econometrics Ltd and Policy Studies Institute and Herring, 2006; Sorrell, 2007). Further

<sup>19</sup> Q-methodology is an analytic tool for policy analysis, allowing for the empirical study of human subjectivity. For a methodological overview, see Durning (1999). For empirical applications of Q-methodology, see Pelletier et al. (1999) and Webler et al. (2001). An interesting application in the present context is the study by Ellis et al. (2006) of objections to a windfarm development in Northern Ireland.

<sup>20</sup> Marvin et al. (1999) consider utility meters as socio-technical systems.

<sup>21</sup> See Owens (2000) for an overview; see also Sanders (1997) and Pellizzoni (2001) for interesting discussion.

<sup>22</sup> Gardner and Stern (1996) and McKenzie-Mohr (2000) offer an approach—‘community-based social marketing’—that merges insights from psychology with expertise from social marketing.

research is likely to help to clarify the implications for energy efficiency policy.

#### 4.8. Confusion of objectives

Implicit in much of the academic and policy discourse on changing attitudes and behaviours is the assumption that we know what we want to change them *to*. In some cases (for example, ‘reducing wasteful energy consumption’), there may be little dissent, but other objectives, such as ‘making nuclear installations (or wind farms, or whatever) more acceptable’ will continue to be contentious. Government itself may be deeply ambivalent about some objectives, such as lowering levels of material consumption. In this sense, a growing interest in the relationship between well-being, material consumption and gross domestic product seems likely to provide an important new avenue for research, with significant implications for the potential to influence attitudes and behaviours in the context of energy.

Finally, it is worth bearing in mind that, while they may seem relatively stable at any particular moment, attitudes and behaviours do change—and change quite radically—over time. Understanding this process, too, will be an important consideration in the shift towards a more sustainable energy economy.

### Appendix A. Research centres, programmes and projects with relevance to energy policy

Below are examples of UK initiatives, centres, programmes and projects in the energy field which include a social science dimension. The aim here is to be illustrative rather than exhaustive.

Defra: Department for Environment, Food and Rural Affairs, EPSRC: Engineering and Physical Sciences Research Council, ESRC: Economic and Social Research Council, NERC: Natural Environment Research Council.

#### A.1. Cross-research council initiatives

- Tyndall Centre for Climate Change Research (NERC, EPSRC, ESRC) (ESRC funding, £1.25 million) (2000–2005): <http://www.tyndall.ac.uk/>.
- UK Energy Research Centre, part of the £28 million towards a Sustainable Energy Economy Programme (NERC, EPSRC, ESRC) (2004–2009): <http://www.ukerc.ac.uk/>; see also the SUPERGEN Programme, supporting research into sustainable power generation and supply: <http://www.epsrc.ac.uk/ResearchFunding/Programmes/Energy/Funding/SUPERGEN>.
- Carbon Vision Initiative (EPSRC and Carbon Trust, with contributions from ESRC and NERC) (see <http://www.carb.org.uk/> for information about a socio-technical, longitudinal study of carbon use in buildings).
- Living with Environmental Change (16 funding partners from across the Research Councils and Government) aims to speed the development of the interdisciplinary evidence base, tools and processes that are needed to inform public and policy debates and people’s choices about mitigation, management and adaptation options and opportunities: <http://www.nerc.ac.uk/research/programmes/lwec/>.
- Interdisciplinary Early Career Fellowships (ESRC and EPSRC, 2007–)—three Energy Fellows funded looking at: domestic energy use; the implications of climatic changes in the Arctic

for UK energy security; and co-design methodologies to encourage sustainable behaviour in schools.

#### A.2. ESRC and collaborative research centres

*Note:* Energy issues are not necessarily the prime focus of research at these centres, but all host (or will host) work that is of relevance to energy.

