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UNDERSTANDING THE PUBLIC ACCEPTABILITY OF HYDROGEN ENERGY

**KEY FINDINGS FROM FOCUS GROUPS IN TEESSIDE, SW WALES
AND LONDON (OCTOBER – NOVEMBER 2006)**

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1 INTRODUCTION

The research in this report forms part of the UK Sustainable Hydrogen Energy Consortium, <http://www.uk-shec.org>.

UKSHEC is a four year multi-disciplinary initiative funded under the Research Council's SUPERGEN Programme, whose aim is to support research into sustainable power generation and supply. UKSHEC brings together eight leading universities/research centres and the Greater London Authority to investigate scientific, technological and socio-economic dimensions of sustainable hydrogen-based economies.

This report presents the findings of the Public Acceptability Work Package of the UKSHEC project, which builds on the Risk Assessment and Public Perception Work Package. Findings from the latter have been reported in Ricci *et al.* (2006) and are available on the UKSHEC Social Science website (www.psi.org.uk/ukshec).

The work was carried out collaboratively by a team at the Institute for Social, Cultural and Policy Research of the University of Salford, and a team at the Policy Studies Institute in London.

The Public Acceptability Work Package aimed at the following **objectives**:

- 1 To stimulate and inform public debate on how a transition to a sustainable energy future can be realised, which includes (but it is not limited to) hydrogen;
- 2 To elicit and understand critical points in relation to behavioural change in energy consumption in the home and transportation;
- 3 To elicit, understand and discuss the 'criteria', and the underlying broader values and beliefs, used by members of the public to appraise in an informal way the 'acceptability' of different components and configurations that a future hydrogen economy might have;
- 4 To identify the key questions raised by publics during the 'appraisal' of the various options, components and configurations of a future hydrogen economy;
- 5 To understand which approaches in communicating such issues and engaging the public in active debates about energy and the environment might be more favoured/effective/relevant.

1.1 Methods

Methodologically, it was decided that a second round of focus groups would be conducted with the same members of the public that had already taken part in the first phase of the project (see Ricci *et al.*, 2006). Where that was not possible, additional participants were sought with the help of the local authorities and organisations that had assisted us in recruiting earlier focus group members.

The team at Salford (Paul Bellaby, Rob Flynn and Miriam Ricci) organised and carried out the groups in Teesside and SW Wales, whereas Julia Tomei, Simon Dresner and Nick Hughes at PSI organised and carried out the groups in London.

The purpose of the focus groups was to present to participants some basic ‘user-friendly’ information about possible scenarios for a hydrogen economy, and to facilitate group identification of the criteria and issues which they believed to be most salient for decision-makers. However, these focus groups did not attempt to carry out a multi-criteria mapping exercise, and members of the public were not asked to state preferences or rank alternatives. Instead, participants were encouraged to set out the issues that they believed require more public debate, identify the kinds of further information they require to give informed judgements, and comment on appropriate formats for information/communication.

In advance of the focus group meetings, all prospective participants were sent six postcards, representing in a schematic way what hydrogen is, how it can be produced, stored and distributed, and how it can be used in portable, mobile and stationary applications. The postcards, developed at PSI, aimed at helping participants of earlier groups recall the overall picture of the hydrogen economy, its potential benefits, disadvantages and unknowns. Moreover, they would be used during the groups to elicit views about different forms of information material. In addition to the postcards, four different fact sheets were developed (by PSI colleagues), each explaining in a more detailed and technical way the various building blocks of a hydrogen economy, from production to final application. The fact sheets contained collated information about hydrogen from a number of sources, in particular the US Department of Energy. These were given to participants only during the groups, as supplementary material for them to take home.

1.2 The fieldwork

Seven focus groups were conducted in the period October – November 2006, in different localities in Teesside in the North East of England, South West Wales and London. A total of 47 people across the UK were involved. The groups were mixed in terms of age, gender and socio-economic background, however, especially in Teesside, there was a predominance of middle-aged people. The London groups were also mixed in terms of ethnic origin. In sum, the fieldwork was characterised as follows:

Location	Number of people	Age range	Facilitators
Redcar, Teesside	7 (2 W + 5 M)	34-65	R Flynn & M Ricci
Guisborough, Teesside	6 (3 W + 3 M)	32-72	R Flynn & M Ricci
Eston, Teesside	10 (5 W + 5 M)	25-71	R Flynn & M Ricci
Carmarthen, SW Wales	8 (4 W + 4 M)	23-71	P Bellaby & M Ricci
Llanelli, SW Wales	5 (4 W + 1 M)	31-55	P Bellaby & M Ricci
London, group 1	8 (5 W + 3 M)	28-76	J Tomei & N Hughes
London, group 2	3 (1 W + 2 M)	28, 47, 77	J Tomei & N Hughes

Participants in the first round of focus groups were invited to participate again in the final phase of the project. In Teesside the response rate was satisfactory and we did not have to recruit new members of the public. In SW Wales and London new participants had to be recruited, with the help of Carmarthen County Council and the London Sustainability Exchange respectively.

1.3 The focus group topic list

The focus group script consisted of 4 main areas of discussion:

1. **Continuity and change in our current way of life.** We addressed:
 - a. whether people had changed or would be prepared to change their behaviour in energy use, in the home and personal transport, to help reduce environmental problems such as global warming, air pollution, etc.;
 - b. whether people had any views on how to encourage behavioural change in the way energy is used;
 - c. whether people would be prepared to pay more or make any sacrifices to help tackle environmental problems;
 - d. and views about becoming small-scale energy producers (for example, having a CHP unit in their home, or a micro wind turbine or solar panels).
2. **Communicating about hydrogen and new energy technologies.** We addressed people's comments about the postcards and their views on ways to communicate such issues to different publics.
3. **Identifying the criteria used by people to assess the different components and configurations of the hydrogen economy.** During the groups, a powerpoint presentation was shown, illustrating with pictures different hydrogen production routes, storage and distribution methodologies and end-use applications. We then asked participants:
 - a. what criteria they would use to assess all those different components and configurations, and how they would judge whether any of those technologies was worth pursuing (prompts: benefits to the environment, reducing pollution, energy security, cost, benefits to the consumers, safety, economic growth and job creation, etc.)
 - b. finally, we showed images of local hydrogen projects and asked for comments.
4. **Public engagement.** We addressed:
 - a. people's views about involving the public in decisions about hydrogen and energy futures in general
 - b. most appropriate ways of doing this (for examples, through citizens' juries)
 - c. and whether people themselves would be willing to be involved.

1.4 Report Outline

This report presents a detailed analysis of the focus group discussions and illustrates the findings in light of the previous round of focus groups. The next section summarises the key findings, which are discussed in greater detail in Section 3. Section 4 connects and contrasts the evidence gathered during the second phase of the project with the results of other social research carried out on similar themes, such as sustainable consumption, new energy technologies and renewable energy. Section 5 concludes the report with key recommendations.

A parallel working paper has been produced by colleagues at PSI (Dresner and Tomei, 2007) which looks in particular at the implications of these research findings for policies and institutions.

2 SUMMARY OF KEY FINDINGS

2.1 Continuity and change in our current way of life

Most participants thought changes in behaviour are possible, as long as they do not disrupt people's lives and routines too much and cause inconvenience. Recycling, switching off lights and appliances when not used, buying more efficient devices and improving home insulation were cited as examples of successful behavioural changes. Environmental values can stimulate changes, however there was a widespread acknowledgement of the mismatch between values on one hand and behaviour on the other (the so called 'value-action gap'). People identified and discussed what they thought to be barriers to change:

- the belief that personal action is ineffective when it is not part of "something bigger" (international agreements and programmes, better eco-regulations for new buildings, involvement of whole communities, etc.);
- a widespread sense of distrust in many areas of society, including politics, big industry, business and 'other people';
- the difficulty of connecting global environmental and energy problems, often perceived as distant issues both in space and time, with the preoccupations of people's everyday lives;
- the financial ability of people to adopt more environmentally-friendly behaviour;
- socio-cultural norms and established habits and routines, which people associate with their 'normal' practices, comfort and convenience;
- and infrastructure and institutional barriers, such as the lack of efficient public transport in rural areas, and better regulations and standards for new products, buildings, etc.

The discussion about possible taxes or incentives addressed also issues of social inequality and fairness (people across all groups indicated that taxes could penalise the disadvantaged). The same applies to whether people would pay a premium or would be prepared to make sacrifices to help tackle environmental problems. Individual sacrifices were considered ineffective, especially in a context where social trust is poor and there is a tendency to place blame and responsibilities on 'others'. However, most people agreed that individuals would have to eventually change their behaviour (especially in the event of a rapid deterioration of the climate and a fossil fuels crisis) and that "doing nothing is not an option". Some participants actually claimed that people would pay more to keep their way of life unchanged, in terms of comfort at home and freedom in using private transport.

In sum, energy and environmental behaviour appears to be the outcome of a complex interplay among many different factors, some of which depend upon the individual and their own psychology and personal circumstances, and others pertain to the cultural, social, economic and institutional context in which people live and interact. Across the groups, a need for guidance emerged on how people can take effective steps in improving their actions towards the environment and in the way they consume energy.

Becoming small-scale energy producers by using hydrogen fuel was for most participants something rather unfamiliar, whereas most people had already heard about solar panels and micro wind turbines. Cost, availability, ease of use and other practical aspects were the most cited barriers to adoption. All groups agreed that people need to have incentives to adopt renewable energy in their homes and installing such systems should be a collective initiative, led by the government through building regulations, instead of an isolated choice left to the goodwill (and financial resources) of the individual consumer. Many questions were asked about domestic combined heat and power (CHP) systems fuelled by hydrogen: how would it be regulated? Would the system take a lot of space? Would it be safe? Would it be difficult to run and require lots of maintenance? Would it create tensions with neighbours? How about if a part was stolen or vandalised?

2.2 Communicating about hydrogen and new energy technologies

Different comments emerged about the postcards: some people felt they could understand them because they had already taken part in the first round focus group, others found them too complicated or too simplistic. We had also comments about the design and visual aspect of the cards (explanations on the back were too small in print, too little details were given). Some people welcomed the balance between pros and cons about hydrogen, but others felt postcards should have been more impartial.

Broadly, people agreed that information needs to come from a source that is trusted and should be differentiated according to the specific target audience. Moreover, information campaigns should, as a first step, stimulate public interest on issues around energy and the environment so that people would consider such issues relevant and important in their everyday lives. Younger people might prefer 'high technology' devices and websites, but for most people TV, radio and newspapers remain the preferred channels for getting information. There emerged however the belief that such issues might appeal only to a certain section of the population and a "shock campaign" might be needed to alert those for whom energy and the environment are not immediate concerns. Many people also suggested that children should be taught about hydrogen (and energy and the environment in general) in science lessons at school, so that they would be able to take the message home to their parents.

2.3 Identifying the criteria used by people to assess the 'acceptability' of different configurations of the hydrogen economy

Most people spontaneously identified as criteria for assessment the following: cost (especially to the individual consumer), safety, effectiveness in tackling environmental and energy security problems, performance and convenience.

People needed to be reassured that hydrogen production was sustainable in the longer term and cost-effective in tackling climate change and that the whole spectrum of new infrastructure, technologies and applications would be safe. People expected that, to be fully accepted and adopted, hydrogen applications need to perform at least as well as conventional technologies (such as cars,

buses and domestic heat and electricity) and provide at least the same level of comfort and convenience people are used to.

