



Public Acceptability of Hydrogen: Lessons for Policies and Institutions

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1. Introduction

This paper builds on research carried out as part of the UK Sustainable Hydrogen Energy Consortium (UKSHEC). UKSHEC is a long term research programme funded under the EPSRC's SUPERGEN programme, which supports research in sustainable power generation and supply. UKSHEC combines scientific research into innovative methods of hydrogen storage and generation, with a broader socio-economic approach that aims to examine the role of hydrogen technologies within future energy systems, as well as social and political structures.

The overall objective of the public acceptability theme has been to facilitate informed public debate about the likelihood and desirability of a hydrogen economy. This paper builds on research from the public acceptability theme, highlighting insights in relation to other work packages, particularly Analysis of Policies and Institutions (WP3.3b) and Regional Infrastructure Drivers (WP3.1b).

The research for this paper was carried out collaboratively with colleagues at the University of Salford; a parallel working paper ('Understanding the public acceptability of hydrogen') has been produced that explores the broader aspects of public acceptability. This paper is available from www.psi.org.uk/ukshec

The research for this paper was carried out in three locations where hydrogen energy developments were either planned or already in operation. These were Teesside, South West Wales and London. The research reconvened the focus groups that were engaged in discussions of risk (WP3.2b) that took place between January and March 2006 (see Ricci *et al.*, 2006). This approach of reconvening focus groups enabled researchers to build upon existing knowledge within the groups and enabled more detailed discussions of the complex issues.

A total of seven focus groups were held between October and November 2006, each with between three and thirteen participants. The team at Salford (P Bellaby, R Flynn and M Ricci) organised and facilitated the groups in Teesside and SW Wales; the London groups were organised and facilitated by J Tomei and N Hughes at PSI.

The focus group discussions addressed several issues related to acceptance of a hydrogen economy. Prior to the focus groups, participants were sent a set of postcards which provided information about a possible hydrogen economy. A presentation, given during the discussions, built on the information given in the postcards and also provided information about planned or current projects in the group's regions. The discussions lasted around one hour and were facilitated by members of the project team.

The remainder of the report is structured as follows; part two provides an overview of public engagement, firstly in science and technology and secondly, with hydrogen. Part three describes the methodology used in the Public Acceptability work package. Part four contains the thematic analysis of the qualitative data as it relates to policies and institutions, and is divided into four themes: Environmental concern; Responsibility; Communication; and Additional themes. The final section,

contains the conclusions and recommendations for policies and institutions that have arisen from the research.

2. Public engagement with hydrogen

Science, technology and innovation are central to economic growth and improving quality of life in today's knowledge-based society but a series of high profile controversies, such as the foot and mouth crisis, and the debate surrounding genetically modified crops, have arguably led to an erosion of public confidence and trust in science and technology. This 'crisis of confidence' in science and technology has led to the development of more inclusive, participatory approaches to public engagement and technology assessment. It has been argued that engagement is still too often restricted to the downstream end of the innovation cycle, occurring only as technologies approach commercialisation (Wilsdon and Wills, 2004). 'Upstream' engagement highlights the idea that engagement should occur early enough to provide opportunities for the public to influence decision-making in science and technology, and for potential objections to be addressed early on in the development of a technology (Royal Society, 2004; Bellaby *et al.*, 2006).

Public acceptability of hydrogen will be fundamental for the successful development and deployment of a hydrogen energy system because how the public perceive hydrogen will have implications for its success or failure. Engaging the public with hydrogen is therefore essential to the development of a hydrogen energy system, enabling potential objections and concerns to be addressed early on. Despite concern amongst experts that the public may react negatively to hydrogen due to associations with the Hindenburg disaster and the hydrogen bomb, research into public acceptance of hydrogen has only recently begun (O'Garra *et al.*, 2005). Research into public acceptance of hydrogen to date has largely focused on specific projects or applications of hydrogen (see for example Dinse, 1999, 2000; O'Garra *et al.*, 2004; Mourato *et al.*, 2004. For a comprehensive review of the available literature on public acceptability and hydrogen see Ricci, 2006). This focus on specific aspects of hydrogen fails to highlight the importance and complexities of the whole energy system.

Exploring public attitudes towards hydrogen is challenging for two key reasons. Firstly, a hydrogen energy system is complex and there are uncertainties in all stages of the energy system- the production, storage, distribution and use. Secondly, there is relatively little public awareness of hydrogen and its applications (Bellaby *et al.*, 2006; Ricci, 2006). These challenges lead to difficulties when communicating these diverse technical issues, particularly when they are remote from peoples' everyday experiences (Ricci, 2006, Flynn *et al.*, 2006). A further complexity lies in the transition to a new energy system. People are not being given a new product but rather are being encouraged to switch to a product with few additional consumer benefits, instead its main advantages are in terms of public goods. A transition to a hydrogen economy will therefore, unlike some other recent technologies, require strong drivers.

For hydrogen to become an important part of the future energy system, public engagement in these complex issues is essential (Ricci, 2006). Understanding peoples' perceptions of, and concerns for hydrogen will allow potential objectives to be addressed, while providing opportunities for the public to influence both policy and

the direction of technological developments before institutions are committed to a particular course of action (Bellaby *et al.*, 2006).

Policies and institutions for hydrogen in the UK

In 2003, the Department for Trade and Industry (DTI) commissioned a strategic review of the UK potential for hydrogen and fuel cells. Hydrogen energy has the potential to help meet key energy objectives that were outlined in the 2003 Energy White Paper, namely security of supply and the target for sixty percent carbon reduction by 2050. The study concluded that six hydrogen energy chains were able to offer cost-effective ways of meeting these energy objectives, all of which were transport related (E4 Tech *et al.*, 2004). The transport focus of the report has quickly become a 'widely accepted cornerstone of the UK hydrogen debate' (Hughes, 2007, 12). To date, the UK government has also adopted a 'light touch' approach to the development of a hydrogen economy and has demonstrated a reluctance to be seen to be 'picking winners' (Marvin and Hodson, 2006).

