Reconsidering public attitudes and public acceptance of renewable energy technologies: a critical review

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CONTENTS

1 Summary

Public acceptance is recognised as an important issue shaping the widespread implementation of renewable energy technologies and the achievement of energy policy targets. Furthermore, it is commonly assumed that public attitudes need to change to make more radical scenarios about the implementation of renewable energy technologies feasible. This chapter critically summarises existing social research on public understanding of, and attitudes towards renewable energy technologies, and provides a novel classification of personal, psychological and contextual factors explaining public acceptance. It concludes by arguing for the need for inter-disciplinary research combining qualitative and quantitative approaches, using innovative social research methods with a greater emphasis upon the symbolic, affective and discursive nature of beliefs about renewable energy technologies.

2 Introduction

Concerns about energy security and climate change are driving significant changes in how energy, and electricity specifically, is generated, transmitted and consumed in the UK. The Energy White Paper contains a commitment to reduce carbon emissions by 60% by 2050, in comparison to 1990 levels, and aims for 20% of total electricity generation to arise from renewable resources by 2020 (Department of Trade and Industry, 2003). Such targets necessitate that low carbon technologies for generating energy, including renewable energy technologies that generate electricity from wind, sun, biomass and ocean sources, become commonplace, rather than 'alternative', as is currently the case. There are many factors that will determine the successful implementation of renewable energy technologies, one of which is widely assumed to be 'public acceptance' (e.g. Ekins, 2004), given that in the recent past, there has been widespread local opposition towards renewable energy developments, particularly wind and biomass (Toke, 2005; Upham and Shackley, 2005; Warren, Lumsden, O'Dowd and Birnie, 2005).

This recognition that public acceptability is a necessary condition of technology development and diffusion is significant but raises many questions about the psychological processes shaping public responses (encompassing cognitive perceptions, emotions and behavioural responses); about the ways in which public responses are being conceived and responded to by key stakeholders such as local government, industry and interest groups; and the implications this has for patterns of public acceptability in the future. Whilst research has an important role in providing critical analysis, insight and evaluation in this area and informing the development of policy and practice, our current level of understanding of public responses to renewable energy techologies, the local experience of resistance and consent and the ways in which public engagement with renewable energy technologies is constructed and practised in the UK, is both limited and restricted, excepting a few case-studies of onshore wind development (e.g. Simon, 1996).

Empirical studies of public attitudes towards energy technologies have, with a small number of exceptions, typically used a quantitative research methodology and been conducted at a range of levels, from national to local. Although typically labelled as researching public 'perceptions' or 'attitudes', and using social research methodologies such as questionnaire surveys and comparative sampling techniques, only on rare occasions are they informed by theoretical frameworks from social science disciplines such as psychology. Instead they are characterised by a market research approach that uses descriptive rather than probabilistic statistical analyses to illustrate public beliefs and responses to specific technologies. As a result, they are more successful in providing a one-off description of public attitudes than a detailed explanation.

McGowan and Sauter (2005) reviewed 33 studies conducted since 2000, noting that 11 were commissioned by Government (e.g. DTI, 2003), 10 by industry (e.g. BWEA, BNFL), 6 by the media (e.g. BBC Newsnight) and 5 by NGOs (e.g. Greenpeace). Only one poll was commissioned by an academic organisation (MIT, 2005). The function of such polling has been characterised broadly as political communication (McGowan and Sauter, 2005), specifically the action of 'agenda setting' by particular actors in the context of policy making or land-use planning decisions. Broadly, the empirical literature is characterised by two kinds of research: opinion poll studies of public opinion, often with large scale (n > 1000) representative samples of respondents, and smaller-scale case studies of local residents' opinions regarding actual or proposed developments. Many studies have had a particular focus upon two low carbon technologies: wind turbines and nuclear power (McGowan and Sauter, 2005), either studied in terms of general levels of support or acceptance, or in terms of specific public responses to proposed local developments. With a small number of exceptions, few studies at either level have examined public attitudes towards energy technologies in light of broader energy and environmental issues, for example energy security/dependence, efficiency and climate change.

2.1 Studies of public awareness and understanding

At the general level, studies have attempted to identify levels of public understanding and awareness of different forms of energy technology and their impacts. These have produced a rather mixed set of findings, in part due to the varied nature of questions asked. McGowan and Sauter (2005) suggest that respondents 'tended to have only a vague idea of where energy was used but a rather better sense of the sources of energy' (page 12). Results suggest high levels of awareness that energy use is rising in the UK (e.g. Eurobarometer, 2003), and that energy sources are varied and often imported into the UK (e.g. Populus, 2005).