People in Teesside and SW Wales were asked in particular whether they would be more supportive of a large-scale hydrogen development if it brought jobs and improved the local economy. Most people acknowledged that hydrogen could bring new jobs, improve the economy and help regenerate obsolete industrial sites. However, people would need to be consulted if new facilities were being planned. They stressed that being used to living near big chemical complexes did not imply they would unconditionally accept new installations.

Overall, most people were not at ease in expressing criteria, as they felt they did not have any practical experience of any new hydrogen development. Most people knew little about local hydrogen projects and felt they could have been publicised more.

From our groups, it appears that 'acceptability' should be conceptualised as a continuum of different dimensions and levels, rather than be simplistically associated with 'risk acceptance', as it is often the case with new, still unknown technologies.

2.4 Public engagement

When people were asked about their views about involving the public in decisions about hydrogen and energy, most of them understood 'involvement' as a form of one-way communication, advertising (by using TV, radio and newspapers) or education (especially of new generations). People expressed also support for more active types of engagement as reflecting democratic ideals, but at the same time they questioned the assumptions underpinning public participation, such as the actual willingness to participate and the ability of people to give their judgement in abstract terms. There emerged a diffused feeling of distrust of 'other people'. While participants claimed they were interested and willing to participate in debates about energy, 'others' would be unaware of the problems associated with energy and the environment, and too busy dealing with their everyday issues (keeping their jobs, making ends meet, etc.).

People across all groups suggested that 'hard hitting' campaigns, or active door-to-door communication, would make citizens more aware and generate the interest in issues around energy. Children education was mentioned frequently as a useful means to prepare younger generations to the future challenges of energy and to get the message across to their parents.

Communication (and setting an example) should be delivered by somebody people trust, or identify with, ranging from celebrities (such as Jamie Oliver), to respected TV presenters (such as Robert Winston), but also ordinary citizens that people would relate to.

Our findings reveal that public engagement on hydrogen, and wider issues around energy and the environment, should reflect a genuine commitment at government level to inform and effectively assist people to shift to a more sustainable way of life.

3 COLLATED KEY FINDINGS

3.1 Exploring public attitudes, beliefs and expectations towards energy consumption; Understanding drivers and barriers to behavioural change

The first topic was introduced by presenting a brief overview of the problems associated with our current energy system based on fossil fuels, namely global warming and climate change, air pollution, dependency on foreign sources, etc. Most participants seemed to be familiar with such issues. It should also be noted that at that time the media were giving significant attention to issues around climate change and energy, as the Stern Report on Climate Change was published at the end of October 2006.

People were asked whether they would be willing to **change their behaviour**, or had changed their behaviour, in the way they used energy in their homes and personal transport. It clearly emerged across all groups that while most people claimed to be doing 'their bit' to save energy and help the environment (by recycling their rubbish, switching off lights and appliances when not in use, improving home insulation, opting for energy-efficient appliances and taking the bus instead of the car, for instance), they felt that their actions were ineffective.

The problem with the perceived lack of agency is expressed in three different dimensions. First, people feel that as individuals they have little power to affect the global picture, if other people don't do the same. Second, they feel that people in general cannot make a difference in saving energy and helping tackle environmental problems if big industries and business do not contribute as well, and if the government does not lead by example. Finally, most participants thought that in the absence of international agreements, to which all national governments would be bound, the measures taken by a single country, such as the UK, to tackle energy and environmental problems would be ineffective.

In Guisborough, for example, one man expressed this feeling of powerlessness:

"I think a lot of people think that the changes that they make individually are very small, compared to the total picture which they believe is really serious and therefore needs something large doing, something on a big scale rather than a few people turning their tellies off rather than being on standby" (Man, Guisborough, Teesside).

Similarly a woman in Eston and another in Carmarthen commented:

"I think as individuals we are trying to do our little bit towards it but I think there is an awful lot like the Americans who have so much pollution. The Chinese, the Koreans and... our little bit, is it doing any good? We do try we use low energy lights and we switch the television off and we take the bus wherever we can because we have got a free bus pass. But we do all that, but is it doing anything to help when we have got these big nations just shoving it all out there, you know? But yes as individuals we do try to help" (Woman, Eston, Teesside).

"I think a lot of people are making the effort, although it seems very small at the time with our energy saving bulbs and extra insulation and draught proofing and that sort of thing" (Woman, Carmarthen, SW Wales).

In one of the London groups, a man believed that business is doing little to save energy:

“Well I am always getting nagged about not leaving stereos and televisions on standby, but from where I am I can look out of my window and see a massive great tower block in the city of which its 20 or 30 floors are lit end to end 24/7. Every time of day or night you look out that block is lit up and I know my switching off of 5 watts of standby power is going to make an actual difference before companies are forced to. I assume they leave it on for security so that the guards can just walk around and look around the building, but they can invest in motion detectors or something instead of leaving lights on. Before they should start nagging us about standby power, which is irrelevant in comparison” (Man, London, Group 2).

Across all groups people acknowledged that energy and environmental problems are global ones, so they were concerned that the UK government, even with good intentions, could not be effective in tackling those issues, unless the other ‘big polluters’, such as America, China and India contributed as well. This was particularly evident in Teesside and SW Wales, whereas in the London groups participants focused more on the difficulty of getting big business and industry to adopt greener behaviour.

“I think there is a lot of resentment as far as America is concerned because they wouldn’t sign the Kyoto agreement and just about everybody else has, so you feel that they are not doing anything at all towards energy conservation.” (Man, Guisborough, Teesside)

“I don’t really expect that the United Kingdom is going to single handedly sort out the world economy or the world environmental situation or the global warming, or any of those things. And if we do try to go it alone then we are being silly, totally silly. But whenever we try to get unilateral agreements across everybody else it just doesn’t work does it. They just can’t agree that we are going the same way. I mean we are all talking about how we should cut down in our use of job energy, fuels, resources, whatever, but of course the growing countries are by design going to use more and more and more. So do we want to lie down and die, let them get on with it and just let them then take over? Without there being an international agreement on what we ought to be doing then I think what we decide in this country is silly, really silly” (Man, Redcar, Teesside).

“There was a letter in the Times a couple of days ago about some chap who said I installed energy saving light bulbs throughout my house, my next door neighbour has just put up 200 fairly lights outside his house, am I wasting my time? And this in many ways relates to some global perspective, we are a tiny little island in the world and if we batter our economy by doubling the price of petrol and this that and the other and the Chinese don’t bother and the Americans don’t bother or the Brazilians don’t bother, you know, I don’t know what difference it makes” (Man, Carmarthen, SW Wales).

A few people across all groups, however, thought that individuals do have the responsibility to make the change happen and that the UK government could be a leader in bringing change about. In Redcar, for instance, after one man had expressed pessimistic comments about what the UK alone can do for the environment, two women replied:

"I agree with that, but equally we have to have like some form of national plan and attempt to implement it on just like our personal national scale as opposed to do nothing, just thinking stuff it everyone else does what they do. Like there must be a balance somewhere between trying to lead and just following on like a sheep because nobody is going to do anything anyway. I mean that's like its pathetic isn't it" (Woman, Redcar, Teesside).

The same woman added later:

"I agree to an extent you cannot lead alone, but equally I think it would be an absolute crime to just do nothing. To have no plan, to attempt nothing" (Woman, Redcar, Teesside).

Another woman acknowledged that the problems with fossil fuels are global, but they require individuals to take action and change:

"I've just come back from China and you think America's pollution levels are excessive, well its much more obvious over there and I think they are now third world economy aren't they and they are thriving. And India with its steel buyout and one thing and another, and I think the problem is a universal one but because it's so big and its dimensions are so large, it is a question of how you get your hand on it, to make it personal, really, to make you as an individual to do something, and change will only begin if I say I will change." (Woman, Redcar, Teesside).

While the majority of participants seemed to be aware of the common types of energy-saving behaviour they could adopt, very few had actually taken bolder steps. The exceptions were a young man in Guisborough, who claimed he had sold one of his two cars, and an elderly man in London, who had changed his boiler after he participated in an earlier focus group meeting with us.

However, while environmental concerns alone motivated the young man in Teesside, the prospect of cutting down bills was the main reason the other man decided to change his old boiler:

"I've made a start we had two cars and we got rid of one car, which puts one of us at considerable inconvenience at times, but it is just one of those things that you have got to do to help the environment." (Man, Guisborough, Teesside)

"It's simply economics. The, when I was at the previous Focus Group erh in the discussion I was going to look at this, so I looked at my bills that I was paying, my boiler was probably 20 years old at that time. So I did a reckon up, had a problem with a toilet and with that decided right, I'm going to change the bathroom, I'm going to change the boiler because I obviously thought 20 years good service compared on speaking to professionals and that is where there is a problem because it suits the gas companies very often, there is a boiler as long as they bang their bills that's okay. But as a result despite the increase in fuel changes in the last six months my fuel bills are much lower because I've got a much more efficient boiler" (Man, London, Group 1).

Adopting energy and environmentally conscious behaviour is clearly something that people would like to do in principle, but in practice they find several barriers, chiefly cost and inconvenience, as the following excerpts illustrate.

"I think we tend to make the changes that are more convenient to us, like we are all very keen on energy efficient light bulbs and that sort of thing, turning the thermostat down, putting insulation in, but we are also quite keen on going abroad for our

holidays and I think we have to almost be forced by some kind of price or having to pay some kind of tax in to being deterred against that at the moment, otherwise I think it would be hard to make that decision.” (Woman, Guisborough, Teesside)

“I think you do [change behaviour] as long as it doesn’t inconvenience you. There was an advert at B&Q and they had a windmill and you think what a great idea and then you go and see the price and you think it’s totally out of reach and as soon as it starts to inconvenience you then you kind of stop and think I’m not going to do this, I’m not going to have time to do it” (Woman, Eston, Teesside).

“The majority of people want to do their little bit but it is a small minority who are willing to accept a whole hearted change and I only think it is when change is forced upon you really when you haven’t got the easy option to take” (Man, Eston, Teesside).

Overall, people indicated that they would adopt environmentally-friendly behaviour as long as it wasn’t too inconvenient and costly. Some actually claimed that the main reason they had changed behaviour was to cut down electricity bills:

“Well, I haven’t had my television on standby because they told me how much it would cost a year and in my bedroom I had a television, video and dvd player all on standby for nothing. There was nobody there you know I’ve turned it off at the plug because it’s the money” (Woman, Guisborough, Teesside).

In SW Wales both groups discussed changes in the way people use personal transport, in the context of a rural area where most people depend primarily on private means of transportation, for their work and everyday day life in general. Most people wanted to know if eco-friendly cars, including hydrogen-powered cars, would be easy to get serviced and how their performance would be on country roads.

“People’s lifestyles are very sort of set, if you ask somebody not to use their car, it is quite a hard thing, it would probably be easier to persuade them to use a more eco friendly car than not use one at all. I certainly would consider it as long as it wasn’t too disruptive and as long as it was sort of a general thing. Especially, I wouldn’t want to be driving a hydrogen car that you couldn’t get serviced unless you took it 100 miles or you know unless things were brought on pretty quickly” (Man, Carmarthen, SW Wales).

One woman in particular made clear that people would not be willing to trade their convenience and performance in personal travel for the sake of the environment:

“I think they will have a problem if you need to convert vehicles from the current ones to a fuel cell sort of system. Because if it doesn’t give the same output to the engine as a normal petrol would people are not going to be very keen on purchasing it I think. Because they are used to having faster speed, faster cars. They’re not really willing to go backwards” (Woman, Llanelli, SW Wales).