At the local and regional levels, the role of local actors and institutions has been identified as being crucial to drive the implementation of hydrogen and fuel cell projects. Local motivations for the development of hydrogen economies are highly specific to local contexts, and are dominated by concerns relating to local economic development, and the regional context set by other policy agendas. As a result, more than one kind of hydrogen economy can exist at the same time in different regions. Informal institutions are also important in many hydrogen-related activities in the UK, examples of such institutions include the knowledge that places have of how to gain public acceptance, and the culture in different locations that will affect the acceptance of hydrogen developments (Marvin and Hodson, 2006; Hughes, 2007).

There is currently, therefore, little alignment between UK policy aspirations and existing business and regional activities, with national Government's focus on transport not reflected by either business or regional interests in hydrogen (Hughes, 2007). For a more comprehensive review of the current UK policy and institutional context, readers are referred to Hughes (2007).

3. Research methodology

In order to fully explore the research objectives a qualitative methodology, based on focus groups, was used. Qualitative research is used to gain a deeper understanding of a research subject, providing contextual and descriptive information; while group processes enable participants to explore and clarify their views in ways that would not be possible using other research methods. To fully explore participants' understandings, assumptions, aspirations and expectations of sustainable energy and hydrogen reconvened focus groups were used. Reconvened focus groups provide a more deliberative approach, giving participants time to consider and reflect on information provided in the first discussion. This deliberation allows more detailed discussions of the issue to ensue. Attrition is an important consideration in focus group research, particularly for reconvened groups, however it was felt that the benefit of building on existing knowledge enabling more in-depth discussion of sustainable energy and hydrogen warranted this risk.

The focus groups were held in three regions where hydrogen projects are either planned or are already in operation.

- *Teesside* has a long-stranding tradition in the chemical and petrochemical industries, and as a result has an established infrastructure for hydrogen production, storage and distribution. Regional authorities are attempting to improve the local economy by capitalising on existing skills and facilities, and several projects around renewable energy and hydrogen are in development.
- *South Wales* is in the process of planning several projects to create a sustainable economy through the use of hydrogen energy, such as the Hydrogen Valley Initiative and the H2 Wales project.
- *London* is witnessing several developments aimed at exploring the potential of hydrogen, especially as a means for tackling air pollution, and is part of the EU wide hydrogen bus CUTE project. The Mayor of London and London Hydrogen Partnership are actively promoting a series of initiatives to develop hydrogen energy projects.

Participants for the focus groups were recruited through existing local authority consultation panels, a representative cross-section of the local population. The groups were not entirely representative because members of consultation panels have more interest in public issues than average members of the public, but due to the complex nature of the subject it was felt that some interest in environmental and energy issues was important, although this was not a requirement for recruitment.

Recruitment for the groups took place in December 2005. The first set of focus group were held between January and March 2006, and explored issues relating to energy, perceptions of hydrogen, safety and risk. At these discussions, participants were asked if they consented to participating in a second round of focus groups. Participants were contacted again in late August 2006 and invited to the second round of discussions to take place in the Autumn.

In total, seven focus groups were held between October and November 2006. The discussions took around an hour and were facilitated by members of the research team.

- Three were held in Teesside (Eston, Guisborough and Redcar) and were facilitated by R Flynn and M Ricci
- Two were held in South Wales (Carmarthen and Llanelli) and were facilitated by P Bellaby and M Ricci
- Two were held in London and were facilitated by J Tomei and N Hughes

The groups varied in size from three to nine participants and were mixed in terms of gender, age, socio-economic group and ethnicity. Annex A summarises the backgrounds of the participants who took part in the second round of focus groups. More detailed information cannot be provided in this report, due to ethical requirements of anonymity.

The overall objective of the focus groups was to facilitate informed public debate about the likelihood and desirability of a hydrogen economy. Each group addressed a number of issues relevant for energy and hydrogen, such as behaviour change, micro-generation and willingness to change. A presentation provided images and information about current hydrogen technologies and current or planned projects in the focus group area, and was used to facilitate discussion on the desirability of a hydrogen economy. A final topic of discussion related to communication and engagement with hydrogen and other energy issues. Readers are referred to Annex B for the discussion guide.

The research data was analysed using NVivo v7, a qualitative data analysis software tool that allows the inclusion of large amounts of data and the merging of different strands of analysis from the different focus group sites. NVivo was used in the coding of the data and the organisation of codes into themes. These codes and themes were then developed further by researchers in the context of policies and institutions.

4. Analysis

The analysis of the focus group discussions found three main themes emerged that were important for policies and institutions. These were: Environmental concern; Responsibility; and Communication. A number of other themes emerged that were unrelated to these key themes, which have been grouped under 'additional themes'.

Environmental Concern

A major theme to emerge from the focus group discussions was that of concern for the environment. Participants discerned a growing awareness about environmental and energy issues both amongst individuals and in society and government.

"People are becoming more and more interested. I mean there has been quite a big media campaign in erm Wales and I think it has been on the BBC news as well about recycling, encouraging people to recycle more and to compost and things. So that is becoming more, not socially acceptable, but that it is becoming more of the norm and it is being promoted and I think it will follow through that the energy consumption will be the same." (Female, Wales, Group 2)

However, some participants were sceptical about the reasons for the current high profile of the environment.