Although individuals may be aware of different energy sources, results suggest that more in-depth understanding of these sources vary markedly. For example, it cannot be assumed that individuals have a clear idea about the kinds of energy sources that may be characterised as high or low carbon, renewable or non-renewable. A study conducted by Devine-Wright (2003) found that many respondents believed 'natural gas' to be a form of renewable energy, whilst awareness of 'biomass' as a form of renewable energy was low. The term 'renewable energy' itself seems to be problematic – for example only 4% of the general public and 3% of an 'informed' sample used the term 'renewable energy' in one study conducted with a representative sample (DTI, Scottish Executive et al., 2003). It has been concluded that members of the public relate to specific renewable energy resources or technologies more than the general term, and wind, solar and hydro are most widely recognised (e.g. awareness by over 70% of respondents), in contrast to biomass (approximately 20% awareness) (DTI, Scottish Executive et al., 2003; MORI Social Research Institute for Regen SW, 2004; Curry, Reiner et al., 2005).

Studies indicate that awareness and understanding also varies over the links between energy sources and climate change. Large-scale surveys of public attitudes towards the environment have noted generally low levels of awareness of links between energy consumption and climate change as well as a significant minority believing that technologies such as mobile phones are a major cause of climate change. In terms of energy generation, Poortinga, Pidgeon and Lorenzioni (2006) note that 39% of respondents believed that nuclear power causes climate change, a finding they note is consistent with previous studies,

whilst two studies of carbon capture and storage have indicated low levels of awareness (Shackley et al, 2005; Curry, Reiner et al., 2005).

Sources of information were probed by several research studies. These suggest that in rural areas, local newspapers play a significant role (e.g. Braunholtz, 2003; DTI, Scottish Executive et al., 2003; MORI Social Research Institute for Regen SW, 2004), whilst more generally, TV is the main source of information about renewable energy mentioned by survey respondents, as well as direct experience, such as having personally seen or visited wind farms. Knowledge about renewable energy sources has been shown to be higher in individuals living close to actual developments but tends to be restricted to the particular technology used in that development (DTI, Scottish Executive et al., 2003).

Taken as a whole, these empirical studies suggest reasonably high levels of awareness of energy issues and sources; the 'iconic' nature of wind and solar as examples of sources of renewable energy; and varied levels of public understanding for less familiar low carbon sources or technologies such as biomass and carbon capture.

2.2 Explaining public acceptance and opposition

Empirical studies tend to show high levels of public support for renewable energy technologies. Approximately two thirds of the UK public support further investment in renewable energy technologies, particularly wind energy, in comparison to approximately one third support for nuclear energy, and this support has been quite stable since 2000 (McGowan and Sauter, 2005). Solar technology is the most positively regarded form of renewable energy technology, and there is evidence of polarisation of opinion around support for wind energy, with 20% of the public against it, whilst 28% are strongly in favour (DTI, Scottish Executive et al., 2003). A variety of potential explanations can be identified in the literature for varying levels of public acceptance of different renewable energy technologies; however, these have rarely been analysed and categorised in detail, and in some cases, research is underdeveloped. McGowan and Sauter's review (2005) cited several personal and contextual factors explaining public attitudes, but omitted explanations at the social-psychological level; whilst Wolsink's empirical analysis (2000) omitted contextual factors. In the following section, I provide a broader review, classifying a range of potential explanations at three levels of analysis:

- personal (age, gender, class, income),
- social-psychological (knowledge and direct experience, environmental and political beliefs, place attachment) and
- contextual (technology type and scale, institutional structure and spatial context)

This classification builds upon environmental psychological theory (e.g. Black, Stern and Elworth, 1985; Guagnano, Stern and Dietz, 1995) in examining psychological and non-psychological influences upon environmental attitudes and behaviour.

2.2.1 Personal factors

Socio-demographic characteristics such as age, gender and social class

Regional surveys have found both higher levels of awareness and opposition towards renewable energy amongst older respondents (MORI Social Research Institute for Regen SW, 2003; Somerset County Council, 2004). In contrast, a national study found levels of

awareness and opposition to be lower in younger and older cohorts (ages 16-24 and 65+) in comparison to middle-aged respondents (ages 35-44 and 55-64). Levels of support for nuclear energy seem to correlate with age, with older people being more supportive than young people (e.g. Populus, 2005; ICM Research for BBC Newsnight, 2005). A London study of micro-scale renewables (e.g. solar PV) found that older respondents were more aware of these technologies, but less likely to install them, in comparison to younger respondents (London Renewables, 2003).