Established habits are difficult to change, especially when they are associated with convenience:

“I think once you’ve had a car, it’s very difficult to get out of not having one. Because of the convenience” (Woman, Llanelli, SW Wales).

Another barrier to behavioural change in energy use is related to the importance that individuals place on such issue. While most participants in our groups agreed they were aware of, and concerned with the problems associated with the intensive use of

fossil fuels, they also believed that energy and environmental problems were not top-of-the-list priorities for other people:

"I really don't think people would reverse their lives. Or consider the consequences of using fuel and petrol and electricity, I don't think it even enters their head. I think people are so busy going to work every day not getting the sack and keeping on top of blah blah, I just don't think it enters their heads you know" (Man, Redcar, Teesside).

Similarly, a young woman in one of the London groups thought that environmental issues are not immediate and relevant concerns for those with economic problems:

"To be fair, you know, if you know you go up to a woman in, you know, five kids in a deprived area or something, the top concerns are maybe making sure the kids get a good meal, good schooling etc. etc. How they save the planet from destruction is probably very low on their list, so you can't lecture" (Woman, London, Group 1).

In all groups people discussed **how behavioural change could be realised**, either spontaneously or after being explicitly asked by the facilitator. They tended to discriminate between change that is imposed forcefully, through higher taxes and stringent legislation and regulation, and change that people can embrace without being forced, through various forms of persuasion. They also tended to differentiate change in people's behaviour from that of industry and business.

Higher taxes were advocated across all groups, but predominantly as a 'last resort' measure.

"I think we are probably going to be forced to in the end. Better if we sort of start the lessons early rather than have them forced on us" (Woman, Guisborough, Teesside).

"If the government gives sort of gentle guidance then sort of honourable folk will think oh yes, yes, I'll curtail myself, I'll do this that and the other, and other people won't. So without sort of draconian measures which nobody likes, you know, like democratic society doesn't like it what do you do? Because people who care are all thinking oh god I should have a shower not a bath, that sort of thing." (Woman, Redcar, Teesside).

People agreed that polluting fuels should be taxed more than non-polluting ones, which should be subsidised instead, and that public transport should be improved to provide a better service for consumers and less impact on the environment. The debate about increasing taxes allowed people to discuss issues of social inequality as well. In all areas, it was felt that the people on low incomes, including older people and pensioners, would be penalised by an increase in taxation and often this was compared to increases in electricity and gas prices.

In SW Wales and in London in particular people discussed about inequalities in how taxes are applied.

"It's very difficult because it always affects the poorest in society" (Woman, Llanelli, SW Wales).

"Well it's like the tax on electric and gas, it's a poor man's tax" (Man, Llanelli, SW Wales).

"If you were to ask old people, like you've got the cold snap coming in, it's always a worry to them the current cost of energy. It's like you say, you have to make it equitable" (Woman, Llanelli, SW Wales).

“When we talk about tax, when we talk about tax what are you feeling about tax? People who do not have the ability to pay” (Man, London, Group 1).

In one group in Teesside, some people felt that environmental issues were being used by politicians to impose additional taxes on people. Distrust of government emerges as a key factor in mediating how people form their views about energy and the environment, and how they interpret information received through the media.

One man was suspicious about the increased attention given by the government to environmental issues:

“I also think it is a cheek of the government to try to persuade us that all of a sudden this is the biggest issue of all time. It’s not” (Man, Redcar, Teesside).

Another man commented later:

“We don’t want the politicians just to start waving this green flag and then use that as an excuse for taking tax off us” (Man, Redcar, Teesside).

Similarly, one man in Guisborough argued that enforcing existing legislation could be a starting point to tackle energy and environmental issues:

“They are just looking at the next regulation where they can get money from you. Where what they need to do is to sit back and enforce the regulations that they’ve got and they would clean up the environment” (Man, Guisborough, Teesside).

A few participants thought that more awareness and education about energy and its impact on the environment could encourage people to alter their behaviour, however most people agreed that awareness and concern alone cannot do much.

“I think you have got to look erm at history and I remember the switch from petrol to diesel and there was just incentives, you know, it’s going to be cheaper for people to run a diesel car rather than a petrol one, so I agree with you to go from A to B in a quick change. Because if you rely on the hearts and minds of people to change it could take a generation. Whereas if you sting people in the pocket they start to think because it hurts” (Woman, London, Group 1).

The ‘value-action gap’, that is the mismatch between people’s values and their actions, was illustrated by a man in Redcar:

“We are still leaving lights on, we are still having baths and showers so we have not really addressed the problem and yet we are aware of it. [...] It’s almost like we are aware of the problem but we are actually waiting for something to help us. We are actually waiting for someone to guide us and do something about it and then we will follow and do it” (Man, Redcar, Teesside).

A rather clear message that emerges from all groups is that people could be persuaded to alter their behaviour in energy use if it was part of a collective, structured plan in which everyone, starting from the government, industry and business, made their contribution.

“I certainly would be prepared to make much more of an effort with my own personal consumption if I could see big businesses also doing the same because I can see my contribution is going to be zilch compared to what some of the larger corporations could do with a little change in their attitudes” (Man, London, Group 2).

One woman in Redcar, who had argued that responsibility for change is also with individuals, claimed:

“And I am not for change for change’s sake. I want to know there is something structured, that there is something planned and that it is a global thing and because we tend to be, well the tail wag’s the dog doesn’t it, between America and us over here and with America at this moment you know not going letting the emissions go it’s very frustrating and demoralising. We try to target something that we feel is beyond our capability, but you have got to start somewhere and why not here and now.” (Woman, Redcar, Teesside).

One man in the same group favoured a collective effort led by the government and added that as an individual he could make an effort mainly to guarantee a future for his children. Other people also mentioned their children as a cogent motivation for individuals to change behaviour in energy use.

“I think a structured approach by the government is the way forward, I mean I would like to say that we individually could make a difference and if you are asking me like your first question was how do we feel about changing our lifestyles. Yes, I would change my lifestyle I would even go to the lengths of saying I would maybe pay more on tax if that is what it took to see the future of my sons and daughters. But at the same time I don’t think you know we can do it individually ourselves as members of the public, I think it has got to be something that is done as a government if not European then international” (Man, Redcar, Teesside).

One man in Guisborough indicated that the role of the government is to make people aware of what changes in behaviour would have the greatest beneficial effect in saving energy:

“I think people are looking for some form of prioritising, what is the thing we should be doing most about, should it be travel or should it be energy efficiency in the home or should there be something at national level. I know people are starting to read things in the newspapers, whatever is currently in vogue seems to be things like standby TV. So people say great I’ll do that for a while but other people are thinking is it making a great deal of difference should there be something else we should be doing, should we be doing it collectively? Some government led initiative that says well these are the 3 main things we need to do as a nation and everyone has got to sign up to them” (Man, Guisborough, Teesside).

In particular in the London groups it was felt that the onus of responsibility to save energy is chiefly with industry and business, and that individuals’ energy consumption and environmental impact is not as significant as that of the industry sector.

“I don’t really think that it is really up to us you know. I think it’s more up to the government and the policies that they have and up to the companies because it is the companies that are producing all these things [pollution, CO₂, etc.]. We have no choice but if we want electricity we sign up for British Gas or something, they don’t give us no alternatives. If they did give us alternatives I’m sure more people would chose them” (Woman, London, Group 1).

“I think the organisations that are bringing out the stuff [pollution, CO₂, etc.] should be taxed, not the people. The people we don’t really have a say, you know even the kind of money we use that is less energy efficient” (Woman, London, Group 1).

In this group the discussion focused also on supermarkets and the excessive amount of packaging used.

“Maybe they should just put a tax on packaging. When the shareholders don’t say oh god, where’s our money gone, it’s all gone on packaging mate. They would soon put less packaging on it, they’d have more dividends then” (Man, London, Group 1).

One young woman in this group argued that to be motivated change behaviour, people need to have the example set by people they can relate to. She referred in particular to a TV programme that followed a middle-class family while they were trying to reduce their energy consumption:

“I was staying with a friend of mine and we were watching GMTV, not my favourite programme. But on that day GMTV, it was the same week that the Stern Report came out and the Stern Report says unless we do something about climate change now, all the global warming. But anyway, GMTV to tie in with the Stern Report they followed this family, said you know, can this family you know, middle class family with two kids and a dog etc. etc. can this family live a whole week, live a more green life style during this week. And I mean, I think [...] when people in middle England watch that they think wow I can do that. [...] But wouldn’t that take it down to a more basic level rather than like, oh, you know, you just read about” (Woman, London, Group 1).

Later on she added:

“When you see these kind of normal people instead of an eccentric with a house full of solar panels, I don’t think people can relate to the eccentric you know whose driving, if there was one eccentric driving a hydrogen car then people would think that’s his little problem. But if you know, normal people started driving hydrogen cars then I just think that is how you change behaviour or change attitudes if you see people that you can relate to doing it” (Woman, London, Group 1).

The two men attending the second group in London expressed the need to encourage industry to improve the efficiency of both products and production processes:

“The major polluters have got to be forced to do something because that’s businesses who are more worried about profits than the environment and they have to be forced to do something before you can start expecting everybody else to be bothered” (Man, London, Group 2).

“And not only encouragement in the products they are producing, but encouragement in the ways that they are producing products. I think as market produced not more emphasis because most of the things produced are not in themselves when they get to the consumer environmentally harmful. All their environmental harm has happened when they are being produced. The majority of everything in cars and transport where the consumer has some responsibility. But I think if you look at the figures in industry producing far more harmful gases and chemicals than individuals are in their homes and cars because you know I haven’t got the figures, but this must be something that you are aware of, do you know?” (Man, London, Group 2).

Participants in all groups indicated very clearly that industry and business should be better regulated to ensure they commit to energy saving and to preserving the environment. The most frequent example people mentioned was the house construction sector, which should be forced to embed energy-efficient appliances and renewable energy (such as solar panel) in all new buildings.

“Why don’t they put solar power in automatically with every new house that is being built. They are being made to be sold so it wouldn’t cost that much more on top of

the house price. It would be a lot more expensive to put it on afterwards, it would be much cheaper to put it on when the house is being built and if all new housing had solar panels that would save an awful lot of energy” (Woman, Guisborough, Teesside).

People need also to believe that energy and environmental issues are relevant to their daily lives, to start changing behaviour. They also need to see benefits from such change for it to be sustained over time.

“Can you show the benefit very easily apart from financially. Where would you see that in terms of general pollution in the atmosphere?” (Man, Guisborough, Teesside).

The same man added:

“If they could see that there was a benefit and then they said right now we are going to move on to this, everybody uses energy efficient light bulbs and then we’ll do this and we can demonstrate it” (Man, Guisborough, Teesside).

Participants were asked if they would **pay more or make sacrifices to help the environment**, for example by paying a premium for ‘green’ electricity or ‘green’ fuels. Most people indicated that only the affluent would have the financial capability to do so and the majority would still choose the cheapest option.

A woman in Guisborough mentioned organic food as an example of a more costly choice that many people have been happy to take on:

“Well it’s happened with organic food hasn’t it? It took a while to take off, but I think people are prepared to pay premium for organic food. So I think if they get in that right sort of mind set then it’s a possibility.” (Woman, Guisborough, Teesside).

