Public Perceptions of Low-Carbon Energy Policy and Technology: Recommendations for Policy Makers and R&D Planners

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Credits

• These slides are based on the Executive Summary of a literature synthesis for the UK Research Councils Energy Programme

• Report not yet public but see preceding report on public attitudes to environmental change (Upham et al, 2009): http://www.lwec.org.uk/news-archive/2009/30102009-report-published-public-attitudes-environmental-change

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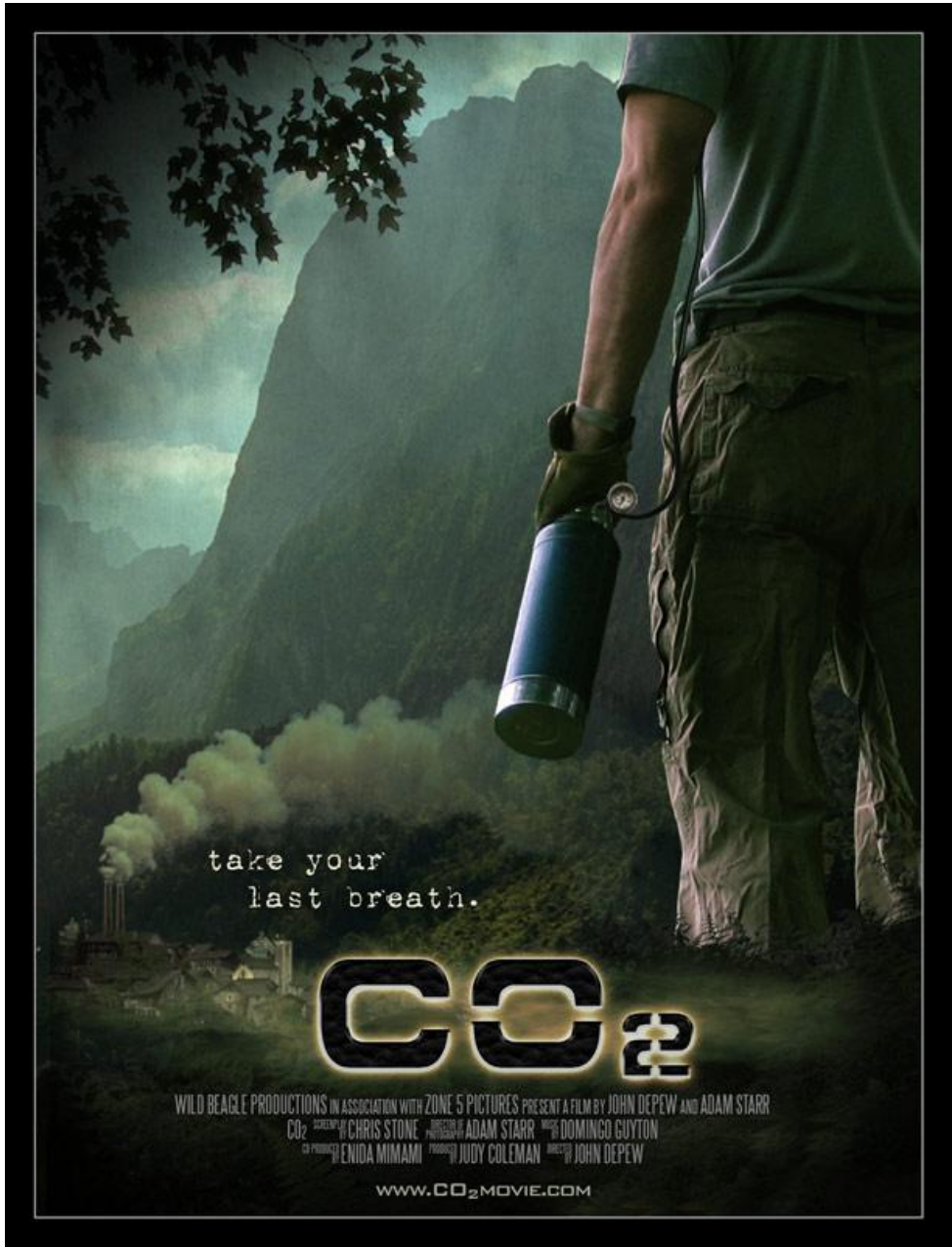
Overview