In terms of gender, existing studies have produced contradictory results, depending upon the focus on awareness: support for renewable energy generally, support for specific renewable technologies and support for nuclear power. For example, the Times/Populus survey indicated strong support by women for new renewable energy development (90%) in comparison to men (66%); however, a national survey identified higher levels of awareness of renewables amongst men (85% vs. 67%) but lower levels of support for development in the locality (31% vs. 23%; DTI Scottish Executive et al., 2003). Women seem to support wind farms less than men (e.g. DTI Scottish Executive et al., 2003; MORI SW Studies, 2003; 2004). There also seems to be higher preferences for nuclear power over wind energy amongst men than women (e.g. 33% vs. 11%; ICM Research for BBC Newsnight, 2005).

In terms of social class, there seems to be a positive correlation between income and class, and levels of support for both renewable energy *and* nuclear power. Separate studies suggest that individiuals earning in excess of £30,000 per annum, and classified as in AB social classes in comparison to DE, were more supportive of new nuclear power stations, renewable energy generally and wind energy specifically (e.g. MORI Social Research for Regen SW, 2004; ICM Research for BBC Newsnight, 2005).

2.2.2 Psychological factors

Degree of awareness and understanding:

Although studies of public acceptance have been driven by assumed negative implications of deficits in public understanding, there is limited evidence that more informed individuals are more accepting of low carbon technologies. Correlations between knowledge and acceptance were found in two studies (DTI, Scottish Executive et al., 2003; MORI Social Research Institute for Regen SW, 2004), however a third study noted that levels of support were independent of levels of awareness, high or low (London Renewables, 2003).

Political beliefs

Empirical findings suggest that political beliefs are correlated with social acceptance of different low carbon technologies. For example, Populus (2005) indicated that 37% of individuals indicating support for the Conservative party were supportive of new nuclear power stations (in comparison to only 12% of Labour supporters and 14% Liberal Democrat) whilst being less strongly supportive of new renewable energy developments (62% as against 86% and 84% respectively).

Environmental beliefs and concern

There is some evidence that support for renewable energy technologies is motivated by levels of environmental concern, specifically about climate change. For example, Poortinga et al., (2006) identified high levels of public support for energy policy-making to be driven by the goal of environmental protection. This study also indicated discriminatory levels of public support across different types of technologies designed to mitigate climate change, with 77% of a representative national sample of 1462 individuals preferring the increased deployment

of renewable energy technologies over new fossil-fuel or nuclear power stations (Poortinga et al., 2006). However, findings from other studies suggest a more complex relationship between environmental concern and public acceptance of renewable energy technologies, depending upon the scale of 'environment' that is the focus of public concern, and how the various impacts of such technologies are evaluated at different scales. For example, Warren, Lumsden, O'Dowd and Birnie (2005) noted that social conflict over proposed renewable energy energy technology developments such as wind farms can be characterised by action motivated by environmental concern on both sides of the conflict. Supportive individuals may be principally concerned about the impacts of climate change at the global scale, who are opposed by individuals concerned for the environmental impacts of technologies in valued localities, a conflict characterised as 'green' on 'green'.

Place attachment

Generally, few studies of public acceptance consider the potential significance of affective aspects of people-place or people-technology interactions. On the theme of local environments and public acceptance, the possibility that emotional attachments to places are implicated in public responses to low carbon technologies was suggested by Devine-Wright (2005) who noted that high levels of place attachment (cf. Altman and Low, 1992), that is positive emotional bonds between people and valued environments, can serve to motivate both public support *and* opposition to proposed technology developments, depending upon whether the technological development was evaluated as posing a threat or an opportunity to the locality. However, few studies have empirically analysed this relationship, with the exception of a Norwegian study that indicated how support for a large-scale hydropower development was positively explained by the strength of attachment to affected areas, and that this factor was more significant than socio-demographic characteristics such as age or gender in explaining public acceptance (Vorkinn and Riese, 1998).

Perceived fairness and levels of trust

Several recent studies have illustrated how perceptions of fairness and levels of trust are implicated in the public acceptance of renewable energy developments. Zoellner, Ittner and Schweizer-Ries (2005) used a questionnaire to study the attitudes of 291 Germans towards wind energy development decision-making, drawing upon an extensive literature within the field of political science literature on theories of equity and justice. Their results indicate that procedural justice (i.e. the subjectively perceived fairness of a distribution process) was significant in explaining people's negative attitudes towards wind energy, particularly concerning zoning, planning and licensing decisions. There were high levels of mistrust in political decisions makers, who were considered to be in coalition with private development organisations. Similar results were found by Upham and Shackley (2006) researching public opposition to biomass plant in the UK, who found low levels of trust in key actors in the development, including the developer, local authority and regional development organisation, which in turn influenced public responses to information and assessments provided as part of the statutory planning process.