However, money can be a barrier for the disadvantaged:

“You will find that in certain areas in a few miles of here where they don’t buy organic food, they don’t buy quality food. Food is bought on price, they buy the cheaper brands.” (Man, Guisborough, Teesside).

“I think you have got to be able to afford it to make that choice.” (Woman, Guisborough, Teesside).

In more than one occasion, participants in our groups showed little trust in other people’s willingness to adopt energy-conscious behaviour. One man in Eston thought that even if people said they would pay more, in a real situation they wouldn’t:

“I think if you ask them face to face they will say yes, but as soon as you turn round they will pay for the cheapest, it’s nature isn’t it?” (Man, Eston, Teesside).

Some people would actually pay more to keep their lifestyles unchanged, and a few participants argued that recent increases in fuel cost did not deter people from using their car as usual.

“Actually we would pay anything personally to carry on using pollutant fuel rather than say we would pay people to stop using it.” (Man, Redcar, Teesside)

“Well they’ve already proved that they can up the price of fuel as much as they like haven’t they? So suggest main saving is convenience, people would be prepared to pay for it” (Man, London, Group 2).

The claim that is usually made about hydrogen is that it would be possible to use it in stationary domestic applications, to produce electricity and heat in our homes.

People were therefore asked if they would be interested in **becoming small-scale energy producers**.

Apart from the London groups, in which participants did not address this topic in detail, the other groups provided interesting insights. First, people were not too familiar with the concept of producing their own energy, especially in relation to using hydrogen to do so, and this is not surprising as the technology is at a very early stage of development. However, most of them had seen or heard about solar panels and micro wind turbines, especially after B&Q had started advertising them, and opinions were mostly favourable.

"I wouldn't mind one of those wind things in my garden" (Woman, Guisborough, Teesside).

Second, in the Teesside and SW Wales groups it emerged that up-front cost, risks to safety and practical aspects (such as ease of use, performance, cost of operation and space required by the system) were the main concerns associated with domestic energy producing systems.

"The trouble is with these B&Q ones, I was quite keen to find about those, but they only generate about 1kilowatt of electricity which isn't an awful lot, you couldn't quite depend on it." (Woman, Guisborough, Teesside)

"But what about pensioners who have nothing. I couldn't find £1,000, I know my mother couldn't and my grandmother couldn't. So it is a case of no you can't so you would do without" (Woman, Eston, Teesside).

Risks to safety and ease of operation were often mentioned in relation to producing electricity and heat with a hydrogen-powered system:

"I think there would be a bit of apprehension on the safety aspect, I think that would affect a lot of households." (Woman, Guisborough, Teesside)

"The space that something might take up to generate electricity." (Man, Guisborough, Teesside)

"And the risk, all that type of thing, that might be a big issue. People have a fear of technology and anything new" (Man, Eston, Teesside).

"Not only that but I don't know how much it costs to run, but if you stick it in the back yard of an 85 year old lady and say there you go operate that now. If it's just a switch and it runs then fine and dandy, but if it's more than that then you are struggling with some..."(Man, Eston, Teesside).

In Llanelli people talked about the cost and payback time of PV (photovoltaic) panels:

"I think it is literally something like £14,000 but you can get a 50% grant at the moment, £7,000 is still quite difficult" (Woman, Llanelli, SW Wales).

"And the payback on that, if you are 20 you might get your money back but if you are come to the latter years then you try and claw it back it is pointless doing it, so people would say no they are not going to do it" (Woman, Llanelli, SW Wales).

The visual impact of domestic wind turbines and solar panels was also discussed:

"I think solar panels are quite subtle aren't they, you know, it makes no difference if you have got a solar panel or a roof tile" (Woman, Llanelli, SW Wales).

“Yes, solar panels aren’t too bad because they tend to blend in, but if you have all these things sticking up like satellite dishes and all this over the place” (Man, Llanelli, SW Wales).

One woman recalled how natural gas was connected to her village and thought it would be similar for hydrogen.

“Well to go back a couple of years, I live out in the countryside and there was no gas in our village, no natural gas in our village and we all had a meeting and said yes we would like it and we all paid, I don’t know how much, I can’t remember, so much per house to have the gas brought to the village and connected to each house because that is what we wanted. We are talking about 15 years ago because until then there was no gas, so it’s a similar thing” (Woman, Llanelli, SW Wales).

Third, people demanded that such domestic energy systems be installed in every new building, through better building regulation and planning processes.

“I think that’s a shame, we are in a new house and I do wish that it’d been possible to have had solar panels and all these other various heat things, I think that they are talking about taxing everything, but I think incentives should be given as well in that, I don’t know no VAT if you were going to put Building, new build had to have certain things” (Woman, Carmarthen, SW Wales).

“We talked about this at the last meeting didn’t we? And I said then my son in law is a property developer and he still is no further ahead in getting certain things passed through planning” (Woman, Carmarthen, SW Wales).

This woman indicated that it was difficult to install renewable energy or more efficient technologies in new buildings as current standards are inflexible:

“It doesn’t conform to building standards as they are laid down now, so you can’t twist it, you can’t bend it, you can’t shake it a little bit” (Woman, Carmarthen, SW Wales). She added later:

“They don’t look forwards, they don’t look at the whole site and the drainage, all sorts of things, they just don’t look at it, the whole picture. So you know, you can quite see that people who want to do things get annoyed because they are sometimes just up against a brick wall, they can’t build what they want in the way they want” (Woman, Carmarthen, SW Wales).

In Redcar the debate addressed whether it should be up to individuals to make the choice of producing their own energy. Most people thought that the government should be responsible to install such systems on a wide scale, as people would not be financially able of bearing the costs.

“Well once again, you know, I mean if you said, we’ve all seen articles in the paper about you know solar panels on your roof and all the rest of it. Well if everybody was given one or you know if industry knew they could produce one for every house then they would produce them very cheaply and then had big teams to install them and, so people would probably buy them. But at the moment it looks like, from what I saw was that the amount you had to pay for them would take at least 10 years to recoup your money.” (Man, Redcar, Teesside)

“I don’t think it’s that so much, I think that if people could afford it they wouldn’t mind, but people can’t afford to spend a tenner never mind £500 for a new... I think it’s not so much how long it takes to pay back, the government need to fund, a thing that

goes round the country and replacing or putting solar panels on houses. I don't think you should leave it to individuals because some people would never afford it." (Man, Redcar, Teesside).

Another man claimed that he would not object if the government imposed an energy producing system in his home, as long as it was part of a nation-wide, realistic plan that did not cost too much to the individual consumer:

"If you are talking about our government as well, I mean I don't mind not being guided, I don't mind being told as long as it doesn't cost me too much because when the government have done these, we didn't have a choice in council tax, we didn't have a choice in the new taxation of vehicles and the different ccs that it comes into. If someone said to be right actually go ahead and make a decision and it's not too much and it's quite realistic and it's okay and I thought to myself if we all go this way and we have to do it and it's not going to cost too much and at the same time I am doing my bit for the environment. So I don't mind not being guided and actually told because then everyone has got to do, just like a lot of things that they have done. Everyone has had to do it and after a period of time, after so many years you think at one stage it was new but now it's just taken as read and you just do it and you don't mind and it goes out whether it is council tax and its goes by direct debit, you know. If it is something like that I personally wouldn't mind doing it. It all comes down to cost and I think it can only come down in cost if everyone takes part" (Man, Redcar, Teesside).

However, opinions on this are mixed as not all people trusted the government to be a credible leader in energy issues:

"And as long as you say it's the government, we have certain ministers with two jags and that sort of stuff; it does not impart a good message does it?" (Woman, Redcar, Teesside).

In Carmarthen, one man argued that becoming small-scale energy producers would eventually become a necessity when resources started to run out and increase in price. He referred to water in particular:

"Where I live if the water becomes so expensive, which it will do eventually because water is obviously going to be the commodity that is going to be turning into gold, I shall just reconnect to the wells that we already have and if it comes to electricity then I shall ask the electricity board if I can put up one of those wind things right in the field behind me, generate me and I can put the excess back into the grid. I shall become self sufficient but that doesn't answer the problem really does it. I mean that's purely selfishness on my part" (Man, Carmarthen, SW Wales).

The same man explained that not everybody might be able to do that, because of the financial burden or the characteristics of their homes. One woman thought that a community-run initiative would make more sense and be more effective in terms of benefits to the environment.

3.2 Communicating about hydrogen and new energy technology

In advance of the meetings, participants in our groups had been sent a collection of six postcards about hydrogen, showing, in diagrammatic form, a hydrogen molecule, how hydrogen energy is generated, stored and distributed, how it might be used, how a hydrogen fuel-cell works and a summary of the total energy system. During each focus group, approximately half way through the meetings, participants were also given a series of more detailed fact sheets on hydrogen, containing more technical information. People were then asked to have a look at the fact sheets and to give their comments (positive and negative) on both the postcards they had received and the fact sheets. They were also encouraged to discuss their views on how to communicate about hydrogen in particular and new energy issues and technologies in general.

Comments about the postcards were highly mixed. In Redcar comments were generally positive, in particular the two women attending the meeting agreed that the postcards contained the right balance of information and were suitable to their knowledge background:

“Well I quite like them. One, because it reaffirmed what you said before, it reminded me where we were coming from and I do like pictures because pictures stay in my mind a bit more and I did like the fact that it pointed out the downside as well as the upside. Erm, and that was fine by me” (Woman, Redcar, Teesside).

The other woman added:

“This is perfect for us girls!” (Woman, Redcar, Teesside).

In contrast, people in other groups indicated that they could understand the postcards only because they had attended previous meetings with us. In a way we expected this sort of comment, as the postcards were designed by bearing in mind that most of the target audience already had some basic awareness and knowledge of hydrogen.

“I thought I could understand them, but only because I’d been to the previous session. If I’d just picked up these I don’t think it would actually have told us” (Man, Guisborough, Teesside).

“That’s what I thought because you know if you didn’t know anything about it to begin with I wasn’t sure if it really clarified things for you and it wasn’t always the case that the writing on the back was directly related to the picture. For example, it didn’t, ‘How does a hydrogen fuel cell work’, well you get that picture, well okay if you knew pretty much what you were looking for in the first place you could probably work it out, but if you didn’t really know how a fuel cell worked then it doesn’t really tell you. You would find it difficult to grasp by looking at it and it doesn’t really clarify it on the back” (Woman, Guisborough, Teesside).

“I didn’t understand that one, ‘How a Fuel Cell works’. I didn’t understand this small diagram; it was too much for me to kind of ... The rest was really quite straightforward and plain, but that one was a little bit...” (Woman, Eston, Teesside).

“It’s only clear if you know about it, you know. I mean to me, when that came it was a bit of a mystery, I just looked at it and thought what the hell does that mean and then I sat there and had a look and remembered and thought about it and managed to get

through. But if it dropped through my door a year ago I wouldn't have known what it meant" (Woman, Eston, Teesside).

Participants in other groups made the same comment about the complexity of the postcard showing the fuel cell and indicated that explanations at the back of each postcard did not always address the question on the front of the postcard, leading to confusion. Some people, especially the elderly, agreed that the font's size was too small for them to read it.