- Theories of energy perceptions
- Extent of UK literature
- Summary of attitudinal findings
- Implications for public engagement in RD&D
- Appendix: attitudes by energy technology



Theoretical underpinning 1

Attitude theory (psychology)

- Dominates studies of public perceptions of energy
- Attitude = an individual's evaluation of something
- Three main dimensions: knowledge, emotion and behavioural intentions
- Attitudes are *frequently not predictive of behaviour*
- Attitudes can be changed through persuasion and experience, but also as a result of behaviour change itself

Social practices (sociology)

- 'Attitudes' rarely feature: in terms of explaining behaviour, *habits and routines* are seen as primary factors
- Changing the social, economic, political and technological context of individuals' daily lives is seen as the main route to behaviour change.

Theoretical underpinning 2

Science and Technology Studies (STS); Socio-Technical Transitions

- People are embedded in and influenced by their environments
- Provide theoretical explanations of how low-carbon energy transition to may occur – emphasises all societal actors are involved
- STS argues that while technology, research and risk governance have generally been restricted to experts and policy-makers, there are good reasons for involving the lay public
- STS also argues that opinion divergence is *not necessarily a sign of ignorance or misunderstanding*; but may be based on *different values, lack of trust, etc.*

Place Identity; Governance

- Concept of NIMBYism is problematic and unhelpful: it overlooks strong attachments to locations which can become part individuals' identities. Public objection to a new infrastructure proposal may be a threat to this identity and to valued places
- Increased role for public in environmental deliberation and decision-making

Extent of UK attitudes literature by topic

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		High	Medium	Low
Supply	Large-scale wind energy		■	
	Biofuels			■
	Bioenergy		■	
	Tidal and wave energy			■
	Geothermal energy			■
	Large-scale hydroelectric power		■	
	Energy from waste			■
	Micro-generation			■
	Fossil fuels	■		
	Carbon capture and storage		■	
	Nuclear fission			■
	Nuclear fusion	■		
	Nuclear waste		■	
	Hydrogen and fuel cells		■	
	Electricity and gas networks			■
Demand	Energy-efficient domestic appliances/equipment	■		
	Energy-efficient homes		■	
	Energy-efficient transport	■		
	Energy consumption	■		
	Low-carbon/differential energy tariffs		■	
	Domestic energy conservation	■		
	Shopping, eating and waste behaviours		■	
	Travel behaviours	■		
	Energy conservation interventions/policies		■	
	Energy systems and scenarios			■
	Energy research			■

Nine summary findings on energy attitudes

1. Most of the UK public are aware that we need to make substantial changes to energy systems
2. Majority prefer renewables but will reluctantly accept nuclear
3. Reluctant acceptance may also apply to CCS, but it is too early to know
4. Most people are willing to make only modest reductions in energy consumption
5. Public expect government, industry and other nations to act but do not see convincing evidence of this
6. Early dialogue is universally recommended to minimise siting objections but is not always practised

Summary findings on energy attitudes

7. Awareness-raising events (exhibitions, displays, educational activities) cannot satisfy the deliberative, dialogue-based aspects of engagement. Most commentators believe that the public has a *right* to be involved in shaping their world.

8. Energy attitudes are affected by non-energy factors: trust in institutions, political leanings, worldviews, lifestyle aspirations etc: attitudes to energy technology do not develop in isolation.

9. 'Undesirable' energy-related attitudes are unlikely to change without associated change in the socio-economic, political or other aspects of the wider environment that help to maintain the attitudes in question (cf 'practice theory')

Notable research gap: attitudes to energy systems and scenarios

- The Big Energy Shift for DECC/OST found people are supportive of changes in energy supply and consumption, providing their quality of life remains the same and they are helped to change.

- RCUK Energy Research Dialogue made recommendations on how to engage the public in energy research strategy development.