2.2.3 Contextual factors

Technological factors: scale and type

Low carbon technologies for energy generation are diverse, encompassing nuclear power plant to diverse renewable technologies such as solar photovoltaic panels; wind turbines of different scale, designs and on or offshore location; energy from waste plants (e.g. anaerobic digestion or incineration); biomass fuelled plant at scales from small combined heat and power plant to large scale power stations (e.g. combusting short rotation coppice); hydro

schemes and ocean technologies (e.g. tidal and wave devices). Since each technology captures different natural resources in different ways, the environmental, economic and social impacts of each technology vary. Public attitudes towards a biomass plant may chiefly relate to the impacts of truck movements and olfactory emissions (Upham and Shackley, 2006) whereas attitudes towards wind turbines may focus more upon visual impacts and noise levels (Warren, Lumsden, O'Dowd and Birnie, 2005). Since these technologies vary both in their relative impacts and in their extent of implementation to date, the literature on public attitudes to each technology is dissimilar. Wind turbines have been by far the most socially contentious renewable energy technology to date, and therefore, more research has been conducted on public perceptions and attitudes to this form of renewable technology in comparison to the others.

It is possible to classify three scales of implementation of renewable energy technology:

- micro (at single building or household level);
- meso (at the local, community or town level)
- macro (at large scale 'power station' level).

Since each scale of technology will present different impacts on the local economy, community and environment, public attitudes towards, and engagement with, renewable energy technologies implemented at different scales is likely to vary considerably. The majority of existing research on public attitudes has been at the macro-level, focusing upon the social impacts of larger-scale energy developments, although research at meso and micro-scales has recently emerged (e.g. meso: Walker, Devine-Wright et al., 2007; micro: London Renewables, 2003; Hub Consultants, 2005). In relation to scale of wind energy development, there are consistent results suggesting that proposed wind farms that are smaller in scale are more positively accepted. Lee, Wren and Hickman (1989) referred to a 'favourability gradient' in noting a negative linear relationship between wind farm size and public support. This finding has been replicated in Denmark (AIM, 1993), Netherlands (Wolsink, 1989) and the Republic of Ireland (Sustainable Energy Ireland, 2003). Few studies at the micro-level have been conducted, although there is a literature from the 1980s studying the determinants of adoption of solar thermal technology (e.g. ??). A study in London identified high levels of support for solar (81%) and micro-wind (75%) (London Renewables, 2003) whilst a study in Wales found that 77% of respondents supported the idea of individual Welsh homes producing electricity from wind energy, whilst 57% reported a willingness to consider it for their own homes.

Institutional factors: ownership structures, the distribution of benefits and the use of participatory approaches to public engagement

Models or structures of ownership employed in renewable energy technology developments can vary widely, encompassing public/private and individual/collective dimensions; for example ownership by public sector institutions such as local authorities, private sector companies, private individuals or some mixture of each; with benefits distributed to private individuals, institutional shareholders, or in the case of cooperatives or social enterprises, a community of interest. As with issues of scale, the majority of existing research on public attitudes has been about renewable energy technologies developed by private utilities or public organisations.

It has been argued that the key to gaining local community support is to use compensation of a financial or other form to redress imbalances in the distribution of costs and benefits (Dorshimer, 1996; Toke, 2002). There is some empirical support for this argument – for example, in Denmark, it has been found that people who own shares in a turbine indicate significantly more positive attitudes towards wind energy than people with no economic interest; and that members of wind co-operatives are more willing to accept further turbines

in their locality in comparison to non-members (Andersen et al., 1997, cited in Krohn and Damborg, 1999). In Scotland, a study of public acceptance of wind farms in the Hebrides indicated that when income from land rental flowed to the community under local ownership of land, levels of acceptance rose from 28% to 39%, and levels of opposition fell from 55% to 44% (MORI Scotland for BBC Scotland, 2005). However, there is likely to be an interaction between levels of compensation and perceptions of fairness mentioned above. Lack of trust in development institutions may result in local opposition regardless of the degree of incentive offered.