Especially the men found some of the postcards too simplistic and lacking important information. In Guisborough, for example, one man thought that hydrogen production methods should have been explained more in detail:

"And then on that one [the postcard illustrating how hydrogen is produced] there is no indication of what is the most efficient way of doing it and the size of the different types of production, which is the most common and which is the most efficient. I know you can get into lots and lots of detail there's too much to get your head around but ...people get that" (Man, Guisborough, Teesside)

The same man commented that some of the postcards make people think that decisions on hydrogen have already been taken:

"See 'How will hydrogen be used'. It makes people think the government has decided we are going to use hydrogen, we don't have to bother any more with these light bulbs and turning the television off because we are going to use hydrogen and that's it all our problems are solved" (Man, Guisborough, Teesside).

In one of the London groups, one man was concerned that safety aspects were not sufficiently emphasised:

"I think they were simplistic and perhaps glossed over a lot of things. How is hydrogen stored and distributed. I suggest they are the sorts of things I would be concerned about is hydrogen is a very volatile gas. I can't see it being piped along in the same way as you do with a lot of other things, natural gas for example, it is more volatile than that isn't it" (Man, London, Group 2).

He added:

"Well, 'How is hydrogen stored and distributed', it could well have had some explanatory note to that effect on it to allay those concerns. When it is explained like you have done certainly it makes sense that you may have problems in that respect, because it is lighter and disperses quicker we've got less problems when you have an explosion you are unlikely to have a large mass of it in close proximity" (Man, London, Group 2).

This man also indicated that the postcards should have been more explicit about the efficiency and cost of the various hydrogen production methods, for example in relation to electrolysis, biomass and fossil fuels.

Some people thought that for most people it is not so important to know exactly how technologies work, in terms of the physics and chemistry behind them. Rather, they would be more interested in knowing practical information about their appearance, size, where they would be sold and how they could be used by ordinary people.

"Well I don't think people are interested to know how it works, the fuel cells, but how big it is how small it can be is it going to be hand portable and I know you said it can be used on mobile phones and things like that. Or is it going to be going back to how

things used to be, is it a brick? I mean you can ask anyone how a battery works, an ordinary Duracell battery, how does that work?" (Man, Eston, Teesside).

"I think in reality as long as you can buy it I don't think many people would care where it came from as long as it's there to use" (Man, London, Group 1).

"And it's not too expensive" (Woman, London, Group 1).

In this group, hydrogen technology was considered as any other high tech device:

"Well if you know about it, you are going to use it. If you don't know about it you can't use it" (Man, London, Group 1).

"It's like plasma TVs everybody wants one if they can get one, once you know about it" (Woman, London, Group 1).

Concerning ways of **communicating about hydrogen and new energy technologies**, most people across all groups thought that both the content and the support of information should be differentiated according to the particular target audience.

Television and newspapers (offering free CDs or DVDs on hydrogen) were the most cited means by which information should be provided, especially to raise awareness and generate the interest initially, when the majority of ordinary people would be unaware of hydrogen and its prospects in society. The internet would be used only by those who would be able to do so (especially the youngsters). Celebrities were often mentioned as an effective way of raising the attention in those people who would not be otherwise interested in such issues.

"It depends what you do doesn't it and want language you speak. I mean I found this brilliant, but I am no scientist, I am not too knowledgeable so this did it for me." (Woman, Redcar, Teesside)

"I think a lot of ordinary people need someone like Kylie Minogue to go on telly to say, I think a lot of people really have no interest, its only if we see role models, you know, personally. But I think basically we live in a capitalist society and it depends on consumption. Everybody is trained you know to consume, I think that's your problem" (Man, Redcar, Teesside)

"What you should do is make a DVD or CD, DVD and get a daily paper to give it as a freebie" (Man, Carmarthen, SW Wales).

"Television and it needs to be at a certain time, for instance half way through Eastenders that sort of programme where you would get a lot of people watching" (Woman, Llanelli, SW Wales).

Another woman argued that a 'shock campaign' would be needed as well:

"And it needs to have the sort of shock tactic as well. But the only sort of successful food campaign has been the reduction in salt one, and the soup and the slug, it has to have some message to it" (Woman, Llanelli, SW Wales).

She added:

"The most effective way to get this message across is just to have a black out" (Woman, Llanelli, SW Wales).

One young woman in London suggested marketing hydrogen at refuelling stations:

"I don't own a car but you know we go to put petrol in a car we are stuck at the petrol station for about 5 minutes, clicking the thing into the nozzle into the tank or whatever. At that time you are a captive audience, maybe some, maybe get bio from Esso, that would be funny. But Shell or BP they seem to brand themselves as very green or whatever. While you are standing there for 5 minutes putting petrol into your tank or whatever, you could kind of get that message while you are standing there for 5 minutes. I think you know when we were a student always put signs up in the toilet so that we knew we had a captive audience for 30 seconds" (Woman, London, Group 1).

Another woman suggested that the most effective way of communicating about hydrogen would be by starting to use it in real applications, in particular mobile phones:

"Just in terms, sorry, of advertising I don't know how the fuel cell would work in a mobile but that could maybe be a way to erm you know, because it is the latest new phone product that is a hydrogen phone" (Woman, London, Group 1).

Information provision alone, according to several people, is not sufficient if people are not interested in what is being communicated to them. One woman in particular stressed that people become interested in issues they believe are relevant to them and their lives:

"I think initially you have got to stimulate the interest in, right across the board and where do you start because we identified that there are different levels of understanding and how we respond to it, but nobody is going to respond unless there has been interest generated and we all know global warming and we all know all the problems, but the thing is it needs to be brought home to us, for us to then pursue it and that means we are going to have to have multi methods from the very simplistic right up to the more technically minded and scientifically minded who really, you know eventually will probably be the people who will guide us in our way of thinking because their understanding will then be shared perhaps" (Woman, Redcar, Teesside).

"That's it, if you have the sort of interest and knowledge to question it, then just being given a website will be sufficient for you to go on and research that then, wouldn't it, yeah" (Woman, Redcar, Teesside).

People across all groups also suggested that children, with proper hydrogen education programmes at school, would be a very effective vehicle for information.

"I think it is the children who go home from school and say - Guess what mum - or - Guess what grandma - and they will tell you or even sometimes if you say what have you learned they say nothing but generally if it is interesting they will come home and they will say you shouldn't be throwing that away you should be recycling. They will tell you, so if you get at the children you can get at the adults" (Woman, Llanelli, SW Wales).

3.3 Understanding the public acceptability of a hydrogen economy: criteria identification and discussion

People were shown a Powerpoint presentation on hydrogen approximately half way through each focus group meeting. The presentation consisted of a series of pictures and images of hydrogen production facilities and the different production methods, storage and distribution infrastructure, and finally end-use applications. People were also informed about the current costs of different hydrogen production routes. The presentation aimed at showing participants what a future hydrogen economy might look like in practice, in terms of new infrastructure, facilities and consumer products.

The presentation was an opportunity for participants to comment on the images they were being shown and to ask questions. People wanted to know whether the cost of producing hydrogen would eventually decrease and which production method was the most promising, in terms of cost and environmental benefits; whether hydrogen technologies would be safe; how carbon capture and storage (CCS) technology would work in practice and whether it had any implications for the environment and public safety; and how hydrogen applications would be operated by ordinary citizens.

People were asked what criteria they would use to assess the various components of the hydrogen economy and how would they judge whether it was something worth pursuing.

Safety, cost (especially to the individual consumer), **effectiveness in delivering benefits to the environment, performance** and **convenience** emerged as the key factors that would shape people's assessments and acceptance of hydrogen.

"But which one [hydrogen production method] has the most potential? Because I think that is the one people want to know about, which is the one we should be going for because it is the cleanest, because it is reasonably cheap and less impact on the environment you know" (Man, Guisborough, Teesside).

People wanted to be reassured that hydrogen would be as **safe** to use as the other fuels currently available, and that it would be **affordable** for everyone.

"Safe, is that what you are asking for. I think safety would be a big thing because you know when you have got nuclear in the frame everyone says safe when you mention nuclear even though I think last time we were here there were a couple of comments saying that it was probably the safest one of the lot, without really knowing I don't know too much about it but safety would be an aspect for me" (Man, Redcar, Teesside).

"And cost, cost would be another one wouldn't it. It would have to be affordable" (Woman, Redcar, Teesside).

"Safety would be an overall important issue to me I think." (Woman, Guisborough, Teesside)

"I think if people were thinking about putting hydrogen in their own back yard they would want it to be very very safe." (Man, Guisborough, Teesside)

"Or even in the boot of their car or even if they haven't got a hydrogen vehicle but if they are likely to crash into someone who is driving one, that would be a concern." (Woman, Guisborough, Teesside)

“If you could be sure that this was going to be a) cheaper and b) safer than the existing fuels that we are using then I think people would think about it but if it is going to be unsafe as in the case of accidents or a lot more expensive then they would think twice.” (Woman, Guisborough, Teesside)

“Terrorism, now that’s fairly high on the agenda alongside the environment at the moment. If you think about the buses, you’ve seen that bus in London, if there was a bomb on that it would be a lot more explosive than a diesel bus?” (Man, Guisborough, Teesside). The same man added later:

“You can’t take those risks in this day and age can you, because I think public transport would be a real good starting point for hydrogen to see how it worked, but I’d be extremely worried about those things.” (Man, Guisborough, Teesside)

“I do think historically hydrogen generally has bad press though. I mean I had no idea that hydrogen could be used in the sort of way that you know would provide an efficient energy source. I just always assumed that hydrogen is bad and we should stay away from it. So in terms of safety then you know people need to be made aware that it can be safe, it can be manufactured safely” (Woman, Carmarthen, SW Wales).

“It’s like swapping electrical appliances, if you said to someone there’s hydrogen, there’s there and they would say – well, what’s the cheapest? And that is what most people do” (Man, Llanelli, SW Wales).

“It’s got to be cost effective” (Man, London, Group 1).

Towards the end of the Eston focus group meeting, one elderly woman asked about the safety risks of domestic CHP powered by hydrogen:

“These units that you can have at the back or side of your house – what do they do? Is there anything to be afraid of, you know, will it blow up, will they let out a gas that will kill us all, you know I’ve no idea what they do, it’s a box. And as far as I’m concerned I would want answers to that and I should imagine a lot of people would. Because when I had a big oil tank I knew what that was you know I knew it could catch fire so I kept it away from the house” (Woman, Eston, Teesside).

She also added:

“Well I think people are scared of anything they don’t know about. And they don’t understand, I know I am if I can’t understand it I have to have it explained to me, once I could understand it I could take it in” (Woman, Eston, Teesside).

Other people believed that as long as the device worked fine, they wouldn’t need to know all the technical details to be willing to adopt it:

“I think I would like to sit back and think I don’t want to think about it I want to be able to forget about it, you know well if it’s there” (Man, Eston, Teesside).

Another man added:

“You don’t think where the electricity is coming from do you, you plug it in, when you switch the telly on” (Man, Eston, Teesside).

A woman asked if someone tried to steal a CHP component:

“Another thing that comes to mind is would it be easy for someone to steal, would any part of the unit be easily...” (Woman, Eston, Teesside).

It was also emphasised that most people would expect hydrogen technologies to **perform** at least as conventional technologies and that they would not entail a loss of **convenience** and **comfort** for the consumer:

“As long as at point of use your cooker works and your fire works then 90% of the population don’t give a toss how it works” (Woman, Redcar, Teesside).

“Well, you might want to have a hydrogen vehicle if you could get from here to London and refuel at a reasonable rate without increasing the weight of the vehicle so much that you couldn’t put your luggage in. So we are looking at something, I don’t know how possible that is, because you are going to need to make your car strong in case of collision and because it is hard to compress the fuel, how much volume you need for your fuel tank you know. Is it really practical to go on a long journey in a car like that or is it just for local mileage?” (Woman, Guisborough, Teesside).