"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." (Male, Teesside, Group 1)

All groups were aware of key issues, such as recycling and reducing energy consumption, although the level of environmental knowledge varied within the groups, with some individuals showing greater awareness of the issues than others. Despite growing awareness and recognition of environmental issues, the difference between the relatively short-term interests of consumers and the longer-term interests of citizens was observed by participants. The difficulty this apparent dichotomy causes in prioritising the environment in people's day-to-day lives was commented on by participants.

"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." (Female, London, Group 1)

One participant argued for this distinction between the consumer's personal and local priorities and the citizen's wider global priorities.

"I think to be honest that's a different top ten, that sounds like a top ten of personal things but if someone said what is your top ten of political issues then energy would be in mine. I think you know whether you have a nice holiday,

that's a very personal thing and that's a different kind of, no it wouldn't be in mine, but if we are talking about political issues then energy would be very high, you know, be very near number one." (Male, Teesside, Group 1)

Pro-environmental behaviour change

The subject of pro-environmental behaviour change was mentioned by participants in all of the focus groups. Participants discerned a value-action gap; although they knew of and intended to act more sustainably, they perceived many barriers to such actions. Convenience and cost were widely perceived as the biggest barriers to adopting more environmentally sustainable behaviours.

"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, other wise I think it would be hard to make that decision." (Female, Teesside, Group 2)

"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." (Male, Wales, Group 1)

Although one participant had gone to considerable lengths to adopt more environmentally sustainable behaviours, a more widely held view amongst participants was that individuals can have little impact on the environment (see also Responsibility).

"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." (Male, Teesside, Group 2)

"I am doing things like switching off of plugs and not keeping televisions and computers on standby. They are small efforts, but I think what she has been saying about the big powers of the future like the Koreans, like the Chinese and America which has already done a lot of damage and continues to do a lot of damage. I think our little bit seems insignificant, but I want to feel in myself that I am doing my tiniest towards an improvement." (Female, Teesside, Group 3)

The importance of incentives, to encourage the adoption of pro-environmental behaviours, and subsidies, to increase micro-generation, was also mentioned in the all of the focus groups. One participant commented on the successful use of incentives in the past to encourage change.

"I think you have to look erm at history, and I remember the switch from petrol to diesel and there was just incentives. You know, its going to be cheaper for people to run a diesel car rather than a petrol one." (Female, London, Group 1)

Another participant felt that incentives would be necessary to encourage individuals to use more sustainable forms of transport.

“I do think a structured, measured approach and many of these things will I suppose have an element of carrot and stick, incentives for people to perhaps give up forms of transport, restrict it and use other taxation, unfavourable taxation maybe on one form of transport and more favourable on another.” (Male, Teesside, Group 1)

The use of taxes to encourage change were conditionally supported in the focus groups, on the proviso that they did not lead to greater social inequalities.

“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.” (Male, London, Group 1)

The groups also acknowledged the issue of timescales when dealing with environmental issues, such as who acts and when, and who benefits and when.

“Part of the problem I suspect is that people of a certain age will they see a measurable change in their, you know, because they might say we’ve got better transport or better fuel economies things like that will the outcomes of that be sort of measurable within say even their lifetimes. What we do now will we be able to see the effects, probably our children and grandchildren will but will we, will we convince people to make a change. Perhaps it’s more of a belief than a measurable outcome because the timescales must be quite extended.” (Male, Teesside, Group 1)

Apathy

The issue of apathy also arose in the focus group discussions and participants commented on a perceived lack of interest in environmental issues.

“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.” (Male, Teesside, Group 2)

“I think basically most people in this country today have gone totally lethargic and most people I talk to do not give a damn about anything. All they give a damn about is the monthly pay check.” (Male, Wales, Group 2)

Discussants also felt there was a lack of awareness amongst the public about the environment and, in particular, where energy comes from.

“You’ve got a national grid and to be honest people don’t care how their lights work. If you put a light under your kettle you don’t say how’s this kettle, you are not bothered are you, you know.” (Male, Teesside, Group 1)

Energy security

Energy security was another issue that arose in relation to discussions about renewable energy. Participants were concerned about the ability of countries, such as Russia, to cut off energy supplies.

“I mean there are forms of energy that would mean we would have to rely on other people like Russia for example but then if they suddenly decide to switch off the supply then where are we, you know. There are all sorts of risks, of different kinds of risks.” (Female, Teesside, Group 2)

“I also think the country needs some sort of energy security because I think that Russia could cut us off quickly you know.” (Male, Teesside, Group 1)

There was wide support amongst participants not only for a variety of energy sources, but also for decentralised, locally produced energy in order to lessen concerns about future energy supply.

“But there is not one thing that we could rely on that would give us a sustainable energy strategy that wouldn’t leave us vulnerable, that would be safe as well, you know, there isn’t a single perfect solution unfortunately so we need to go along the route of pursuing all different solutions to mitigate the risk.” (Female, Teesside, Group 1)

“I would like to see as wide a variety [of energy sources] as possible, because I think fuel terrorism is a very real possibility in the future... Not putting all your eggs in one basket.” (Female, London, Group 1)

Given that energy was recognised as an important issue for the environment and society, it is perhaps not surprising that support for renewable and alternative sources of energy was widespread amongst participants in the focus groups.

“Wouldn’t that be great you know, there is all these landfill sites everywhere if we could actually get something from all the waste that we churn out every week.” (Male, Teesside, Group 1)

Aesthetics

Despite support amongst the groups for renewable energy, there was concern about the visual impacts of some renewable energy installations, such as wind turbines. This was perceived by some participants as a form of NIMBY-ism.

“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.” (Male, Teesside, Group 3)

Aesthetics was one of the themes in which regional differences arose. Participants in the Teesside focus groups, possibly due to the industrial history of the region, were

more willing to consider large energy installations and it was felt that such projects might bring benefits to the region.

“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 sadly has gone.” (Male, Teesside, Group 1)

By contrast, aesthetics was mentioned only a couple of times in the South Wales groups and was not mentioned at all in the London groups.