- Focus group work in Manchester with the GRIP energy-emissions model found the public had little trouble envisaging their role in a 42% reduction in domestic (residential) CO_2 emissions, made up of reduced gas consumption, changes to the electrical grid mix and domestic power and heat generation. The timescale for achieving this, though, was probably over-optimistic.

- UKERC-funded work will explore public opinion of energy scenarios.

Implications for public engagement in national energy programme research

- At this level, value is best added by bringing the public into decision-making about the *strategic direction* that energy research should take to meet societal needs and aspirations - e.g. MORI/RCUK study

- Also *educating* the public about energy innovations and *learning from* the public about how these innovations may (or may not) be taken up

- *Normative rationale*: public's 'right' to learn about and shape public-funded research and innovation.

- *Pragmatic rationale*: communicating research results may contribute to more informed populace, better able to make decisions on energy

Implications for education

- Prioritise areas where understanding is poor: by (a) public or (b) researchers

- Examples of (a): relative GHG contribution of different energy-consuming activities; specific technologies – inc bioenergy, marine, geothermal, fusion, hydrogen, fuel cells, CCS

- Examples of (b):

➢ attitudes to energy systems, scenarios and microgen

➢ attitudes to gas pipelines; nuclear fusion; biofuels; geothermal; marine

➢ attitudes to low-carbon vehicles; low-carbon diets; air-conditioning

➢ segmentation of publics in terms of specific energy-use behaviours

Engagement for education: other considerations

(a) which groups within the public may benefit most from education (e.g. those most likely to be affected, those with particular interests)

(b) how best to communicate with each group (using appropriate communication tools, media, messages etc.)

(c) to what end (e.g. to promote science or science careers, raise awareness about particular risks or innovations)

(d) where researchers themselves may benefit from public engagement (e.g. gaining feedback on technologies and debating their implications; to explore public reactions)

(e) Remember to evaluate the impacts of communication activity

Implications of energy attitudes for strategic decision-making

Need to consider:

a) which technological or social innovations are likely to most affect the public –number of people or particular risks

b) which innovations are likely to be particularly socially contentious – for financial, cultural, and/or moral reasons

c) where innovations are in the RD&D chain

- Engagement should not be expected to resolve controversy, but should increase understanding

Implications for energy conservation interventions

- *Energy smart meters*: assessments show they can lead to energy savings of 5-15%; also appears to be widespread public support for the technology and a clear preference for informational feedback in monetary terms.

- *Carbon labelling:* the little research on this topic shows public support for carbon labelling of products is moderated by scepticism about the motives of companies involved and also comprehension difficulties.

- *Carbon calculators*: initial assessments show these can increase interest in cutting carbon, although not necessarily produce actual behaviour change.

Conclusions - 1

- Since much energy consumption is inconspicuous and habitual/routine, *information campaigns* to change energy habits will likely have only small effects in themselves

- We need to make it easy and routine for people to use not only lower carbon intensity fuels but also to use less energy in absolute terms. Not easy in a consumerist paradigm.

- While there are research gaps re specific energy technologies, equally important is understanding energy attitudes and practices in the context of daily lives

Conclusions - 2

- The public are rarely engaged at a strategic level in energy R&D – waiting until deployment stage may be counter-productive
- Renewables are widely accepted in principle but often encounter local opposition
- Nuclear generally divisive but very local acceptance can still be high. CCS – some similarities but lacks the potential community relations benefits of a single site location
- The transition to low carbon energy systems should have begun decades ago – would have made this easier?!

Appendix – attitude summaries by technology

- Source: Public attitudes, Understanding and Engagement in relation to low-carbon energy: a selective review of academic and non-academic literatures (unpublished as of May 2011)

- **Lorraine Whitmarsh[1,2]; Paul Upham[2,3]; Wouter Poortinga[1,4]; Carly McLachlan[2,7]; Andrew Darnton[5]; Patrick Devine-Wright[6]; Christina Demski[1]; Fionnguala Sherry-Brennan[6]**

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Attitudes to energy technologies

Large-Scale Wind Energy

- Wind energy is one of the most familiar sources of renewable energy
- UK public attitudes towards wind energy have been consistently positive over the last decade.
- Levels of overall wind energy support mask diversity across social categories; e.g., older respondents hold slightly less favourable attitudes
- Very little is known about the development of attitudes before, during and after the construction of wind-farms, or about attitudes to offshore wind
- Resistance to wind energy developments appears to be primarily driven by negative perceptions of their visual impacts, with a considerable minority finding them unsightly and noisy
- Research does not provide unequivocal evidence that benefits provision (paying compensation) increases the social acceptance of wind energy. The limited evidence suggests that while energy security framing can elicit strong support for renewable energy, economic framing may contribute least.