“Time, they won’t want anything to take any more time because we all have busy lives you know. Is the car going to go as fast? Are we going to get there?” (Woman, Guisborough, Teesside).

“It depends on how it performs doesn’t it, because and until we can use it we don’t know that. If your car is being run on that, is it going to perform as it performs now using diesel or petrol” (Woman, Llanelli, SW Wales). She also added:

“Whether it can do the same job and we can’t say until we can use it to find that out. And how would it be running your house with that?” (Woman, Llanelli, SW Wales).

“Yes and then the infrastructure for the set up and back up, to get it repaired. There’s a whole ball game” (Man, Llanelli, SW Wales).

“You’ve got to have the space to store it” (Man, London, Group 1).

“I don’t care as long as the buses run. I think that’s what we care about, as long as your house is heated to a temperature that you like” (Woman, London, Group 1).

A few participants thought that people would not want to live near to big hydrogen plants:

“It’s the relative costs isn’t it that’s going to be the driver. Do this or else this is what else you do instead and then taking a balance on those things along with safety, environment. Convenience is going to be a big issue as well. I mean having some of those huge hydrogen factories stuck on the doorstep will not be very nice for a lot of people. Do you really want them? I mean we are used to it here on Teesside, I imagine with ICI, they might not be. They might want to build them somewhere where we don’t want them to build them” (Man, Redcar, Teesside).

“I think it comes down to not in my backyard, if they can have the source of the hydrogen much further away like the wind turbine so they don’t have to see it. The environmentalists, I mean you are talking about coal and gas, but the wind turbines are in the beauty spots where the wind is” (Man, Eston, Teesside).

“Price first and then they say what does it look like you know. If it’s in your backyard well they think I’m not having that you know where they might have a dustbin. I mean I wouldn’t mind having one of those in my backyard, because it’s not as unsightly as, I used to have oil in a tank and that was very unsightly, a great big tank” (Woman, Eston, Teesside).

One man in SW Wales commented about the images of large hydrogen production plants in Teesside:

“That’s all very well, but Teesside is the best place for it. We don’t want it in sunny Towyn and Carmarthen, do we?” (Man, Carmarthen, SW Wales).

There emerged the idea that the fuel economy would radically change in the future and make hydrogen one attractive option despite its costs or relative temporary shortfalls in performance. People also tended to make sense of **technological change** in hydrogen energy by drawing on their experience of more familiar technologies.

“Performance on cars will be important initially but gradually it won’t because there is no alternative you know” (Man, Guisborough, Teesside).

“Well fossil fuels have got a limited life, so the price of those is going to be so much that people won’t be able to have cars that either work on diesel or petrol. So they are going to have an alternative quite simply they are going to have private transport or they won’t and the cost will be the cost. They may not like it they may decide, things may evolve such as they recognise that the private transport now can only be used for short distances. Or alternatively, it becomes a privilege of the super rich. People will react once they see how the fuel economy production works. If petrol stays relatively cheap then they won’t want to change but it won’t so they will have to change” (Man, Guisborough, Teesside).

“The only thing that strikes me is that it is not going to happen in my lifetime. It’s something that is quite far on in the future I would have thought.” (Woman, Guisborough, Teesside).

“There will be a time, say after a couple of hundred years where people will become more and more sensitive and more concerned about the rate that fossil fuels will be declining, alternative fuels and the political implications of all that and they will perhaps become more amenable and more willing to look at alternative.” (Man, Guisborough, Teesside).

“I am encouraged to see that there could be a fuel source that’s not going to run out. One day for my children and maybe their children things are going to be quite different. And although to us it’s very expensive, it’s twice the price of coal now, one day there’s not going to be a choice, really, it’s going to be this much and that’s it because there is nothing else” (Man, Eston, Teesside).

“Well I didn’t think it was going to take a lot of persuading because eventually the time will come when they will say this is the only alternative” (Man, Carmarthen, SW Wales).

“Television took about 50 years didn’t it from 1926 and now we’ve got it. That’s what will happen with this one [hydrogen]. We will have stumbling blocks and then all of a sudden boom, it’s true, they work like that” (Man, London, Group 2).

“[People] will either pay more for the greener ways of powering things or they will pay even more for the even less green ways of powering things. There will just be more tax on petrol in order to evaluate the costs and perhaps make the hydrogen economy slightly cheaper” (Man, London, Group 2).

Groups in Teesside and SW Wales were asked whether **improved employment prospects** would make people more willing to accept hydrogen developments in

their area. In Redcar one man suggested (without being prompted) that hydrogen could create jobs :

“It could be a big employer couldn’t it for the whole country” (Man, Redcar, Teesside).

Although most people acknowledged that developments in hydrogen energy could bring new jobs and improve the local economy, they were reluctant to express unconditional acceptance exclusively on the basis of this factor:

“Well, if they are building new stations for hydrogen then there is obviously going to be new jobs, isn’t there?” (Woman, Guisborough, Teesside).

“I don’t think I would say yes to it just because it was going to create a lot of jobs. You would have to give me a lot more than that.” (Woman, Guisborough, Teesside)

“People say bring it up here, well they always do. A lot of jobs go down south and we get the rubbish. Which is always the same, well it has always been my opinion over all the years I’ve worked, they took the cream methods with all the rest” (Man, Eston, Teesside).

One man in SW Wales suggested that hydrogen could be an opportunity to bring back jobs in engineering and manufacturing:

“It would create a new industry but only to make up for what we have lost from the eighties and nineties. Now, like I said I grew up when Britain was built on engineering now there isn’t anything left so it would bring that back in yeah, which I’d like to see. To go back to what we built our country with rather than be a service country, which is what we are” (Man, Llanelli, SW Wales).

Some people indicated that it was difficult for them to express a judgement on a future hydrogen economy, because they needed to see **hydrogen in action** and understand how it would be used in a real situation:

“It’s hard, you’d have to see it operate, like I said it’s like going into an exhibition hall, you are looking at something so what they would have to do is build something and then say to people this is how it is going to be, rather than sort of go, just go piecemeal about it. Build something up and then say right” (Man, Llanelli, SW Wales).

“It is because until you use it, then you have got nothing really to base, because it hasn’t been seen before. No prior knowledge of it, is there?” (Woman, Llanelli, SW Wales).

In Redcar people were also asked if they would be supportive of a **large scale hydrogen development in their area**. This was an opportunity for people to discuss their perceptions of the local environment, a complex mix of nature, industrial heritage and social needs:

“I would have thought because Teesside has always been associated with chemicals it is probably more acceptable here than elsewhere because the skyline has always had them” (Man, Redcar, Teesside).

“I don’t think we should just accept that we would be the place because we were in the past, I think there has got to be something more considered and that’s the opinion of the people in their localities really.” (Woman, Redcar, Teesside).

One woman suggested that hydrogen could help regenerate brown sites that otherwise would be left to degradation:

“Well the advantage we have in this area is there has been buildings from ICI and whatnot rotting since the early 80s. Now Redcar was quite prosperous when ICI was booming you know it was okay, so it wouldn’t be such a big issue to resurrect old sites as opposed to just letting them rot. Yeah, yeah, to me that would be much more preferable” (Woman, Redcar, Teesside).

“Much of the, I believe, Billingham site has been cleared, but the site is still there, you know and you are quite right in what you say that industry has been on Teesside for many many years and there is expertise in handling dangerous chemicals and gases and you know largely in a safe and controlled manner” (Man, Redcar, Teesside).

“I think people in the north east might quite like to see, well when I say north east I mean local Councils as well. I think employment in the area would be greatly boosted if we had some big kind of plan on Teesside. I think that would be, I think someone in Redcar or Cleveland or Middlesbrough, I think they would sort of say yes to something like that. Yes, they would have to take public opinion in. But I am one of these people, I know it’s easy to say, because nothing has ever happened close to me like a mass storage or some kind of new building that’s popped up or some kind of landfill, it’s never happened to me, but I am one of these people that say if it’s going to happen it’s going to happen, its going to benefit me, they have got to put it somewhere. You know, everyone likes these ideas about things, but at the same time no one wants it near them” (Man, Redcar, Teesside).

People in our groups were shown images and information about **local hydrogen demonstration projects and plans**. These included, in Teesside, a slow-down traffic signal, a lighthouse, a sign on one of Middlesbrough’s landmarks, the Transporter Bridge and plans to develop a hydrogen-powered CHP in Middlehaven, a regeneration area of Middlesbrough. In SW Wales there are plans that envisage the creation of a local hydrogen economy based on the resources of the region, in particular using biomass (crops) to generate the hydrogen. Finally, participants in London were shown pictures of the hydrogen bus currently in operation.

People across all groups had little awareness of the broad range of projects and plans in their regions. They all agreed that people should be better informed about such projects and that they would be a good means of communicating and advertising about hydrogen.

“And I did wonder how the traffic signs, because there is no kind of wiring and I wondered and I did think how it was powered” (Woman, Eston, Teesside).

“But this is the best form of advertising, isn’t it. Something that is actually up and running where they can actually say, this is run off hydrogen” (Man, Eston, Teesside).

“Well, why don’t they tell us, why don’t they stick a sign on top hydrogen powered. Hydrogen is powering this sign” (Woman, Eston, Teesside).

Some of the debate focused on **safety** and the **risks** (in its broader connotation) demonstrations project would entail:

“I think it is good, I think we need to be doing, there might be risks associated with hydrogen and you know all the things we have discussed you know, but we have to start thinking about it and we have to have local projects and I think we should be doing something about it. It might not work, there might be risks and dangers associated with it, but there are risks with all the others.” (Man, Guisborough, Teesside)

“And the risk of not doing anything is even worse” (Woman, Guisborough, Teesside).

Local demonstration projects would also improve the image of the area as a catalyst of technological development:

“It’s the kind of press it would attract as well, pioneering for the north east and the area you know it might be nice from that point of view. It might restore some of the prestige that has been lost, because this area had a very very good reputation for heavy industry and a lot of that has sadly gone. But obviously along with that was a massive amount of pollution and possibly that might offer a clean new technology that is away from the other new technology which is computing and all that type of thing that came up in the eighties. That we really lost out on in this area.” (Man, Redcar, Teesside).

Participants in the London groups were asked if they would mind if the hydrogen demonstration bus in London was carbon-intensive. People agreed it did not make sense in a long term perspective, but it could be acceptable as a temporary demonstration project.

“Well you are talking about using it as a marketing strategy basically, an awareness raising thing. [...] Because there would be no point unless it was just a stopgap while you developed more efficient technology” (Woman, London, Group 1).

“If you are going to crack on using hydrogen as a fuel we should really make it locally, you should make it in the country, instead of having it shipped from thousands of miles away” (Man, London, Group 1).

3.4 Public engagement in decision-making about hydrogen and new energy technologies

Several insights emerge from the discussion on this theme.

First, people in all groups tended to interpret ‘involvement’ and ‘engagement’ as a form of one-way dialogue, with information flowing from the ‘experts’ to the general public. One reason could be that very few people had experience of active participation in interactive, face-to-face debates. The majority were more familiar with questionnaire-based forms of consultation. Another reason could relate to their belief, frequently expressed during the meetings, that people have scarce knowledge and awareness of issues around energy and new technology, so information provision would be an essential first step to introduce more participatory forms of engagement.

