Reconsidering public acceptance of renewable energy technologies: a critical review

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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 the acceptance of renewable energy technologies, and provides a novel classification of personal, psychological and contextual factors that combine to shape public acceptance. It concludes by arguing the need for more systematic research on public acceptance driven by coherent theoretical frameworks drawn from psychology and other social science disciplines, explicit definitions of concepts, the use of innovative methodological tools and a greater emphasis upon symbolic and affective aspects.

1: Introduction to social and psychological research

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 2003 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 be generated by 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 demands a deeper understanding of social and psychological processes, since our current level of understanding of public views about, and responses to renewable energy technologies, 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 views about renewable energy technologies have, with a small number of exceptions, typically used a quantitative research methodology and targeted views about renewable energy generally (often through large scale opinion polls), or views about the siting of renewable energy technologies in a particular location (typically through smaller scale

case studies). Although usually labelled as researching public 'perceptions' or 'attitudes', and using social research methodologies such as questionnaire surveys and comparative sampling techniques, few studies at either general or local level have been informed by theoretical frameworks from social science disciplines such as psychology.

Studies that have targeted general public views about renewable energy are often characterised by a market research approach that uses descriptive rather than probabilistic statistical analyses to illustrate public beliefs and responses to specific technologies. McGowan and Sauter (2005) reviewed 33 studies of public opinion within the UK 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 studies are more successful in providing one-off snapshots of public views (even if the large samples are more representative of target populations than many academic studies) than a more detailed explanation of underlying causes that may be generalised across different contexts and help to build theory.

More generally, there is, as yet, little coherence in the literature as a whole, either in the sense of clarifying what 'public acceptance' or 'public resistance' means, or how this may relate to the unit of analysis of the research, which has included terms such as public perceptions, public opinion, public beliefs, public attitudes, public awareness, public understanding, social representations or risk perceptions. Although there is an emerging consensus, at least amongst academics, that NIMBYism is a deficient conceptual basis from which to explain a lack of acceptance, or resistance to energy technologies (Devine-Wright, 2005a; Warren et al., 2005; Wolsink, 2006; Owens and Driffil, 2006), as yet there is little in the way of alternative, coherent conceptual frameworks proposed to replace the NIMBY concept and to guide social research. As a recent study concluded '*there is a need to develop a research agenda for understanding the role of subjectivity in wind energy debate'* (Ellis et al., 2006, page 22). This chapter aims to help develop this research agenda, by reviewing research on public awareness and understanding, and by pulling out discrete factors that the literature has indicated may shape public acceptance.

2: 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), that energy sources are varied and often imported into the UK (e.g. Populus, 2005), that renewable energy, particularly technologies such as solar panels, are strongly supported, both in the UK and across Europe, but that most individuals are reluctant to pay more for energy generated from renewable resources (Eurobarometer, 2006).

Although individuals are aware of different energy sources, results suggest that more in-depth understanding of these sources vary markedly, and that terms used by experts to refer to different kinds of fuels or resources are not always familiar to members of the public. For example, a study conducted by Devine-Wright (2003) found that many respondents believed 'natural gas' to be a form of renewable energy, whilst awareness of term '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). Such findings have implications for the ways in which organisations and institutions engage with the public - the use of unfamiliar terms such as 'biomass' or 'renewable energy', for example, may be counterproductive.

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 low levels of familiarity with less familiar sources or technologies such as biomass, renewable energy and carbon capture.

3: Explaining public acceptance

Empirical studies tend to show high levels of public support for renewable energy technologies, both in the UK and across Europe (Eurobarometer, 2006). 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 views, 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, perceived impacts, 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 environmentally significant attitudes and behaviour.

3.1: Personal factors

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

Some 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 with 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 results showing differences between women and men, depending upon the focus on awareness: support for renewable energy generally, support for specific renewable technologies and support for nuclear. 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 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 individuals 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 (e.g. MORI Social Research for Regen SW, 2004; ICM Research for BBC Newsnight, 2005).

3.2: Psychological factors

Degree of awareness and understanding:

Although studies of public acceptance have been driven by the assumption that negative perceptions are embedded in deficits in public understanding, there is limited evidence that more informed individuals are more accepting of renewable energy 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). Despite this, many organisations assume that awareness raising will lead to more favourable attitudes, as evidenced by attempts to make the technologies more familiar to individuals through site visits, information provision and photomontages.

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).