Attitudes to energy technologies

Bioenergy and biofuels

- Bioenergy remains one of the least familiar renewable energy technologies to the public, despite biomass combustion being an ancient technology, but awareness is increasing.
- About half of the UK population have positive views of bioenergy; but support for biomass in the UK is among the lowest in Europe.
- Burning waste for energy is perceived more negatively than use of biomass.
- There is very little publicly available literature on UK attitudes to biofuels.
- That major fuel suppliers generally avoid drawing attention to the biofuel content of retail fuel suggests that public views may be mixed or negative.

Attitudes to energy technologies

Tidal and Wave Energy

•Relatively little is known about public attitudes to tidal and wave energy; but, marine energy projects likely to encounter many of the same issues as other renewable projects (e.g., issues of trust, motives, distribution of benefits, contested desirability, level of environmental benefits).

•Although wave and tidal energy are often grouped under the term 'marine energy', their impacts and performance may prove to be different and public opinion may become more differentiated as more devices deployed.

•Performance and impact of the early wave/tidal energy developments have the potential to substantially shape public attitudes to the sector.

Geothermal Energy

•Little research conducted so far.

•2006 Eurobarometer survey found 36% in the UK had heard of geothermal energy, lower than EU average of 44%. Also lower levels of awareness compared to other emerging technologies e.g., wave, tidal, CCS.

Attitudes to energy technologies

Micro-generation

•Few UK studies on public attitudes and decision-making on micro-gen; literature very much smaller than that on attitudes renewables in general.

•Upfront capital cost has been major obstacle to uptake of all micro-gen.

•Motivations for adoption of renewable heat technologies include perceptions of low running costs, self-sufficiency, ready access to raw materials and positive environmental performance.

•Barriers to uptake include lack of awareness or understanding of the options (particularly heat pumps); (very) high installation costs and long payback times; uncertainty as to efficiency, effectiveness, consistency and environmental performance; difficulty in finding credible installers and suppliers; concerns about ease and costs of maintenance; and the inability of renewable technologies to satisfy all heat requirements.

Attitudes to energy technologies

Energy from waste

- Public concern about incineration, energy from waste and energy from biomass residues evident in several EU countries; common concerns include:
  - Atmospheric emissions: dioxins, acid gases, heavy metals
  - Disposal of fly ash from incineration or residues from energy from biomass residue plant
  - Noise, odour, traffic movements
  - Lack of flexibility of contracts for municipal solid waste and their impact on new reduction or recycling initiatives and importation of waste from outside the region
  - Insufficient justification of the plant (the principle, size or scale)
  - Costs and security of finance
  - The visual impact of the scheme on the locality
  - The impact of the scheme on the character of an area
  - The impact of the scheme on local house prices

Attitudes to energy technologies

Large-scale hydropower

- Most (78%) participants in 2008 had heard of hydroelectric power and a large majority approve of it in principle.
- However when asked about potential hydro development 'in your area', a notable 27% would be resistant to it and only 47% would approve it.
- Despite broad support, some express concerns about visual or noise impact, and felt if such schemes required flooding of valleys the negative social impacts would be unacceptable. This suggests *contingent* support.

Attitudes to energy technologies

Conventional Fossil Fuels

- Literature very limited in the UK. Attitudes to fossil fuels often not studied in isolation, but within a wider set of energy sources.
- Few of the UK public (20%) are *in favour* of using any of the three main fossil energy sources on an on-going basis – comparable level to nuclear energy.
- But levels of *opposition* to coal, oil and esp. gas are lower than to nuclear.
- Few think coal, gas or oil fired electricity power stations should be built in Britain in the next 10 years.
- Coal is particularly negatively evaluated as it is regarded to cause air pollution and climate change, create dangerous waste, spoil the landscape (even more so than wind and nuclear energy), and an inefficient source of electricity; only 10% think coal is a clean source of energy.