Issues of trust and the channelling of benefit implicate the degree to which local people are directly involved in the setting up, ownership and financial framework of a project. Many authors, consistent with a 'deliberative turn' within the social sciences (Owen and Driffil, 2006), have advocated more participatory approaches to public engagement, to at least minimise social conflict if not to secure public acceptance (e.g. Hinshelwood, 2000; Upreti and van der Horst, 2004; Toke, 2005; Bell et al., 2005; Upham and Shackley, 2006). There is some empirical evidence that individuals seek greater levels of involvement in renewable energy developments. For example, a study in Wales reported high levels of public support for wind energy developments conducted 'in partnership' with local people (88.5%), for local use of locally generated energy and profit sharing with local people (over 80%) and local ownership (52%) (Devine-Wright, 2005b). However, it cannot be assumed that deliberative public engagement in renewable energy developments will secure public acceptance. In fact, it may cause the opposite, providing a means for local people to collectively organise and communicate their concerns within a interactive process. Given this, it is important, as Bell et al (2005) recognised, '*to provide policy makers with a better understanding of the proper purpose, character and techniques of public and stakeholder participation'* in renewable energy developments (page 28).

Spatial factors: regional and local context, spatial proximity and NIMBYism

Some studies have noted similarities between national, regional and county levels of support for renewable energy technologies. For example, it has been shown that levels of support in Devon (47%) and the South West region generally (61%) were quite similar to the national average of 55% (MORI Social Research Institute for Regen SW, 2003; 2004). Another study suggested that levels of support for wind and nuclear energy differed between respondents in the North and South of England, with 29% of those in the South opposing wind energy in comparison to 23% in the North, and 74% of those in the South opposing nuclear energy in comparison to 83% in the North (Guardian, 2005).

Devine-Wright (2005) noted a general assumption in the literature on wind energy that those living most proximate to developments are likely to have the most negative attitudes. However, the empirical literature is inconclusive. Several studies suggest the opposite – that when compared, individuals living closer to developments tend to have more positive attitudes towards them, in comparison to those living further away (DTI, Scottish Executive et al., 2003; Braunholtz, 2003; Warren, Lumsden, O'Dowd and Birnie, 2005). However, Hubner and Meijnders (2004) found that those living close to biomass power plants had more negative attitudes towards purchasing biomass electricity.

The search for a proximity (or direct experience) effect on public acceptance links to one of the most common explanations for public opposition – the NIMBY concept. NIMBY (not in my back yard) is a way of thinking about public acceptance of unwanted land-uses that suggests those opposing developments are motivated by concern 'for their back yard' and, although supportive of the land use per se, would prefer it sighted elsewhere. In a critical review of literature on public attitudes towards wind energy, Devine-Wright (2005a) concluded that there was limited empirical support for the NIMBY hypothesis, given that many studies indicate higher levels of support for development in their locality in comparison to regionally

or nationally (e.g. Hoepman, 1998 cited in Krohn and Damberg, 1999; Warren, Lumsden, O'Dowd and Birnie, 2005). Aside from its conceptual utility, academics have been critical of the ways in which the NIMBY concept has been rhetorically applied, both by researchers and in practice. It can serve as an 'off the shelf', easy to use way of thinking about local opposition to renewable energy technologies that was characterised as 'lazy' by one writer, impeding understanding (Wolsink, 2006). Politically, discursive studies have revealed how the NIMBY label can be deployed by pro-development organisations in contexts of social conflict as a pejorative label used to undermine the legitimacy of opponents' views (Haggett and Smith, 2004).

In terms of empirical research, Wolsink's work (1989; 1996; 2000) reveals the complex and multi-dimensional nature of public attitudes in greatest detail. For example, in an empirical survey of three Dutch wind farm sites, Wolsink (2000) applied causal modelling techniques to examine the determinants of anti-wind farm resistance behaviour (i.e. self-reported participation in activities such as signing a petition, writing a letter, visiting a meeting etc.). From the results, he contended that public attitudes towards a local wind farm were mainly explained by visual perceptions, rather than the NIMBY idea, and that resistance behaviours were directly explained by local factors rather than more general arguments in favour of wind energy (e.g. that wind energy is a 'clean' energy source).

However, this body of research leaves a number of unanswered questions: for example, the degree to which emotional response, perhaps linked to place attachment or identity processes (Devine-Wright and Lyons, 1997), are significant in shaping cognitive perceptions or behavioural responses, as suggested by Vorkinn and Reise (2001); and the manner in which perceptions at the individual level (e.g. those concerning perceived visual impacts) are socially influenced by stakeholders such as developers, civic opposition groups, local media and local government, for example through the media and internet sites of proponents and opponents of renewable energy developments.