Hydrogen and the environment

A final theme related to environmental concern that emerged from the focus groups was that of hydrogen and the environment. The main benefit of hydrogen was perceived by participants to be in the reduction of carbon dioxide and other pollutants.

“Well you are getting rid of all the pollution from fossil fuels and so forth. The overall view you know.” (Male, London, Group 2)

“It depends how the hydrogen is made really doesn’t it? If it is made from a source that doesn’t create a lot of carbon dioxide then they have improved things.” (Female, Teesside, Group 2)

One participant argued that although a switch to hydrogen would cost more, it would enable us to continue with our current way of life.

“I don’t know the technical jargon for all of this, all I tend to feel is that we will have used the system over the last 100 years for the oil and coal and everything else and that is going to run out in the future anyway so this alternative way of producing energy or whatever, hydrogen, has got to be a way to look forward to think about whatever the cost because if we want to maintain our style of life and the way we live then it is going to cost us.” (Male, Wales, Group 1)

However, although participants recognised the potential benefits of hydrogen, their support for the energy carrier was conditional. Firstly, participants were concerned that no environmental or sustainability benefits would be obtained from a switch to hydrogen if fossil fuels and nuclear power were used to produce hydrogen.

“Well I was going to say, I know nothing scientific or anything, but just reading this card, because from the last one I thought that hydrogen was the answer, but I am just a little worried having read the cards that hydrogen if I can read it correctly can be produced from fossil fuels and nuclear and all the rest.” (Female, Wales, Group 2)

Secondly, participants were concerned about the additional step in the energy chain that is needed to produce hydrogen.

“The biggest selling point might be and I think it is a great thing and it’s a clean fuel is just that it appears to me just to generate hydrogen we put another step in the energy chain and that’s the biggest thing to me. I mean we’ve got wind turbines that generate electricity, why do we have to put another process in to produce hydrogen? How can that possibly be energy efficient and that’s the biggest argument and I have to get my head round that. You stick a wind turbine and it generates electricity at the end of it.” (Male, Teesside, Group 3)

Thirdly, participants wanted to know more about the benefits of hydrogen compared to other energy carriers.

“What is the difference between hydrogen and electricity then, where you are using the same, burning up the same things, natural gas, coal etc. in producing this form of energy? Electricity is clean, why go for hydrogen?” (Male, Wales, Group 1)

And finally, the difficulty in developing and deploying a hydrogen energy system was recognised.

Male: The thing about distribution and setting up a network, what comes first the network or whatever is going to use the gas that comes through it. You know it is chicken and egg situation.

Facilitator: They have to develop simultaneously don’t they.

Male: That’s right they have got to be in demand before you put in the facility. (Wales, Group 1).

Responsibility

‘Responsibility’ is an overarching theme that contains several distinct sub-themes:

- Attributing responsibility for causing climate change
- Attributing responsibility for dealing with climate change
- Unilateral vs. multilateral action
- Individual vs. collective action
- Regulation and taxes
- Trust

Attributing responsibility for causing climate change

Attributing responsibility for causing climate change is subtly different from attributing responsibility for dealing with climate change. A number of people suggested that the contribution of the UK to greenhouse gas emissions is small compared to the US, China, India and some other countries. That theme recurs and is discussed in more detail below in the section on unilateral vs. multilateral action. However, it was at the same time accepted that the UK and individuals in the UK do have an impact.

“I don’t think you can say it’s not worth us bothering because I think we do have to bother.” (Female, Wales, Group 1)

Unilateral vs. multilateral action

Many participants raised the apparent futility of the UK or individuals trying to prevent climate change when others carry on regardless.

“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.” (Male, Wales, Group 1)

One individual expressed this point much more forcefully than the others:

“Well I think it is all a bloody cheek personally. Erm, 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.” (Male, Teesside, Group 1)

There was a strong belief that to be effective multilateral action was necessary. A number of participants identified the US in particular as a barrier to international action.

“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.” (Female, Teesside, Group 2)

Although China and India’s increasing greenhouse gas emissions were mentioned by several participants, sympathy was expressed for China and other developing countries by a few.

“I think countries like China, are going through a change that we went through maybe 150 to 200 years ago when you got a move from agriculture to factory work and it is a massive development now in their economy. And people, whether we like it or not, say in China, are going to want the benefits of the better incomes that we all had all that time ago and we reaped the benefits.” (Male, Teesside, Group 1)

“I think we have to change the way because the Third World are going to want the same standards as us and it’s not just sustainable for everybody to have our standards, so we are going to have to meet somewhere in the middle. If they are coming up we are going to have to come down to.” (Female, London, Group 1)

Individual vs. collective action

In addition, many people were very conscious that voluntary individual action can easily be outweighed by the carelessness of others.

“But its sods law isn’t it, 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?” (Female, Teesside, Group 1)

Some people portrayed themselves as taking some action to reduce their energy consumption, but saw individual action as inadequate on its own.

“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. And cars, well you are into transport then, well you have got to get from A to B so there has to be some other sort of provision there.” (Female, Wales, Group 1)

Attributing responsibility for dealing with climate change

The responsibility for dealing with climate change and a transition to hydrogen was widely seen to lie primarily with government, then companies and only last with individuals.

“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.” (Female, London, Group 1)

One view was that when a lead was set by government people would follow, but others saw the role of the public less passively.

“It was worrying because its almost like well we’re aware of the problem but we’re actually waiting for someone 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.” (Male, Teesside, Group 1)

“Alright, everyone has to take part, the Government, and the population, its everybody’s responsibility. Because if we say we want it the Government is going to have to do it.” (Male, London, Group 1)

Some participants expressed the view that the wealthier had greater personal responsibility than the poorer.