- Centre for Climate Change Economics and Policy (October 2008–): <http://www.lse.ac.uk/collections/pressAndInformationOffice/newsAndEvents/archives/2008/climatechange.htm>.
- Centre for Social and Economic Research on the Global Environment (CSERGE) (UEA): <http://www.uea.ac.uk/env/cserge/> (ESRC funding now ended).
- Centre for Business Relationships, Accountability, Sustainability and Society (BRASS) (Cardiff University): <http://www.brass.cf.ac.uk/projects/>.
- Centre for Competition Policy (UEA) (initiated autumn 2004): <http://www.ccp.uea.ac.uk/>.
- Potential Centre on Sustainable Behaviours: ESRC/Defra with devolved administrations and Environment Agency (being commissioned at the time of writing).
- Potential Transport Research Centre: ESRC/Department for Transport with Scottish Executive, other Research Councils and others (being commissioned at the time of writing).

#### A.3. ESRC research groups

Funded under the £28 million Towards a Sustainable Energy Economy Programme (NERC, EPSRC, ESRC):

- Sussex Energy Group (University of Sussex): <http://www.sussex.ac.uk/sussexenergygroup/>.
- Electricity Policy Research Group (University of Cambridge) <http://www.electricitypolicy.org.uk/>.
- Research Group on Lifestyles, Values and Environment (RESOLVE) (University of Surrey): <http://www.surrey.ac.uk/resolve/>.

#### A.4. ESRC research programmes

The ESRC’s *Sustainable Technologies Programme* (£3 million, 2002–2007, completed) was aimed at innovative and policy-relevant research on the social and economic processes that shape, foster or inhibit more sustainable technologies: <http://www.sustainabletechnologies.ac.uk/>. Projects included (details at <http://www.sustainabletechnologies.ac.uk/projects.htm>):

- diffusion of alternative technologies (wind energy and eco-housing comprise two of three case studies examined),
- wind energy—planning process,
- fuel cells—innovation, adoption and use,
- low carbon technologies innovation policy (electricity generation comprises one of two case-study areas),
- household energy consumption (domestic appliances),
- oil and gas—measuring sustainability (ESRC contribution to link project),
- regulation, markets and development of renewable energy technologies (fellowship),
- integrating micro-generation in networks and buildings,
- innovation systems in renewables,

- community energy initiatives,
- social psychology of sustainable consumption (fellowship).

*Environment and Human Behaviour Programme* (completed): <http://www.psi.org.uk/ehb/>. Projects included (details at <http://www.psi.org.uk/ehb/projectlist.html>):

- taxation futures for sustainable mobility,
- wind energy—public attitudes,
- future comforts: reconditioning urban environments,
- climate change and fuel poverty,
- predicting thresholds of social behavioural responses to rapid climate change.

#### A.5. Other ESRC initiatives

Leadership Fellowships in Climate Change (2008–).

#### A.6. Responsive mode funding

A number of projects with relevance for attitudes and behaviour in the context of energy have also been supported under the ESRC's responsive mode funding.