3 Reconsidering public acceptance of renewable energy technologies

Despite a range of studies being carried out on public attitudes towards renewable energy technologies, genuine understanding of the dynamics of public acceptance remains elusive. One reason for this is the fact that the determinants of public acceptance are rarely considered as a whole, taking account of the multiple personal, psychological and contextual factors described above. Future research on public attitudes should use more innovative methodologies and avoid attempting to identify a surfeit or deficit in public understanding, but instead probe implicit ways of thinking about energy technologies, drawing upon work by Kempton and Montgomery (1982) on 'folk' models and Moscovici (1984) on 'social representations' shaping how individuals think about, talk about and use energy technologies. An example is the work of Leggett and Finlay (2001), in which participants, sampled according to gender and profession, created collages from magazine cuttings which revealed different 'meanings' associated with energy: health and well-being; consumption; and personal energy as a metaphor for renewal.

There is also a need to better explore symbolic, affective and discursive aspects of facility siting disputes. Geographers, such as Thayer and Hansen (1988) and Pasqualetti (1999; Landscapes of Power book) have contributed useful discussions of symbolic aspects of renewable energy technologies, but there is little empirical work studying either symbolic or affective aspects of renewable energy technologies, with the exception of an early study (Lee, Wren and Hickman, 1989) in which 62% of a sample of 1286 respondents associated wind turbines as a 'sign of progress', 15% with 'harking back to the past' and 16% with a

combination of both. Several recent studies have employed a discursive approach to understanding public opposition to wind farms (e.g. Haggettt and Smith, 2004; Ellis, Barry and Robinson, 2006), drawing out how rhetorical and communicative aspects of the social context influence the beliefs and actions of individuals and organisations involved in siting disputes.

I would identify several implications of these studies:

- that a deficit of technical understanding does not equate with an absence of personal meanings or beliefs associated with energy technologies
- that there are important symbolic, affective and discursive aspects of how individuals relate to renewable energy technologies that have been insufficiently captured in the literature thus far, but may play an important role in motivating public responses
- that such beliefs are 'social' as much as 'personal', dynamic rather than static, in that they may be shared across a community or social network, and generated through interpersonal communication, hence the incompleteness of an approach to public understanding based upon a more individualistic and static 'public attitudes' perspective
- that qualitative, visual and discursive research methodologies have a useful role to play, complementing more quantitative, empirical studies based upon questionnaire surveys
- that more deliberative methods of public engagement are widely cited as being necessary to address problems with public acceptance; however, there is relatively little empirical research critically examining the nature of deliberative engagement , and its impacts upon levels of public acceptance in the context of specific projects
- that there is a need for interdisciplinary research to integrate and consolidate existing research, leading to a multi-level conceptual framework integrating the many factors identified as shaping public acceptance of renewable energy technologies.

4 Conclusion

Instead of seeing public attitudes as an obstacle or barrier towards technological progress, I would argue that we need to better understand the dynamics of public engagement in renewable energy technological development. This can be facilitated by inter-disciplinary research using innovative qualitative and quantitative social research methods with a greater emphasis upon the symbolic, affective and socially-constructed nature of beliefs about renewable energy technologies. As Kahn observed (2001), there is a need to study renewable energy siting *'from different scientific disciplines and theoretical perspectives, in order to develop a more structured understanding about what characterises renewable energy siting conflicts'* (page 28).

5 References

AIM Research A/S. Holdningsunderøgelse til vind energi. Report prepared for the Danish Wind Turbine Manufacturers Association 1993. Cited in N. Daugarrd. Wind Turbine Manufacturers Association 1993. Cited in N. Daugarrd. Acceptability Study of Wind Power in Denmark 1997; Copenhagen: Energy Centre Denmark.

Altman, I. and Low, S. (1992) Place Attachment. New York: Plenum Press.

Anderson et al. (1997) Rapport om hvordan en dansk commune blev selvforsynende med ren vindenergyi og skabte ny indkomst til kommunens borgere. Nordvestjysk Folkecenter for

Vedvarende Energyi, In: Krohn, S. & Damborg, S. (Eds.) On Public Attitudes to Wind Power. Renewable Energy 1999; 16: 954-960.

Bell, D., Gray, T. and Haggett, C. (2005) The 'Social Gap' in Wind Farm Policy Siting Decisions: Explanations and Policy Responses, Environmental Politics, 14(4), 460-477.

Black, J.S., Stern, P.C. and Elworth, J.T. (1985) Personal and contextual influences on household energy adaptations. *Journal of Applied Social Psychology,* 70, 3-21.

Braunholtz, S. (2003) Public Attitudes to Windfarms: A Survey of Local Residents in Scotland. Http://www.scotland.gov.uk/library5/environment/pawslr.pdf, Scottish Executive Social Research/MORI Scotland.