Second, people indicated that most citizens would not be interested in such issues and therefore would not be so willing to be consulted.

“The problem is people who care will get involved in whatever format is suggested and people who couldn’t give a hoot would have to be dragged into it” (Woman, Redcar, Teesside).

“Not everybody wants to be consulted on these things though, a lot of other people have got more important things in their lives or they consider more important things. Nearly everybody I know, I can’t think of one person who would come to something like this. The people that I work with are just not interested, there’s other people looking into those things and I would say the vast majority of people aren’t bothered about being consulted” (Man, Guisborough, Teesside).

“They don’t vote, but moan about it when the consequences are there” (Man, Guisborough, Teesside).

“Unless there is something in it for them really. To get an opinion a lot of people say well they haven’t got time or I can’t be bothered to think about it, I’ve got too much on my mind work and kids and suchlike” (Man, Eston, Teesside).

“Some people are never going to get involved are they; I mean that’s one of the reasons I’ve got involved in it really. Its also partly if you are asked to participate in something for the greater good then its your responsibility as a responsible adult I suppose to come and participate” (Man, Eston, Teesside).

Third, people should be made aware that the issue which they are going to be informed and consulted about is important and relevant to them and their everyday lives.

“It’s difficult to get people to think, to give an opinion on something unless they think its something that is going to affect their lives” (Man, Eston, Teesside).

“It is about getting people passionate” (Woman, Llanelli, SW Wales).

“Because they perceive it as being something that you know the changes aren’t going to happen in their lifetime, but the global warming and things, it is happening” (Woman, Llanelli, SW Wales).

Fourth, television, radio and newspapers were cited most frequently as the best ways to convey information, especially if associated with celebrities and ‘hard-hitting’ messages.

"I think a lot of the people they are not particularly focussed they are just unaware and maybe it needs to be on our, say like BBC1's local news sort of saying these are up for discussion and having an open forum, I mean we have had this great open forum going on about persons and what have you over there and people who think things are maybe controversial or new and might stimulate interest are alerted and people who may not have thought, like me, that they might have an interest suddenly find that they are stimulated and you get a social conscience about it, but you need to be aware that there are things to consider and essentially we are all busy people living busy lives and perhaps sometimes we forget the greater aspect. So local news and radio inviting to an open forum and then if you don't put up you shut up don't you really" (Woman, Redcar, Teesside).

"And if you made it near Eastenders then more people would watch it. Or put it on Tricia, you know, or what the hell it is, there are 100 of these things on every morning" (Man, Redcar, Teesside).

"I think the face to face thing that we have got here tonight is quite good for, so that we can ask questions and also for getting our views heard. But I also think that you also need to target the wider audience and as most people watch television I think there ought to be documentaries on television explaining what our energy choices are and what the problems are. And some of the cleverest ones that I've seen, that have maybe caught people's attention are those where they have had a projected scenario on what might happen if we didn't do anything and that is often something that suddenly makes people wake up and think hang on we might have a problem." (Woman, Guisborough, Teesside). She added that a celebrity, such as Jamie Oliver, may be needed.

"A scare tactic in the newspapers would help. Then people would start to be engaged when they start talking about the alternatives." (Man, Guisborough, Teesside)

"You said about the hard hitting campaign, you know, do it like an advert, here we are now but in 20 years there is no more gas, so you can't be like pods on a cow and think oh no. That's going to shock people if you just show them well this is how it is going to be, this is going to be lovely, then they're going to go, well we'll in 20 years" (Woman, Llanelli, SW Wales).

One young woman in London thought that people should be involved more actively through door-to-door campaigning:

"I'm currently working in an organisation that is funding a project in which we go and knock on doors, we go on estates and knock on doors and say did you know that there is recycling facilities down at the Emily Road and that you can do x y and z. So when you ask how do we get people involved it's not just television, it's not just magazines, it's probably going to their house and saying this is what you can do x, y and z, and going to them a month later and saying have you made any changes" (Woman, London, Group 1).

Fifth, trust in the information source appears to be as important as the content of information, which should be factual, clear, easy to understand, impartial and consistent.

"Television is ideal for that provided its in depth enough, you would need to have some real facts and say look at the alternative energy sources. Try and get some consensus amongst the experts as to like how much could be produced that way and

what it would cost and what the implications of that are.” (Man, Guisborough, Teesside)

“And you kind of need it to be objective and not loaded one way or the other” (Woman, Guisborough, Teesside)

“It’s got to be I think, you know, something that people could get information from they could use to come to their own views about things rather than just pushing one particular line. And it’s got to be able to answer lots and lots of questions that people have” (Man, Guisborough, Teesside)

“And on a level that people could understand” (Woman, Guisborough, Teesside).

“You need the arguments presented with clarity, at the right level by somebody who you can trust. So you would have to find some kind of public figure that people would trust to put across the argument and you know could present it clearly. But you know you would have to make it interesting, you know not just have somebody talking to you. You would have to have ways of making it interesting and sort of presenting” (Man, Guisborough, Teesside).

“I think you need someone credible, that’s the thing that you’ve got to do” (Man, Eston, Teesside).

“Someone who knows that does really care” (Woman, Eston, Teesside).

Sixth, people suggested that children should learn about hydrogen and energy at school, so that they could also get the message across to their parents.

“I think one other way is erm in the long term of stimulating interest is through the schools because just think of how many parents have stopped smoking because the kids at school have gone home and said you are killing yourself and this” (Man, Redcar, Teesside).

“Hydrogen competition for children and so they could take things home and show their parents to help them do it” (Man, Redcar, Teesside).

“The local people need to be consulted and informed about it, quite how high a level you would go I’m not sure. But I certainly think school children ought to be involved in the earliest stages so that by the time it starts to come into function then they know what it is about.” (Woman, Guisborough, Teesside)

“You definitely want an answer which way to do it is to get it into schools, some sort of format for the kids take that home and ask your parents as a kind of energy source, get your dad’s opinion on this and make it some sort of project just to drive the point home” (Man, Eston, Teesside).

Seventh, people thought that seeing hydrogen ‘in action’ would raise awareness and facilitate its diffusion as a technology.

“You’ve already got them running courses, put a bus in here. This is clean power” (Man, Eston, Teesside).

“Advertise it for what it is, paint it, make it stand out bright pink on yellow dots, but let people know what it is” (Man, Eston, Teesside).

“It’s like the sign post, everybody’s seen the sign post but nobody knew it was hydrogen powered. Are they not shooting themselves in the foot there?” (Man, Eston, Teesside).

“From an advertising point of view as you said before about actually building something that is a working model, that people can go and visit and the media will be there and then you can get it into the wide public as well and then you can actually see something happening. Because until you can actually see something happening you don’t really know, you just think that’s scientists playing and it’s got nothing to do with me” (Woman, Llanelli, SW Wales).

“Well the one thing that you talk about community. One thing I like is like Putney Shopping Centre they always have people saying you know come switch energy supply, come switch energy supply. If they had a display saying look we have powered this laptop on this hydrogen cell I think that would be convincing you know. On my way, do all the shops whatever. Instead of someone trying to tell me to change my energy supply. If someone showed me, in front of me, right there while I had to go to Putney Shopping Centre anyway and they said this is how we powered a laptop I would be impressed by that” (Woman, London, Group 1).

Another woman stressed that mobile phones could be a good marketing strategy:

“Well like [another woman] said, because I mean if this is an ongoing thing and you want to get the next generation involved then mobiles are a very good way to do it because you have got to have the latest mobile don’t you so, so that would be the thing to have” (Woman, London, Group 1).

Finally, despite a broad agreement that citizens need to be informed and involved in decision-making, some people questioned the assumptions that underpin common discourses on public engagement, identifying shortfalls and open issues, such as the willingness to be involved and how to reach consensus on decisions.

“In answer to the last question you posed if you actually make information readily available to anyone who wants it, that’s good. But I think you will find most people will just accept whatever they are given as long as it doesn’t discommode them in any way. If it is not too expensive they don’t mind. As long as they can live a comfortable life then they are not bothered. That’s really it, we are all being selfish” (Man, Carmarthen, SW Wales).

Another man added:

“I don’t think you would get very far if you just had these Juries or whatever you say and Committees you are just going to go round in circles. You have basically got to get feedback maybe, press on say use mass media to convince everybody and that sort of thing. You sort of involve umpteen pounds of people they are all going to have different view anyway” (Man, Carmarthen, SW Wales).

4 Discussion

This section aims to explore the findings from our research in greater depth and to compare and contrast them with evidence from previous fieldwork conducted within the UKSHEC project and other research carried out across different disciplines of the social sciences, such as geography, sociology, ecological economics and psychology.

4.1 The broader context: environmental values and current behaviours in energy use

The second round of focus groups allowed us to gather significant insights on how people understand and conceptualise environmental problems (climate change, global warming, air pollution, etc.) and how, and to what extent, they relate them to issues around energy consumption at home and in personal transport.

Connecting the global to the local

When discussing the impacts of using fossil fuels to produce energy, people acknowledged that these are global issues and as such they need to be tackled on a global scale. Some people displayed a rather articulated knowledge of and interest in environmental and energy issues, and could relate them to international politics and economic phenomena. However, a recurrent claim that was made in all groups is that, even when people are aware about energy and environmental problems and consider them relevant as political issues, they find it difficult to connect them with their daily life and preoccupations. The lack of saliency and immediacy of issues around energy and the environment in people's everyday experience has been found in several surveys (for a review see Ricci, 2006), which indicate that social issues such as health, crime and education are the principal top-of-mind concerns. The effects of climate change are generally considered distant, both in space and time, and are not easily linked to individual behaviours in areas such as using electricity, providing heating and cooling in the home, getting around and travelling.

Blame and responsibility

We found a tendency, among those who participated in our groups, to place both blame and responsibility on 'others'. In the London groups, people thought that industry and business are the biggest contributors to energy consumption and global warming, and that citizens have a negligible role. In the other groups, people blamed the US and rapidly growing economies, such as China and India, for not complying with environmental standards and international agreements. As a consequence, most people felt it should be those countries, and industry and business to make the greatest sacrifices to avert energy and environmental crises rather than individual consumers. There were a few people, however, who felt that taking personal responsibility for the environment in a global sense was almost a moral obligation. Some of our participants felt that any unilateral attempt by the UK Government to act alone would be useless or, at worst, counterproductive. At the same time, however,

the role of Government was advocated as a leader in building commitment, among the citizens as well as internationally, and driving the change.

The value-action gap

One key finding from this second round of focus groups is that, despite their self-proclaimed concerns about the environment and energy futures, and pro-environmental attitudes, people do not seem to be actively and radically changing their behaviour with the primary purpose of tackling problems such as energy shortages or global warming. Behavioural changes (such as switching off lights when not used, avoid leaving appliances on stand-by, buying more efficient products, etc.) appear to be 'marginal' rather than 'radical' and are dominated, in people's narratives, by recycling. Such actions may well reflect a genuine willingness to take personal responsibility for the environment, however, we need to take into account the possible bias of social desirability in people's statements and that other intentions may motivate environmentally-friendly behaviour. In particular, as in the first focus group series (Ricci *et al.*, 2006), it emerged that positive attitudes towards the environment are not generally a sufficient condition to motivate energy-conscious behaviour. In some cases, they are not even necessary: many people admitted that financial incentives or cutting down bills can be stronger drivers of reducing energy consumption. The mismatch between values on one hand, and actual behaviour on the other, is a recurring finding from numerous studies seeking to understand public behaviour towards the environment (for a review, see Ricci, 2006 and Darnton, 2004a and 2004b). Such disconnection, termed 'value-action' or 'attitude-behaviour' gap, refers to the evidence that awareness of certain issues (such as the negative impact of individual behaviour on the environment) as well as positive attitudes towards the environment do not necessarily lead to pro-environmental behaviour.