"I'm generalising here, but my opinion is that poorer people have a smaller carbon footprint. They are the ones shopping in the market, they are the ones taking the bus, you know, look at the lifestyle in the carbon footprint. It is the wealthier who have bigger carbon footprints I think." (Female, London, Group 1)

Regulation and taxes

Regulation and taxes were both identified for government to bring about change. Regulation was most widely identified as the way for government to tackle the issues. For example, it was suggested that only energy-efficient light bulbs be allowed to be sold and that solar panels be mandated for new housing.

"One sort of peripheral to this is that we seem to be over regulating in so many different ways in this country that there is like energy efficient light bulbs. Everybody knows that if you use them they are a great way of saving energy, so why have we still got the choice between an energy efficient one and a non-energy efficient one." (Female, Wales, Group 1)

"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." (Female, Teesside, Group 2)

Taxation was also suggested by several participants as a way to bring about change.

"That's the only way you will ever change people, if they turned round and doubled the price of petrol." (Male, Wales, Group 1)

"If you want to move very quickly from A to B, taxing is the only way that's going to make people wake up immediately." (Female, London, Group 1)

However, there was also concern about using taxes. Firstly, they were perceived by some participants to have a disproportionate effect on the poor.

"Well it's like the tax on electric and gas it's a poor man's tax." (Male, Wales, Group 2)

"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." (Male, London, Group 1)

Secondly, there was suspicion from some individuals that the environment would just be used as a cover for raising taxes.

"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." (Male, Teesside, Group 1)

Trust

In several of the groups there were a number of remarks revealing lack of trust in what they are told, particularly by politicians. This phenomenon was most pronounced in the Teesside groups.

“The population has been told so many lies by government that at the end of the day they take most things, and they think well its all a big lie.” (Male, Teesside, Group 1)

“Everything the government says is not true, you know people tend to think it is. Now when people say Tesco's, all these companies, business controls government, companies control government and they tell what people what to do.” (Male, Wales, Group 2)

In a couple of cases it was expressed as disbelief that environmental problems such as climate change are real.

“Climate change is only an excuse for charging you more.” (Male, Teesside, Group 2)

“I do take it with a pinch of salt when the government says you're doomed type thing because we were all going to die of bird flu not too long ago. You know, they seem to have these scares, one minute its global warming is going to be a disaster.” (Male, Teesside, Group 1)

The open disbelief in messages from the government and implicitly from the scientific community relates to issues discussed in the section on communication.

Communication

Communication was another major theme to emerge from the focus group discussions. The importance of providing information to the public about environmental and energy issues was mentioned in all focus groups, although it was recognised that information would need to be tailored to meet the needs of different publics.

“I think initially you have got to stimulate the interest in right across the board and where do you start because we've identified that there are different levels of understanding and how we respond to it. But nobody is going to want to understand or 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, multi methods from the very simplistic right up for the more technically minded and scientifically minded... because their understanding will then be shared perhaps.” (Female, Teesside, Group 1)

Informal information networks were also considered important for the dissemination of information to a wider public.

“I’ll go home now and I’ll talk to my friends, my colleagues and its, information then goes on and because you’ve had correct information it hasn’t just been grapevine information ‘oh guess what’ its proper information, so you are actually passing on proper information.” (Female, Wales, Group 2)

One participant was concerned about the lack of information about hydrogen energy systems, arguing that expert and policy acceptance of hydrogen appeared a ‘done deal’.

“There ought to be more information about it, about what is actually going on and I mean this comes as a surprise to me just how far ahead you are with it and to me as a punter it is a done deal really. I mean what you are really trying to do is to get it across that this is what is going to happen.” (Female, Wales, Group 1)

It is worrying that, in these early stages of hydrogen energy, individuals already feel that they have little opportunity to influence the development of technologies. This comment leads us to argue that further engagement is needed in order to fully engage the public in an upstream debate about the development of a hydrogen economy.

Participants also argued for as many people as possible to be engaged and involved in debate about energy and environmental issues, despite concerns about widespread public apathy.

“It’s got to be acceptable so the more people involved the better isn’t it. It’s no good trying to impose it.” (Female, Wales, Group 1).

Several participants argued that getting people involved needed more than just advertisements on television or in newspapers, but that people need to be made aware that this was an issue that would affect them personally.

“It’s difficult to get people to think, to give an opinion on something unless they think it’s something that is going to affect their lives.” (Male, Teesside, Group 1)

“When you ask how do we get people involved its not just television, its 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.” (Female, London, Group 1)

One participant commented that emphasising the ‘doom’ aspect of climate change would encourage people to act.

“If you actually did some kind of TV advertising campaign, if you were to use the word doomed and if you actually said right okay in whenever it is, 2050, you know if we don’t do something about it now the world’s going to come to a standstill. Stop and think about, you know, what is going to happen in the

future. There needs to be some kind of hard hitting campaign because the word doomed, is what is the future?" (Male, Teesside, Group 1)

Education

Education was also considered important by participants, although there was some disagreement within groups about whether it should be schools, young people or adults who should be targeted.

"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." (Female, Teesside, Group 1)

"I think people are too set in their ways, but again it is taking the 20 odd something and educating them into a different way of life." (Male, Wales, Group 2)

Champions

The issue of champions was raised in several of the focus groups, in two different ways. Firstly, the power of celebrity was suggested to encourage pro-environmental behaviour change, and to endorse the use of hydrogen.

"A popular person saying, a pop singer or somebody who says 'I use low energy light bulbs', you'd get all the youngsters saying 'oh can we use them'." (Female, Wales, Group 2)

"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." (Male, Teesside, Group 1)

The second way in which participants raised the issue of champions was through strong leadership. This issue was only raised in the London and Teesside focus groups, regions which both have charismatic and prominent mayors: Ken Livingstone and Ray Mallon, respectively.