Attitudes to energy technologies

Carbon Capture and Storage

•As CCS is an unfamiliar technology, public perceptions are heavily influenced by the information and framing provided by researchers, which may or may not set CCS in the context of other energy and emissions reduction options; it may provide light or heavy detail on CCS and its climate change rationale; and interaction with the info. may or may not be highly controlled by the researchers. These factors help account for variation in research findings.

•Overall, research suggests that CCS tends to be supported in proportion to the extent of high quality information provided.

•Without convincing explanation of the merits of CCS and adequate responses to public concerns by trusted people, the public tends to prefer a renewable energy future and to see CCS as end-of-pipe, unsatisfactory solution.

•Serious local opposition has been experienced in the vicinity of at least one proposed onshore storage site in Europe (Barendrecht, NL). Opposition to offshore storage may be lower.

Attitudes to energy technologies

Nuclear Fission

•Against backdrop of nuclear accidents and unresolved issue of radioactive waste disposal, unsurprisingly public support for nuclear power is low.

•Representative studies show only one-third of British public hold favourable views about nuclear power.

•Concerns include: disposal of radioactive waste, risks of accidents and radioactive contamination, and nuclear energy installations being potential terrorist targets, but also that 'better solutions' are available.

•But, opposition has been declining in recent years:

- in 2002 about 40% opposed the building of new nuclear power stations in Britain to replace those that are being phased out over the next few years
- in 2007 fewer than one-third did so; dropping to one-in-five in 2008
- Researchers have perhaps rightly characterised the UK public's approach to nuclear power as one of 'reluctant acceptance'.

Attitudes to energy technologies

Nuclear Waste

- Long-term disposal and storage of nuclear waste is seen by the public as the greatest disadvantage of nuclear energy as a source of electricity.
- Even local communities broadly accepting of nuclear power remain highly concerned about storage and transport of radioactive waste.
- Negatively evaluated on a range of psychometric characteristics of risk, incl:
  - unknown consequences, risks to future generations, dread, being informed, control, unfair distribution, and moral concerns.
- 2008 Eurobarometer found that "if there was a permanent and safe solution for the management of waste", more than half of the UK public would be in favour of energy production by nuclear power stations.
- 94% agree that "a solution for high level radioactive waste should be developed now and not left for future generations", with about 40% agreeing deep underground disposal is most appropriate long-term solution

Attitudes to energy technologies

Nuclear Fusion

•Hardly any studies on public attitudes to nuclear fusion

•One Eurobarometer survey (2003) asked about future of nuclear fusion. Most UK respondents responded with "don't know" to questions, revealing public's unfamiliarity with the technology.

•Those responses that were obtained indicate wariness. More people thought that nuclear fusion:

- is *not* safe against major nuclear accidents (29% versus 20%),
- would produce as much long term energy nuclear waste as today's nuclear power station (25% versus 18%),
- would contribute to global warming (29% versus 22%), and
- would use abundant fuel resources (27% versus 16%).

- Some of the public who participated in the 2007 RCUK Energy Research Dialogue discarded fusion as a potential beneficiary of their hypothetical R&D funding allocation, on the grounds that little progress had been made in return for historically large public investments in the technology.

Attitudes to energy technologies

Hydrogen and Fuel Cells

- Overall knowledge of hydrogen energy, production processes, storage, and infrastructure is low, yet general support remains positive.
- *But s*upport is conditional upon concerns about safety, personal and global costs and benefits, and technological efficacy being met.
- Most research emphasises hydrogen use in transportation and related infrastructure rather than hydrogen electricity production. Very little research specifically on fuel cells.