Habits, norms and convenience

As a growing body of social research in this area demonstrates (for a review, see Jackson, 2005), 'linear' models of human behaviour, based on the assumption that people are perfectly rational agents seeking to maximise their utility function, have serious limitations in understanding and predicting behaviour. Behaviours are the outcome of a complex interplay among many different factors, some of which depend upon the individual and their own psychology and personal circumstances, and others pertain to the cultural, social, economic and institutional context in which people live and interact (Briceno & Stagl, 2006; Schaefer & Crane, 2005; Connolly & Protero, 2003). Energy consumption encompasses many different behaviours, most of which are taken for granted as part of people's routines and are not usually understood in terms of their impacts on the environment. The work of British sociologist Elizabeth Shove exploring lay definitions of comfort, cleanliness and convenience (Shove, 2004 and 2003) indicates that understanding how to change behaviour in the way people consume material goods and services requires taking into account that consumption reflects well-established patterns of life, social and cultural norms, habits, needs and aspirations (see also Barr, 2003 and Stern, 2000). When participants in our groups were asked to discuss how behaviours could be changed in light of the problems with energy availability and its impact on the environment, they talked about the difficulty, and aversion, to change certain behaviours, chiefly the use of private transport, because it would diminish the levels

of comfort and convenience people are used to. Such behaviours are deeply ingrained in people's lifestyles and through them citizens construct their identities, status, social affiliations, etc. Other studies have shown that people can take up new, pro-environmental actions when they fit into their current way of living (Hobson, 2003 and 2001).

Infrastructure and institutional lock-in

Across all groups we found a consensus that in many circumstances people are actually 'locked' in certain types of behaviours and activities because of the limitations available infrastructure (in terms of technological options, design, etc.) and institutional setting (such as regulations, standards, laws, etc.), which citizens feel unable to change. A frequently cited example refers to building regulations and house design as strong barriers to the diffusion of energy-saving and renewable energy technologies in the built environment. One group in London complained about the large amount of unnecessary packaging used by supermarkets, while in rural areas some people pinpointed the lack of an efficient public transport network as a cause of car dependency. In sum, people acknowledged that there are many cases in which personal choices are in fact dictated by what is available and affordable to them. The importance of 'structural' factors in shaping consumer behaviour is highlighted by Sanne (2002), who in particular addresses the effects of working life conditions leading to a work-and-spend lifestyle, the conditions of urban living and the impacts of pervasive marketing.

People as 'consumers' and 'citizens'

When participants in our groups discussed their willingness to change behaviour in energy use, a conflict emerged between the short-term economic and social interests of 'consumers' and the long-term environmental and social concerns of 'citizens'. On the one hand, people were reluctant to take radical steps to significantly alter the way they used energy, in the home and in personal transport, because they felt that such a change would not be effective in a global picture and it would diminish their freedom, comfort and convenience. Most people stressed that they would need to have private benefits from a shift in behaviour, for it to become sustained over time. On the other hand, environmental values and concerns for the next generations could encourage people to change. In our groups, people frequently mentioned their loved ones, such as children and grandchildren, when identifying cogent reasons to change behaviour as individuals.

4.2 Changing behaviour in energy use

Changing people's behaviour in the way they use energy and encouraging the take up of new, environmentally-conscious behaviours is clearly a very complex undertaking. In some cases, it has happened with recycling, which many of our participants regarded almost as normative and part of their everyday behaviour. Not all new actions, however, are so easy to fit in people's daily routines and become powerful means of social identification. Behavioural change, in our groups, was always conceptualised as a collective initiative that can occur within broader changes

in the way technologies are designed and become embedded in people's everyday lives, and in the regulatory and institutional approaches to energy saving, efficiency and environmental protection in all sectors, from private business to government.

Behavioural change as a collective initiative

Findings from this final series of focus groups largely resonate with evidence gathered from the first focus group series. In both series we found a widespread belief that people lack agency in making significant changes to tackle the problems associated with energy generation and consumption, and that people need significant persuasion to change their behaviour in energy use. In particular, citizens need to be convinced that they are part of a wider, structured plan, led by the government, backed by credible international agreements, and endorsed by all actors of society, including industry and business as well as the people.

Similar evidence, concerning the UK public, emerged from a recent study conducted by the Sustainable Consumption Roundtable (2006), which was a joint initiative from the National Consumer Council and Sustainable Development Commission, and funded by Defra and the DTI. The study used a structured, deliberative Consumer Forum involving over a hundred people, who deliberated about their aspirations in four areas of consumption (at home, food and drinks, getting around and holiday travelling) and how they fitted with policies encouraging sustainable consumption. The key message is that people are willing to see new policies introduced that will help them change their behaviour to tackle environmental problems such as climate change. However, they need the government to set an example and create incentives to facilitate citizens to 'unlock' from unsustainable behaviour. People need to know they are not in isolation to make changes, but their effort is matched by that of other people, industry and business.

Fairness

In all focus groups people discussed the personal costs of changing behaviour and taking up new energy efficient or renewable technologies. There was a general agreement that a shift towards energy-conscious behaviour could not imply higher costs to consumers as people on low income, such as pensioners and the unemployed, would not be able to afford it. Issues related to fairness appear to be important in how people think about behavioural change and they need to be accounted for to avoid that environmentally-friendly behaviour becomes associated with the (negative) perception that it will increase social inequality and be a 'luxury' that only the affluent can afford (see also Hobson, 2002 for further discussion on the role of social justice in shaping people's understandings of behavioural changes).

Guidance and information

All groups agreed that people need to be better informed on the choices available to them and need guidance on what actions they need to take up to effectively contribute to combat climate change and save energy. The demand for more information may reflect a 'knowledge deficit' that people feel on their part, however, such 'deficit' is not about information as a collection of notions and facts, but rather of practical advice people can trust and credible examples they can follow. Means of

communications such as television, newspapers and radio (both national and local) were frequently cited as preferred information channels, however, also 'informal' ways of getting messages through were indicated, like word of mouth among friends and education of children at school.

Trust

Trust and especially distrust are key elements shaping and mediating beliefs, attitudes and expectations across all groups. People expressed a clear distrust of most politicians, with the exception of local politicians such as Ken Livingston, Mayor of London, and Ray Malone, Mayor of Middlesbrough, two controversial but rather charismatic figures in bringing about changes in their respective areas. Distrust of national politicians causes suspicion when issues like climate change and energy saving are seen to suddenly become priorities in the political agenda or during elections. People do not trust industry and business to take the environmental cause seriously, and they also distrust 'other people' to become committed towards the environment and energy saving.

4.3 The public acceptability of hydrogen energy and technologies

Concerning hydrogen energy and associated infrastructure and technologies, people expressed neither full support nor outright opposition. It must be noted that 'acceptability' should be conceptualised as a *continuum*. There are likely to be differing degrees of acceptability (or acceptance), and different reasons for acceptability, among different groups. According to our focus groups, acceptability is mediated by, and is contingent upon, numerous complex factors, including cost, safety, effectiveness in tackling climate change and improving energy security, performance and convenience. Focus groups with the public indicate that the acceptability of hydrogen technologies can only be assessed in relative terms, i.e., comparing benefits, costs and risks with existing and other alternative energy systems and applications. Focus group members spontaneously posed questions about the entire cycle of hydrogen production, distribution and use, effectively adopting a 'whole systems' approach.

In practice, acceptability can only be gauged when there are real 'demonstration' projects available for inspection, which enable people to evaluate how the new technology connects with their everyday lives, needs and aspirations. Our findings suggest that how people make sense of hydrogen does not only depend upon the specific technologies and their characteristics, but also on the context in which they will be developed and the process by which they will be introduced. People do not expect to become 'experts' in hydrogen use: they expect to be able to manage their lives with no additional worries and concerns, and to be able 'to forget' (as one of the participants put it) that the fuel they may be using is hydrogen, as they have done with other technological innovations (new types of fuels, mobile phones, etc.).

Communicating about hydrogen, and new energy technologies in general, should be varied in breadth and depth, to account for a heterogeneous public with different levels of understanding. People in our groups needed to receive sound explanations about the areas in which hydrogen could really be beneficial (globally and for the

consumers). However, the prerequisite is that people are interested in such issues and persuaded that they are relevant for them and their everyday lives.

Our findings resonate with evidence from a study of public perceptions and understandings of underground coal gasification (UCG) in the UK, carried out by Shackley and colleagues (2006). Similarly to hydrogen, UCG is a technology at its very early stages of development and public awareness is rather low. Despite this, people acknowledged the beneficial aspects of it but needed to know the broad picture about UCG, in particular how safe it would be for humans and the environment, whether it would be cost-effective and bring potential benefits to the local community. This research confirms that complex contextual and socio-cultural factors are key in understanding how people's attitudes, perceptions and beliefs are shaped.

4.4 Public engagement

Although public participation in decision-making over energy futures was generally favoured and expected as an expression of democratic principles, people emphasised the barriers rather than the benefits. It would be difficult, for example, to involve those who are not interested, or those who think that energy issues are not their immediate and most relevant concern. Reaching consensus on the decisions to take would be also be a complex task, as it would require the negotiation of different and conflicting interests and agendas.

Similar evidence is reported in a study conducted by MORI (2005) exploring, through a quantitative and qualitative approach, public attitudes towards public engagement with science, awareness of and interest in consultation about science and technology, and trust in science and scientists. The study indicated that people are supportive of consultation and participation, despite having a very low awareness of it, but preferably on scientific issues that are perceived to have a direct bearing on their lives.

'Public engagement' strategies cannot rely on providing information alone; public engagement requires public debate and deliberation, targeting different audiences and groups, using 'multi-methods'.

5 Conclusions

Most participants in our groups gave positive feedback about the meetings, as they provided an informal platform where they could engage in an open debate about the role of hydrogen in a future energy economy, learn and ask questions, and exchange ideas with peers.

The debate about hydrogen and its 'public acceptability' took place in the wider context of energy consumption and the different approaches by which society can shift towards a more sustainable energy future. One key finding is that 'acceptability' itself is problematic as a concept. Many commentaries about a future hydrogen economy are replete with the term 'acceptability', which is often equated to the lack of explicit public opposition, generally on the basis of risk perception. Evidence from our research suggests that such conceptualisation is too narrow and misses other key aspects and dimensions by which people make sense of new technologies and 'consume' them.

Hydrogen technologies, from production to applications, will have different impacts on people's lives, depending on the local context in which they will be developed and the process by which they will be introduced. Acceptability, in its broader meaning, will include issues related to the changes in behaviour that will be required to take up hydrogen technologies (for instance, due to the different safety risks posed by hydrogen), to the added benefits (in terms of comfort and convenience) they will bring to consumers, their costs (both in monetary terms and as environmental consequences), their effectiveness in tackling energy and environmental problems, and the overall regulatory and institutional framework in which they will be embedded.

Findings from our fieldwork also indicate that distrust is widespread, within and between different social groups, between citizens and the realm of national and international politics, and between consumers and business and industry sectors. In this context, public demand for credible policies, communication and participation on one side, and government's attempts to shift behaviours on the other, are likely to be more difficult to be met.

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