Curry, T.E., Reiner, D.M. et al. (2005) A Survey of Public Attitudes towards Energy and Environment in Great Britain. http://lfee.**mit**.edu/metadot/index.pl?id=2637&isa=Item&field_name=item_attachment_file&op=download_file (July 8th 2006)

Department of Trade and Industry (2003a) Energy White Paper: Our Energy Future - Creating a Low Carbon Economy, Department of Trade and Industry, London.

Devine-Wright, P. & Lyons, E. (1997) Remembering Pasts and Representing Places: The construction of National Identities in Ireland. *Journal of Environmental Psychology*, **17**, 33-45.

Devine-Wright P. (2003a) A cross-national, comparative analysis of public understanding of, and attitudes towards nuclear, renewable and fossil-fuel energy sources. Proceedings of the 3rd conference of the EPUK (Environmental Psychology in the UK) network: Crossing Boundaries – The Value of Interdisciplinary Research, 2003a; 160-173.

Devine-Wright, P. (2005) Beyond NIMBYism: towards an integrated framework for understanding public perceptions of wind energy. *Wind Energy*, 8(2), 125-139.

Devine-Wright, P. (2005) Local aspects of renewable energy development in the UK: public beliefs and policy implications. *Local Environment,* 10(1), 57-69.

Devine-Wright, H and Devine-Wright, P (2005). Representing the demand side: 'deficit' beliefs about domestic electricity users. *eceee 2005 Summer Study*, Mandelieu, France, 30 May-4 June, pp. 1343-1348.

Dorshimer, K. (1996) Siting major projects and the NIMBY phenomenon: the Decker Energy Project in Charlotte, Michigan. *Economic Development Review*, **14(**1), 60-62.

Department of Trade and Industry, Scottish Executive et al. (2003) Attitudes and Knowledge of Renewable Energy amongst the General Public: Report Findings. http://www.dti.gov.uk/renewables/policy_pdfs/nationalreport.pdf (July 8th 2006)

Ellis, G., Barry, J and 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. Available at the following website: http://qub.ac.uk/research-centres/REDOWelcome/

Ekins, P. (2004) Step changes for decarbonising the energy system: research needs fo renewables, energy efficiency and nuclear power. *Energy Policy*, 32, 1891-1904.

Eurobarometer (2003) Energy: Issues, Options and Technologies. Eurobarometer Special Report 169, Wave 57.

Guagnano, G., Stern, P.C. and Dietz, T. (1995) Influences upon attitude-behavior relationships: A natural experiment with curbside recycling. *Environment and Behavior,* 27, 699-718.

Haggett, C. and Smith, J.L (2004) Tilting at windmills? Using Discourse Analysis to Understand the Attitude-Behaviour Gap in Renewable Energy Conflicts. Paper presented at the British Sociological Association Annual Conference, March 22-24, University of York.

Hinshelwood, E. (2000) Whistling in the wind: the role of communities in renewable energy development. Network for Alternative Technology and Technology Assessment Newsletter 127 (Sept-Oct) pp. 17-20.

Hoepman N. Foar de Wyn. Provinsje Friesland, 1998. Cited in Krohn S. & Damborg S. On Public Attitudes to Wind Power. Renewable Energy, 1999, 16: 954-960.

Hub Research Consultants (2005) *Seeing the light: the impact of micro-generation upon how we use energy: qualitative findings.* Sustainable Development Commission: London.

Hubner, G. and Meijnders, A. (2004) Public Acceptance of Electricity from Biomass: Impact of Direct Experience on Attitudes. Paper presented at the International Association for People-Environment Studies Bi-annual Conference, Vienna, July.

ICM Research for BBC Newsnight (2005) Nuclear Power Survey. www.**icmresearch**.co.uk/reviews/**2005**/ BBC%20-%20energy%20poll/**bbc**-energy-poll-may-**2005**.asp (July 8, 2006)

Kahn, J. (2001) Siting conflicts in renewable energy projects in Sweden: experiences from the siting of a Biogas plant. Presented at New Perspectives on Siting Controversy Conference, Glumslov, Sweden.

Lee, T., Wren, B. & Hickman, M. (1989) Public responses to the siting and operation of wind turbines. *Wind Engineering*, **13,** 188-195.

Leggett M. & Finlay M. (2001) Science, Story and Image: a new approach to crossing the communication barrier posed by scientific jargon. Public Understanding of Science, 2001, 10: 151-171

London Renewables (2003) Attitudes to Renewable Energy in London: public and stakeholder opinion and the scope for progress. London: Greater London Authority. www.**london**.gov.uk/mayor/environment/ **energy**/renew_resources.jsp (July 8, 2006)

Owens, S. and Driffil, L. (2006) How to change attitudes and behaviours in the context of energy: State of Science Review. Paper commissioned by the Office of Science and Innovation, London.