Electricity and Gas Networks

- Few studies on UK public attitudes to energy supply infrastructures such as gas or electricity networks, as distinct from fuels themselves. We found *no* studies specifically on attitudes to gas network technologies.
- Survey and qualitative work finds that electrical grid operators are not well-known to the public, who associate National Grid with physical infrastructure of pylons and cables rather than the businesses involved.

Attitudes to energy technologies

Energy-Efficiency Measures

- Conceptual and attitudinal differences between:
- (a) *purchase-related* behaviours (e.g. energy-efficient light bulbs, appliances) and
- (b) *habits*, which include energy curtailment behaviours (e.g., reducing hot water temperature, putting on more clothes instead of more heating etc.)
- Clear majority (70%) in UK consider reducing household energy use as a virtuous thing to do for the environment
- *But* policy measures aimed at reducing household energy use are generally unpopular: few think that measures, such as 'green' taxes (34%), road pricing (30%), and carbon rationing (28%) are socially acceptable.
- Similarly, enthusiasm for changing lifestyles appears is muted: a 2010 British survey found 65% agree they are prepared to greatly reduce their energy use to help tackle climate change, but only 44% are prepared to pay significantly more money for energy-efficient products.

Attitudes to energy technologies

Energy-saving light bulbs

- No evidence found on perceptions of compulsory phase-out of incandescent bulbs, but public attitudes to energy-saving light bulbs generally positive.
- Willingness to use energy-saving light bulbs in the next 12 months due to concerns about climate change rose from 66% in 2006 to 80% in 2009.
- Second most popular 'environmental behaviour' after recycling.
- Amongst those with at least one non-energy saving light bulb, reasons cited for not installing more energy-saving bulbs include: energy-saving light bulbs do not fit their light fitting (42%), and quality of the light is poor (14%).

Attitudes to energy technologies

Energy-efficient appliances

- In 2007, 60% said they are already buying energy-efficient appliances and intend to continue to do so.
- 70% who had bought at least one appliance in the last year said that they had looked for the Energy Saving Recommended logo in most purchases; and 72% said that the appliance they actually bought had the logo on it.
- The proportion of respondents looking for the logo and actually buying an appliance with the logo on it increased substantially since 2007, suggesting the logo is helping people to make more energy-conscious purchases
- The most frequently mentioned barrier to purchase relates to the perceived 'utility' of energy-efficient products and their higher cost.

Attitudes to energy technologies

Energy efficiency of homes

•Attitudes to insulation and double glazing are generally very positive – many seeing an energy-efficient home to be worth more because it saves on heating bills; and 42% say they are willing to pay more for refurbishment if it also makes their house more energy-efficient.

•*Barriers to installation:*

- many households may lack the funds and/or access to credit to make these investments possible;
- renters usually cannot install insulation or double glazing and are dependent on the willingness of the landlord to make these investments;
- consumers are often unaware of the possibilities and struggle to understand all the issues; individuals more likely to install energy-efficiency measures if they can discern the financial benefits

Attitudes to energy technologies

Energy efficiency in travel and transport

- Little UK research on attitudes to energy-efficient / low-emission vehicles.
- Buying a low-emission vehicle (e.g., hybrid, electric, biofuel, or less than 1.4l engine), is among the least common pro-environmental behaviours in UK
- 2009 survey found 27% of current drivers has either never thought about switching to or never heard of an electric/hybrid or LPG car; and 53% said they probably will not or do not want to switch.
- Only 15% said they were thinking about switching to an electric, hybrid or LPG car; 27% said that they were thinking about buying a more fuel efficient, smaller, or diesel car, while 26% said they had already done so.
- 2010 survey found two-thirds of the adult UK population would like a car with low carbon emissions if they could afford one and about 75% would consider fuel efficiency an important factor when buying their next car.
- However only around 25% would consider an electric car the next time they buy a new car.

Attitudes to energy technologies

Energy consumption and conservation

- Energy use is primarily driven by economic (income, cost, etc.), structural (location, home ownership, household size, etc.), and social factors (status, meaning, identity, etc.) and by everyday (consumption) practices and habit; environmental values tend to have relatively little influence.
- It would be misleading to assume that all, or most, everyday energy use behaviour is financially driven – energy use and travel behaviours usually move quickly from considered deliberations over perceived personal costs and benefits to the more habitual sphere.
- 'Habit' is also the most common reason given for not switching off lights and appliances.