Perceived impacts

Many studies have investigated how individuals conceive the impacts, positive and negative, of renewable energy technologies, presuming that negative impacts equate with a lack of acceptance. Since such technologies are diverse, and since each technology captures different natural resources in different ways, the perceived impacts of technology siting vary. Public perceptions of a biomass plant may chiefly relate to the impacts of truck movements, changes in the appearance of the landscape and emitted smells (Upham and Shackley, 2006) whereas perceptions of wind energy focus more upon the perceived visual impacts of the turbines, noise levels and perceived economic impacts on residential property values and tourism (Warren, Lumsden, O'Dowd and Birnie, 2005). At a more general level, future research needs to systematise the measurement of perceived impacts, ensuring that they are captured across environmental, economic, personal and social aspects; and can vary across scales from local to national to global; and in time from now to the more distant future. Furthermore, research needs to be sensitive to how individuals make sense of ambivalent perceptions of both positive and negative perceived impacts, and how these inter-relate with other factors to lead to behavioural responses.

Environmental beliefs and concern

There is some evidence that support for renewable energy technologies is motivated by levels of environmental concern. 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 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 of local developments have considered 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 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 individual and/or locality/community more generally. 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).

The relevance of the concept of 'place' has been recognised in literature on risk and wind energy conflicts. Simmons and Walker (2003) argued that '*a focus upon a sense of place enables us to develop a richer understanding of how technological activities and their associated risks can encroach upon people's feelings about where they live and compromise associated place values*' (page 91). Similarly, Haggett et al.'s (2004) analysis of conflicts over wind energy concluded that '*it is crucial to consider the importance of 'place', the local social and historical context of an area, and the attachment that people have to their local environment … views are developed in the context of immediate surroundings, and any changes to this are a perceived threat to identity'* (page 5). This suggests fruitful avenues for future research, to use the concept of place to better understand local responses to the siting of renewable energy technologies 'in place', and to specifically focus upon affective bonds between person and environment that may influence public acceptance.

Perceived fairness of the development process and levels of trust in key actors

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 decision 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. The studies suggest that 'how' renewable energy technologies are sited, in addition to 'what' technologies are sited, are important factors shaping public acceptance and responses; that pre-existing levels of mistrust in local political institutions and processes may undermine support for the siting of renewable energy technologies, and that further research is required to deepen our understanding of the interplay between general views about energy technologies and views about local siting, in part shaped by aspects of the development process.

3.3: Contextual factors

Technological factors: scale and type

Renewable energy technologies for energy generation are diverse, encompassing 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, changes in the appearance of the landscape and emitted smells (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 widespread and 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 the 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. Guagnano, Hawkes, Acredolo and White, 1986). 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 (NOP World Consumer, 2005).

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. For example, a 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 to be involved in renewable energy developments. For example, a study in Wales reported high levels of public support for wind energy developments that were 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 and differences between levels of support for renewable energy technologies at national, regional and county levels. For example, it has been shown that levels of support in Devon (47%) and the South West region generally (61%) varied from 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 an effect of proximity (or direct experience) on public acceptance links to one of the most common explanations for public opposition – NIMBYism. 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 views in 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.). Perceived visual impacts, rather than a NIMBY attitude of preferring technology siting elsewhere, emerged as the main factor explaining public attitudes towards a local wind farm, and 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 that future research could explore: 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 influenced by actors 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.

4 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. Another issue is range of terms used in the literature to describe the object of study, including public or social acceptance, support, positive perceptions, beliefs or attitudes as well as terms like objection, resistance and opposition, which are rarely defined. This leaves ambiguous whether public acceptance is best conceived as a positive perception or evaluation, a favourable affective response, an action of a particular kind or kinds, a combination of these or something else entirely, such as a discourse or narrative; and whether acceptance can be conceived as the absence of resistance or whether acceptance and resistance are best treated as separate social phenomena. My view is that approaches need to unbundle beliefs or attitudes from actions or

behaviours, since each may be shaped by different underlying factors, and that different resistance actions, from signing petitions to forming or joining a group, need to be explored as separate but related phenomena, as has already been shown in relation to different types of environmentally significant behaviour (Stern, 2000).

Future research on public views 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; 2002) 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), and such studies are helpful in 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 the antecedents of public views about renewable energy technologies are often complex and multi-faceted, requiring systematic conceptual and methodological approaches to capture factors and how they inter-relate
- 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, but not replacing, 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.

5: Conclusion

To conclude, 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 views about renewable energy technologies, particularly how they are shaped by processes of engagement in technology siting. 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).

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