McGowan, F. and Sauter, R. (2005) Public Opinion on Energy Research: A Desk Study for the Research Councils. Sussex Energy Group, SPRU, University of Sussex.

MORI Social Research Institute for Regen South West (2003) Public Attitudes Towards Renewable Energy in the South West. http://www.regensw.co.uk/content-download/REPORT-MORIPublicAttitudes.pdf (July 8, 2006)

MORI Social Research Institute for Regen South West (2004) Attitudes Towards Renewable Energy in Devon. http://www.regensw.co.uk/content-download/DevonMORIPollReport-091104.pdf (July 8, 2006)

MORI Scotland for BBC Scotland (2005) Hebridean Windfarm Plans. www.ipsos-**mori**.com/polls/**2005**/**bbcscotland**.shtml (July 8, 2006)

Moscovici S. The phenomenon of social representations. In R.M. Farr & S. Moscovici (Eds.) Social Representations. Cambridge: Cambridge University Press, 1984

Pasqualetti M.J. Morality, space, and the power of wind-energy landscapes. Geographical Review, 2000, 90: 381-394

Poortinga, W., Pidgeon, N., and Lorenzioni, I. (2006) Public perceptions of nuclear power, climate change and energy options in Britan: Summary of findings of a survey conducted during October and November 2005. School of Environmental Science, University of East Anglia.

Populus (2005) Energy Balance of Power Poll. www.**populus**limited.com/pdf/**2005**_07_01_times_nuclear.pdf (July 8, 2006)

Shackley, S., McLachlan, C., and Gough, C. (2005). The public perception of carbon capture and storage in the UK. Climate Policy, 4, 377-398.

Simon, A.M. (1996) A summary of research conducted into attitudes to wind power from 1990-1996. British Wind Energy Association, 1996. [Online]. Available: www.bwea.com/ref/survey.html

Somerset County Council (2004) Somerset Environment & Quality of Life Questionnaire 2004. www.**somerset**.gov.uk/**somerset**/ete/sustdev/renewable/index.cfm?override=publications&pubid=1208 (July 8, 2006)

Sustainable Energy Ireland (2003) Attitudes towards wind farms and wind energy in Ireland, Dublin: Sustainable Energy Ireland.

Thayer, R.L. & Hansen, H. (1988) Wind on the land: renewable energy and pastoral scenery vie for dominance in the siting of wind energy developments. Landscape Architecture, 78, 69-73.

Toke, D. (2002) Wind Power in UK and Denmark: Can Rational Choice Help Explain Different Outcomes? Environmental Politics, 11(4), 83-100.

Toke, D. (2005) Explaining wind power planning outcomes: Some findings from a study in England and Wales. *Energy Policy*.

Upham P. and Shackley, S. (2006) Stakeholder opinion of a proposed 21.5MWe biomass gasifier in Winkleigh, Devon: implications for bioenergy planning and policy. *Journal of Environmental Policy and Planning*, 8(1), 45-66.

Upreti, B. & van der Horst, M. (2004b) National renewable energy policy and local opposition in the UK: the failed development of a biomass electricity plant. Biomass and Bioenergy, 26, 61-69.

Vorkinn, M. & Riese H. (2001) Environmental Concern in a Local Context: The Significance of Place Attachment. *Environment and Behaviour*, **33,** 249-263.

Walker G. (1995) Renewable Energy and the Public. Land Use Policy, 12, 49-59.

Walker, G., Devine-Wright, P., Evans, B., Hunter, S. and Fay, H. (forthcoming) Harnessing community energies: explaining and evaluating community-based localism in renewable energy policy in the UK. Special issue of *Global Environmental Politics*

Warren, C.R., Lumsden, C., O'Dowd, S. and Birnie, R.V. (2005) 'Green on Green': Public Perceptions Wind Power in Scotland and Ireland. *Journal of Environmental Planning and Management*, 48, 853-875.

Wolsink, M. (1989) Attitudes and expectancies about wind turbines and wind farms. *Wind Engineering,* **13,** 196-206.

Wolsink, M. (1996) Dutch wind power policy: stagnating implementation of renewables. Energy Policy, 24, 1079-1088.

Wolsink, M. (2000) Wind power and the NIMBY-myth: institutional capacity and the limited significance of public support. *Renewable Energy,* **21**, 49-64.

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. NS31, 85-91

Zoellner, J., Ittner, H. and Schweizer-Ries, P. (2005) Perceived Procedural Justice as a Conflict Factor in Wind Energy Plants Planning Process. Paper presented at the 6th Bi-annual Conference of Environmental Psychology, University of Ruhr: Bochum, September.