Attitudes to energy technologies

Low-carbon and differential energy tariffs

- Uptake of renewable energy tariffs by households is extremely low (0.3%).
- Awareness of green energy schemes is also quite low: when shown a list of green energy suppliers' names or logos, 63% of English public said they were not aware of any of the companies/schemes and 83% had never used them.
- Reasons for low take-up include:
  - the cost of tariffs,
  - limited information on green energy,
  - the effort involved in switching supplier (switching 'inertia') and
  - low levels of public trust about claimed environmental benefits of green energy schemes.
- Qualitative research shows differential tariffs, which can spread demand, are viewed positively by many (though not by all) via their association with cost reductions.

Attitudes to energy technologies

Domestic energy conservation

•Stated willingness to change energy habits (i.e. surveys do not measure *actual* behaviour), appears to be increasing:

- 2010 survey data shows increase from 19% (2008) to 38% (2009) in the proportion of UK public stating they are doing 'lots of things' or 'quite a number of things' to reduce their energy use and emissions
- More (32%), however, say they are doing small things, while 10% say they are unwilling or unable to reduce their energy use.

- Actions to save electricity for lighting seem to be more popular than heat- and washing- related energy saving actions.

Attitudes to energy technologies

Shopping, eating and waste behaviours *(i.e., indirect energy use)*

- Support amongst UK public for buying local and seasonal produce, with 73% claiming to make an effort to buy things from local retailers and suppliers, and 60% saying they buy fresh food that has been grown in season
- In respect of low-carbon diets, 59% say they are willing to change their diet to reduce their environmental impact.
- Qualitative work in 2007 found food choices involve complex interaction of factors (e.g., convenience, cost, health, habit, offers, taste, availability); but sustainable food production/consumption is rarely considered.
- Acceptability of low-carbon diet is under-researched despite this potentially offering considerable emissions savings.
- Avoiding waste increasingly accepted as a social and moral obligation. Recycling now very widespread – in 2009, 91% of UK public claimed to recycle (up from 70% in 2007). Reuse is also becoming more common with 83% taking their own bags when shopping and 75% claiming to reuse items. However, only 30% avoid buying products with too much packaging.

Attitudes to energy technologies

Travel behaviours

•More support for technologies or policies to encourage behaviour change ('pull measures', e.g., public transport) than 'push measures', e.g., increased taxes/tolls which may restrict individual freedom; also more support for restricting expansion of airports (47%) than for raising taxes on flying (32%).

•Only 21% car share, while the same proportion would not want to; 50% say they 'would only travel by bus if I had no other choice'; only 23% agree that 'for the sake of the environment car users should pay higher taxes'.

•Eco-driving is more acceptable than reducing car use with 77% claiming to drive in a 'fuel-efficient way'.

•24% of Britons say they have cut the no. of flights they are taking, while 35% would not want to and many others (23%) have not thought of it.

•Resistance to changing travel behaviour *not* primarily due to lack of awareness – most are aware of transport problems, e.g., air pollution congestion, climate change. Indeed, gap between awareness and behaviour most apparent amongst well-off, environmentally-aware sections of society.

Attitudes to energy systems and scenarios

- Very little work on public attitudes to energy systems, scenarios and energy research, perhaps partly due to the interdisciplinary demands, but also due to a lack of related programmatic funding and referee challenges.
- The Big Energy Shift for DECC/OST found people are supportive of changes in energy supply and consumption, providing their quality of life remains the same and they are helped to change.
- RCUK Energy Research Dialogue made recommendations on how to engage the public in energy research strategy development.
- Focus group work in Manchester with the GRIP energy-emissions model found the public had little trouble envisaging their role in a 42% reduction in domestic (residential) CO_2 emissions, made up of reduced gas consumption, changes to the electrical grid mix and domestic power and heat generation. The timescale for achieving this, though, was probably over-optimistic.
- UKERC-funded work will explore public opinion of energy scenarios.