"I do have a lot of time for the man. He did say, we were talking about hydrogen buses, when he said that the first manufacturer to come up with a hybrid bus will get the contract for all London buses. That is a commercial incentive, so you know, he balances out the eccentric bits of you know not flushing, he's giving manufacturers a commercial incentive. An entire fleet of London buses, he's putting London's money where his mouth is." (Female, London, Group 1)

"One of the people in Middlesbrough, don't shoot me down with this one, they may say Mayor Mallon has actually pushed this, been out to the Arab world, he's pushed this one to get money for Middlehaven etc. etc. someone who will listen to him, I know he does go on a bit, you'll have to shoot me down for this one, but you know someone who has got credibility that local radio would listen to." (Female, Teesside, Group 3)

Demonstration projects

All groups commented on the importance of demonstration projects when promoting hydrogen and other new forms of energy. It was argued that demonstrating the applications of hydrogen would enable individuals to see how it applied to their own everyday lives.

“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.” (Male, Teesside, Group 3)

“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 its got nothing to do with me.” (Female, Wales, Group 2)

Despite widespread support for projects that demonstrated the applications of hydrogen, there was very little awareness of local hydrogen demonstration projects. One participant argued that current hydrogen projects needed to be better advertised in order to gain publicity.

“Advertise it for what it is, paint it, make it stand out bright pink on yellow dots, but let people know what it is. 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?” (Male, Teesside, Group 3)

Additional themes

Cost

Cost was the single issue that came up most in the focus groups, ahead of environmental concerns. By far the most commonly raised points, coming up dozens of times, were that the bottom line was cost and that participants were not prepared to pay more for hydrogen than for conventional fuels. It was also said a number of times that it came down to financial circumstances, some people could afford to pay more, but many people including they themselves could not. One participant made all these points together in one statement.

“I know that if you are financially okay to do it, but unfortunately in this country a lot of people aren’t and a lot of people I talk to are in that position and they think the exact opposite we’ve got a divided country here. We’ve got all these people that want to save the planet and we’ve got all these people who think I want to do it but if it is going to cost more then I’m sorry I’m not going to do it and as soon as we get round that corner then perhaps then we will get down to making a decision but it would all boil down to one thing and that’s cost.” (Male, Wales, Group 2)

Only one participant in Wales (Group 2) indicated he might be prepared to pay more, but even that statement was conditional.

Male: I mean judging on the slide you showed before the relative costs of producing it at the moment, I mean things may change, but at the moment its going to cost three or four times the amount of petrol or something or oil or whatever.

Female: Everything eventually comes down doesn't it?

Male: Yes if it came down approaching it, there is a point where you think ah well for the benefit of mankind, if you like, I will change to hydrogen, but personally not if it costs three times as much."

A few participants suggested that the way that a switch to hydrogen would happen was if conventional fuels became much more expensive, although different possible reasons were put forward.

"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 production works. If petrol stays relatively cheap then they won't want to change but it won't so they will have to change." (Male, Teesside, Group 2)

Safety

Safety was in a sense 'the dog that didn't bark'. It did come up as an issue, but much less than cost or environmental issues. In five of the groups one person or more mentioned the issue of safety. Rather than outright opposition to hydrogen, they generally expressed a desire for answers to reassure them that hydrogen would be safe.

"I think if people were thinking about putting hydrogen in their own back yard they would want it to be very, very safe." (Female, Teesside, Group 2)

"And you are talking about putting these tanks and stuff like that under you say 2,000 psi or 200 bar or whatever and you are talking about a crash or something you are talking about a disaster just looking to happen and again there is a lot of safety aspects come into it and training people in how to use it. I know in Sweden and a lot of places they have the hydrogen things and they are pretty well monitored and whatever." (Male, Wales, Group 2)

As the last quote above indicates, an emphasis on strong safety regulation would seem to be necessary to establish public confidence in hydrogen. One person remained more fundamentally doubtful of hydrogen.

“I just thought that there must be something else, there must be another form of energy that we can get that is safer than hydrogen, because to me hydrogen is still explosive.” (Male, Teesside, Group 2)

Others argued that the risks of hydrogen were relative.

“Oil isn’t completely safe, petrol isn’t safe.” (Female, Teesside, Group 2)

In the Carmarthen group the issue of safety was raised a number of times, but the view expressed was that hydrogen was not particularly dangerous. This view may well have been a consequence of the information they had received while taking part in the study.

“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.” (Female, Wales, Group 1)

“If you think about the home now I mean we live with natural gas heating, which if it escapes is quite a problem. We live with electricity, we have learnt to live with that and that’s highly dangerous, its just customer practice to some extent. You learn to live with things and learn how to use them.” (Male, Wales, Group 1)

Convenience and Performance

As well as cost, another important factor for people is convenience. Many participants stated that they would not switch from petrol to hydrogen unless hydrogen was as convenient.

“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.” (Male, Wales, Group 1)

“Well, you might want to have a hydrogen vehicle if you could get from here to London 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?” (Female, Teesside, Group 2)

Performance was also seen by some as a factor as there was reluctance to accept lower performance than from a petrol car.

“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.” (Female, Wales, Group 2)

In reality, the market need for both range and performance to be comparable with petrol cars is accepted by manufacturers and drives much of the present research in hydrogen technology.

Employment

Employment was briefly mentioned once or twice in four groups: the three Teesside groups and the Llanelli group. Participants raised the possibility of jobs in a new hydrogen industry, but some of them were rather wary.