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### References

- Adams, J., 1995. Risk. UCL, London.
- Bickerstaff, K., Lorenzoni, I., Pidgeon, N.F., Poortinga, W., Simmons, P., 2008. Reframing nuclear power in the UK energy debate: nuclear power, climate change mitigation and radioactive waste. *Public Understanding of Science* 17, 145–168.
- Blake, J., 1999. Overcoming the 'value-action gap' in environmental policy: tensions between national policy and local experience. *Local Environment* 4 (3), 257–278.
- Bulkeley, H., 1999. Valuing the global environment: publics, politics and participation. Unpublished Ph.D. Thesis, University of Cambridge, Department of Geography.
- Burgess, J., Harrison, C., Filius, P., 1998. Environmental communication and the cultural politics of environmental citizenship. *Environment and Planning A* 30 (1), 1445–1460.
- Cambridge Centre for Climate Change Mitigation Research (4CMR) with Cambridge Econometrics Ltd, Policy Studies Institute and Herring, H., 2006. The Macro-Economic Rebound Effect and the UK Economy, Final Report to Defra: <[http://www.defra.gov.uk/science/project\\_data/DocumentLibrary/EE01015/EE01015\\_3554\\_FRP.pdf](http://www.defra.gov.uk/science/project_data/DocumentLibrary/EE01015/EE01015_3554_FRP.pdf)>.
- Darier, E., Schüle, R., 1999. Think globally, act locally? Climate change and public participation in Manchester and Frankfurt. *Local Environment* 4 (3), 317–330.
- Department for Business, Enterprise and Regulatory Reform, 2007. Renewable Energy Awareness and Attitudes Research. Management Summary, URN 07/706, provided by GfK NOP Social Research: <<http://www.berr.gov.uk/files/file41239.pdf>> (accessed 10 June 2008).
- Devine-Wright, P., 2005a. Beyond NIMBYism: towards an integrated framework for understanding public perceptions of wind energy. *Wind Energy* 7, 125–139.
- Devine-Wright, P., 2005b. Local aspects of UK renewable energy development: exploring public beliefs and policy implications. *Local Environment* 10 (1), 57–69.
- Devine-Wright, P., 2006. Energy citizenship: psychological aspects of evolution in sustainable energy technologies. In: Murphy, J. (Ed.), *Governance of Sustainable Technologies*. Earthscan, London.
- Devine-Wright, H., Devine-Wright, P., 2004. From demand side management to demand side participation: towards an environmental psychology of sustainable electricity system evolution. *Journal of Applied Psychology* 6 (3–4), 167–177.
- Devine-Wright, H., Devine-Wright, P., 2006. Prospects for smart metering in the UK. In: Jamasb, T., Pollitt, M., Nuttall, W. (Eds.), *Future Electricity Technologies and Systems*. Cambridge University Press, Cambridge.
- Durning, D., 1999. The transition from traditional to post-positivist policy analysis: a role for Q-methodology. *Journal of Policy Analysis and Management* 18 (3), 389–410.
- Eden, S., 1993. Individual environmental responsibility and its role in public environmentalism. *Environment and Planning A* 25 (12), 1743–1758.
- Eden, S., 1996. Public participation in environmental policy: considering scientific, counter-scientific and non-scientific contributions. *Public Understanding of Science* 5, 183–203.
- Ellis, G., Barry, J., Robinson, C., 2006. Renewable energy and discourses of objection: towards deliberative policy making. Summary of main research findings. Queen's University Belfast (ESRC Grant reference: 000-22-1095): <<http://www.qub.ac.uk/researchcentres/REDOWelcome/filestore/Filetoupload,31634,en.pdf>> (accessed 17 May 2008).
- Fisher, R., 1971. *Basic Negotiating Strategy: International Conflict for Beginners*. Penguin, London.
- Flynn, R., Bellaby, P., Ricci, M., 2006. Risk perception of an emergent technology: the case of hydrogen energy. *Forum: Qualitative Social Research*, 7, 1, Article 19: <<http://www.qualitative-research.net/fqs-texte/1-06/06-1-19-e.htm>> (accessed 17 May 2008).
- Foster, J., 1997. Environment and creative value. In: Foster, J. (Ed.), *Valuing Nature? Economics, Ethics and Environment*. Routledge, London.
- Freudenburg, W., Pastor, S., 1992. NIMBYs and LULUs: stalking the syndromes. *Journal of Social Issues* 48 (4), 39–61.
- Gardner, G., Stern, P.C., 1996. *Environmental Problems and Human Behavior*. Pearson Custom Publishing, Boston, MA.
- Gregory, R., 1971. *The Price of Amenity: Five Studies in Conservation and Government*. Macmillan, London.
- Haggett, C., 2004. Tilting at windmills? The attitude-behaviour gap in renewable energy conflicts. Final Report of ESRC Environment and Behaviour Programme Project (accessed 10 June 2008): <<http://www.psi.org.uk/ehb/docs/finalreport-Haggett.pdf>>.
- Haggett, C., Toke, D., 2006. Crossing the great divide: using multi-method analysis to understand opposition to windfarms. *Public Administration* 84 (1), 103–120.
- Hinchliffe, S., 1996. Helping the earth begin at home: the social construction of socio-environmental responsibilities. *Global Environmental Change* 6 (1), 53–62.
- Jackson, T., 2005. Motivating sustainable consumption: a review of evidence on consumer behaviour and behavioural change. Report to the Sustainable Development Research Network. University of Surrey, Centre for Environmental Strategy, Guildford, Surrey, UK.
- Jaeger, C., Dürrenberger, G., Kastenholz, H., Truffer, B., 1993. Determinants of environmental action with regard to climate change. *Climatic Change* 23 (3), 193–211.
- Jasanoff, S., 2006. Risk in hindsight: constructing a politics of reflection. In: Richter, I., Berking, S., Müller-Schmid, R. (Eds.), *Risk, Society and the Culture of Precaution*. Macmillan, London, pp. 28–46.
- Kemp, R., 1990. Why not in my backyard? A radical interpretation of public opposition to the deep disposal of radioactive waste in the United Kingdom. *Environment and Planning A* 22 (9), 1239–1258.
- Levin, G., 1993. Too green for their own good. *Advertising Age* 64, 97.
- Lovell, H., 2005. The governance of emerging socio-technical systems: the case of low energy housing in the UK. Unpublished Ph.D. Thesis, University of Cambridge, Department of Geography.
- Marvin, S., Chappells, S., Guy, S., 1999. Pathways of smart metering development: shaping environmental innovation. *Computers, Environment and Urban Systems* 23, 109–126.
- McGowan, F., Sauter, R., 2005. Public opinion on energy research: a desk study for the research councils. Sussex Energy Group, SPRU, University of Sussex: <<http://www.eprc.ac.uk/CMSWeb/Downloads/Other/EnergyAttitudesDesk-StudySussex.pdf>> (accessed 10 June 2008).
- McKenzie-Mohr, D., 2000. Promoting sustainable behavior: an introduction to community-based social marketing. *Journal of Social Issues* 56 (3), 543–554.
- Office of the Deputy Prime Minister, 2004. *Planning Policy Statement: Renewable Energy*. TSO, London.
- Owens, S., 1985a. Potential energy planning conflicts in the UK. *Energy Policy* 13 (6), 546–558.
- Owens, S., 1985b. Energy, participation and planning: the case of electricity generation in the United Kingdom. In: Calzonetti, F., Soloman, B. (Eds.), *Geographical Dimensions of Energy*. Reidel, Dordrecht, pp. 225–253.
- Owens, S., 1995. Predict and provide or predict and prevent?: Pricing and planning in transport policy. *Transport Policy* 2 (1), 43–49.
- Owens, S., 1996. I wouldn't start from here: land use, transport and sustainability. In: Cartledge, B. (Ed.), *Transport and the Environment: The Linacre Lectures 1994–95*. Oxford University Press, Oxford.
- Owens, S., 2000. Engaging the public: information and deliberation in environmental policy. *Environment and Planning A* 32, 1141–1148.
- Owens, S., 2002. A collision of adverse opinions?: major projects, planning inquiries and policy change. *Environment and Planning A* 34, 949–957.
- Owens, S., 2004. Siting, sustainable development and social priorities. *Journal of Risk Research* 7 (2), 101–114.
- Owens, S., Cowell, R.J., 2002. *Land and Limits: Interpreting Sustainability in the Planning Process*. Routledge, London.