“I think employment in the area would be greatly boosted if we had some big kind of plan on Teesside.” (Male, Teesside, Group 1)

“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.” (Female, Teesside, Group 2)

“It would create a new industry but only to make up for what we have lost from the eighties and nineties.” (Male, Wales, Group 2)

It is unsurprising given the nature of the area and why it was chosen for study that the Teesside groups would be more likely to think about possible future employment with hydrogen than the other groups. It is if anything rather unexpected that they did not discuss employment potential more. However, the discussions in Teesside had shown that people there were particularly cynical about promises for the area and anyway were not necessarily enthusiastic about the highly industrial nature of the area. These brief remarks are consistent with that.

5. Conclusions

The level of environmental knowledge varied among the participants in the focus groups, but most participants shared to some extent concerns about climate change and other environmental issues, although a few were sceptical. However, the participants had difficulty in prioritising environmental concerns in their everyday lives. A distinction can be drawn between their personal priorities as consumers and their political priorities as citizens, a distinction described by Jacobs (1991). Participants perceived barriers in terms of convenience and cost to following more environmentally sustainable behaviours. They also believed that there was widespread apathy about environmental issues among the general public.

Participants accepted that individual lifestyles in the UK contributed to the problem, but emphasised that it was only a relatively small part. They wanted to see the United States, China and India control their emissions and did not favour the UK making reductions unilaterally. As individuals, most of them said they were willing to take small steps, such as recycling, voluntarily, but were reluctant to do anything more substantial, such as changing their travel patterns, on a voluntary basis. There was a great fear of being taken advantage of by making personal sacrifices that others would not. Many participants expressed support for regulation and choice editing to enforce change on everyone. Some also supported the use of taxation, despite concerns that would impact disproportionately on the poor.

Hydrogen was seen as potentially environmentally beneficial, but support for it was not unconditional. Firstly, some participants were concerned that environmental benefits would not be obtained if fossil fuels or nuclear power were used to produce hydrogen. Secondly, participants were concerned about the additional step in the energy chain that is needed to produce hydrogen. Thirdly, participants wanted to know what the environmental benefit of hydrogen was compared to another energy carrier such as electricity. In addition, participants saw potential difficulty in setting up a hydrogen distribution system.

The future transition to hydrogen was seen as being likely to be driven by government imposing it on environmental grounds or perhaps because of economic necessity as oil became increasingly expensive. People's most widespread concern about hydrogen was cost. Most made clear that they would not switch to hydrogen if it was more expensive than conventional fuels. The discussions strongly support the view that the transition to hydrogen will have to be driven by regulation or taxation. Given the importance of cost in most people's perceptions, even higher costs imposed by regulation are likely to lead to opposition among many members of the public.

Safety seemed to be a rather less salient concern for the participants than cost. Some people were worried by the explosive properties of hydrogen and the idea of storing it under high pressure, but most seemed to believe that hydrogen technology could be made acceptably safe. Others emphasised that, in their view, petrol and natural gas are at least as dangerous as hydrogen. In general, participants expressed trust in

the regulatory regime and trusted that adequate safety regulations for hydrogen would be adopted and enforced.

Convenience and the related issue of performance were also raised in the discussions. Hydrogen would not be accepted if the range, luggage capacity and performance were not comparable with those of petrol cars.

Energy security was a concern among some participants, specifically the idea that a country such as Russia could cut off energy supplies. There was support not only for a variety of energy sources, but also for decentralised, locally produced energy.

The employment potential of hydrogen was briefly touched on in the Teesside groups and one other, but it was not seen as particularly significant.

There was very little trust in anything said by the government and people expressed cynicism about politicians in general. Paradoxically, people were generally supportive of government regulation to protect the environment and some were positive about charismatic local politicians such as Ken Livingstone (in London) and Ray Mallon (in Teesside), who they often saw as champions of alternative energy. Science communicators such as Robert Winston were suggested as voices that would be trusted by the public. It was also suggested that the endorsement of celebrities such as pop singers would have an impact on the less interested or informed. It was felt that information needed to be tailored to meet the needs of different parts of the public. It was emphasised that to get people engaged with the issue they needed to be made aware that it was something that affected them personally. Participants argued for as many people as possible to be involved in debate about energy and environmental issues despite concern about public apathy. Only through public engagement early could support be built for such a transition. One participant expressed concern that hydrogen seemed to be already a 'done deal' among experts and policy-makers.

The most effective way to promote the use of hydrogen and to communicate how hydrogen may one day be used in people's everyday lives, was seen as being through the use of demonstration projects.

It is apparent from the discussions with members of the public that most expected a transition to hydrogen to be driven by policy, rather than market demand. Only one person suggested that it would be driven by the price of oil as it becomes increasingly scarce. The greatest concern that people had about hydrogen was cost, not safety. There seemed to be widespread trust in government to adopt and enforce adequate safety regulations, but widespread suspicion of government when it came to taxation. People made it clear that they would not switch to hydrogen if it was more expensive than using conventional fuels. That would seem to imply that taxation would have to be used to make such a switch attractive to individuals. However, because of suspicion of tax and concern about regressive effects on lower income households, regulation would have more widespread support. It is likely that in reality both would have to be used to bring about the transition.

Hydrogen is not being pursued for its own sake but because of concerns about climate change and to a lesser extent oil depletion. Public engagement has to be in

the context of those concerns and the need to transform our energy system. These are long-term issues which most people engage with little in their everyday lives. Few people were sufficiently engaged with environmental issues to have already made lifestyle changes themselves. People had a preference for approaches to the problem which did not involve making significant lifestyle changes. Hydrogen appealed to some as a technical fix to avoid making lifestyle changes, but others seemed to be sceptical of the need to make any changes at all. Hydrogen offers few additional consumer benefits and its main advantages are in terms of public goods such as reducing climate change. Cost is likely to be the biggest barrier to acceptance of hydrogen and participants made clear a lack of willingness to change voluntarily. The groups demonstrated the possibility of consumer resistance to a mandated switch, particularly if hydrogen were more expensive. If taxation were used to increase the cost of petrol and diesel and to subsidise hydrogen, there is likely to be resistance to higher taxes on existing fuels.