- Pelletier, D., Kraak, V., McCullum, C., Uusitalo, U., Rich, R., 1999. The shaping of collective values through deliberative democracy: an empirical study from New York's North Country. *Policy Sciences* 32, 103–131.
- Pellizzoni, L., 2001. The myth of the best argument: power, deliberation and reason. *The British Journal of Sociology* 52 (1), 59–86.
- Petts, J., Owens, S., Bulkeley, H., 2008. Crossing boundaries: interdisciplinarity in the context of urban environments. *Geoforum* 39 (2), 593–601.
- Poortinga, W., Pigeon, N., Lorenzoni, I., 2006. Public perceptions of nuclear power, climate change and energy options in Britain: summary findings of a survey conducted during October and November 2005. *Understanding Risk Working Paper 06-02*. School of Environmental Sciences, University of East Anglia, Norwich.
- Rein, M., Schön, D., 1991. Frame-reflective policy discourse. In: Wagner, P., Weiss, C., Wittrock, B., Wolman, H. (Eds.), *Social Sciences and Modern States*. Cambridge University Press, Cambridge, pp. 262–289.
- Sanders, L.M., 1997. Against deliberation. *Political Theory* 25 (3), 347–376.
- Schön, D.A., Rein, M., 1994. *Frame Reflection: Towards the Resolution of Intractable Policy Controversies*. Basic Books, New York, USA.
- Shackley, S., McLachlan, C., Gough, C., 2005. The public perception of carbon capture and storage in the UK. *Climate Policy* 4 (4), 377–398.
- Shove, E., 2003. Converging conventions of comfort, cleanliness and convenience. *Journal of Consumer Policy* 26 (4), 395–418.
- Shove, E., Warde, A., 1998. Inconspicuous consumption: the sociology of consumption, lifestyles and environment. In: Dunlap, R. (Ed.), *Sociological Theory and the Environment*. Rowman and Littlefield, Colorado, USA, pp. 230–251.
- Sinclair, P., Löfstedt, R., 2001. The influence of trust in a biomass plant application: the case study of Sutton, UK. *Biomass and Bioenergy* 21, 177–184.
- Slovic, P., 1993. Perceived risk: trust and democracy. *Risk Analysis* 13 (6), 675–682.
- Sorrell, S., 2007. The rebound effect: an assessment of the evidence for economy-wide energy savings from improved energy efficiency. *UK Energy Research Centre, London* <<http://www.ukerc.ac.uk/Downloads/PDF/07/0710Rebound-Effect/0710ReboundEffectReport.pdf>> (accessed 10 June 2008).
- Stirling, A., 2004. Opening up or closing down?: analysis, participation and power in the social appraisal of technology. In: Leach, M., Scoones, I., Wynne, B. (Eds.), *Science and Citizens: Globalisation and the Challenge of Engagement*. Zed, London.
- Thompson, P.B., Dean, W.E., 1996. Competing conceptions of risk. *Risk* 7 (4), 361–384.
- Thompson, M., Rayner, S., 1998. Risk and governance, Part I: The discourse of climate change. *Government and Opposition* 33 (2), 139–166.
- Thompson, M., Rayner, S., Ney, S., 1998. Risk and governance, Part II: policy in a complex and plurally perceived world. *Government and Opposition* 33 (4), 330–354.
- Upham, P., Shackley, S., 2006. Stakeholder opinion of a proposed 21.5 Mwe biomass gasifier in Winkleigh, Devon: implications for bioenergy planning and policy. *Journal of Environmental Policy and Planning* 8 (1), 45–66.
- Van Vliet, B., 2004. Shifting scales of infrastructure provision. In: Southerton, D., Chappells, H., van Vliet, B. (Eds.), *Sustainable Consumption: The Implications of Changing Infrastructures of Provision*. Edward Elgar, Cheltenham.
- Webler, T., Tuler, S., Krueger, R., 2001. What is a good public participation process? Five perspectives from the public. *Environmental Management* 27, 435–450.
- Wilhite, H., 1997. *Cultural aspects of consumption*. ESF-TERM Workshop on Consumption, Everyday Life and Sustainability, Lancaster University, Lancaster, unpublished manuscript (discussed in Guy, S., 2006. *Designing knowledge: competing perspectives on energy and buildings*. *Environment and Planning C, Government and Policy* 24(5), 645–659).
- Wolsink, M., 2006. Invalid theory impedes our understanding: a critique on the persistence of the language of NIMBY. *Transactions of the Institute of British Geographers* NS 31, 85–91.