This research has also highlighted the importance of a regionally sensitive approach in the development of a hydrogen economy, a finding echoed not only in the first round of focus groups (see Ricci, 2006), but also in expert stakeholder workshops on the economics of hydrogen technologies (see Hughes, 2006).

Policy Recommendations

- There was general support for action by the UK to reduce carbon emissions, but as part of a multilateral framework involving the United States and industrialising countries, including China and India, rather than unilaterally.
- There was recognition of the environmental impact of individual lifestyles and acceptance of the need for changes by individuals to reduce impacts, but it was thought it should be achieved through regulation and perhaps taxation rather than relying on voluntary measures.
- As well as environmental concerns, a lesser reason for support for a change in the energy system was because of energy security.
- There was conditional support for a transition to hydrogen, but three related environmental concerns need to be addressed:
 - Using fossil fuels or nuclear power to generate hydrogen is seen to compromise any environmental benefits;
 - Energy losses from using hydrogen as an additional step in the chain and the consequent life-cycle environmental impact of using hydrogen as a carrier;
 - What environmental benefit hydrogen offers over electricity or another energy carrier.
- People will not accept hydrogen if it involves compromises in convenience or performance.

- There will be no voluntary switch to hydrogen unless it becomes cheaper than conventional technology. There appears likely to be substantial resistance to even a transition enforced by regulation if it means a significant increase in cost to the consumer.
- There are some concerns about the potential safety of hydrogen, but most people seemed to believe it could be made acceptably safe.
- Engaging with the public about energy and environmental issues was seen as important to gain acceptance of the need for change.
- Demonstration projects were seen as clearly the most effective way of communicating with the public about hydrogen.

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Annex A

Summary of the Focus Groups

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- 77	J Tomei & N Hughes

Annex B

FOCUS GROUP SCRIPT

Good evening and welcome to the hydrogen energy focus group. We would like to thank you for agreeing to participate in this meeting. This evening we want to talk about several issues around alternative energies and hydrogen technologies. As you might recall from our last meeting, this work is part of the UK Sustainable Hydrogen Energy Consortium and it is funded by the EPSRC.

My name is _____ and I will facilitate the discussion. The discussion will last for about an hour and will be recorded, but as we explained, no-one will be identified in the transcript.

I would like to stress that this is not a test and we are not here to assess your knowledge. We would like to know your views about important developments around energy and hydrogen. To do so, I will ask you a series of questions to stimulate debate among yourselves. The discussion will be as informal as possible and visual material will be presented. My concern is that everyone gets a fair hearing.

START RECORDING

ASK NAMES

1. Continuity and change in our current way of life

Background: In our last meeting we talked about the problems associated with the use of fossil fuels (oil, natural gas, coal, petrol, etc.) in public and private transport, and to produce heat and electricity in our homes, industries and businesses.

There is now a large consensus among scientists and policy makers that a shift to a more sustainable way of producing and using energy is urgently required, if we are to avert the threats of climate change, global warming and air pollution.

There are several options that are currently being explored: renewable energy (such as wind, solar, wave, biomass, hydroelectric, etc.), often coupled with 'distributed generation' [where energy is produced (and then used) locally according to available renewable resources (as opposed to centralised generation)], energy-efficient and energy-saving technologies, cleaner fuels (such as hydrogen and bio-fuels).

- i. Would you be prepared to change your behaviour in energy use (in personal transport and in the home) to help reduce global warming, pollution, etc.?
- ii. Would you pay more or make any sacrifice to help reduce global warming, pollution, etc.?
- iii. What do you think of becoming energy and electricity producers on a small scale?

- iv. What do you think of having a Combined Heat and Power in your home (fuelled or not by H₂)?

2. Communicating about hydrogen and new energy technologies

Background: Hydrogen has been identified as an attractive 'energy carrier', clean at the point of use, capable of linking various primary energy sources (including conventional fossil fuels and renewable energies) with different mobile, stationary and portable applications.

Hydrogen might also be used to store energy from intermittent renewable sources when it is not immediately needed.

Hydrogen does not occur naturally, but can be generated by several means from most primary sources of energy, both green and not green. Hydrogen energy is now and is likely to remain an expensive option for some time ahead. Hydrogen is a flammable and explosive gas, and experience to date in its use is chiefly within industry, not in everyday use by end-consumers, such as motorists. A future economy based on hydrogen might incorporate many different technologies, some of which are still at laboratory scale and others nearer to commercialisation.

We sent you postcards showing how hydrogen can be produced, stored, distributed and used.

- i. Do you have any questions about the visual material (postcards) we have sent you?
- ii. What are, in your opinion, the best ways of communicating these issues to people?
 - Leaflets?
 - Internet sites?
 - Radio, TV?
 - National or local press?
 - Others?

3. Identifying the criteria used to assess different configurations of the hydrogen economy

SHOW PRESENTATION

- i. What criteria would you use to assess different hydrogen production routes, storage and distribution methods, and applications? Why?
 - Benefits to the environment?
 - Reducing pollution?
 - Improving energy security?
 - Cost?
 - Benefits to the consumer?
 - Effectiveness?
 - Safety?
 - Primary energy availability?

- Reliability?
- Ability to generate jobs and economic growth?
- Any others?

SHOW IMAGES OF LOCAL HYDROGEN PROJECTS AND SEEK REACTIONS

4. Fourth topic: public engagement

- a. Do you think people should be involved in deciding about energy?
 - b. How should they be involved?
 - c. Are people interested and willing to be involved?
- What do you think about citizens' juries? (explain what they are)

ANY OTHER COMMENTS OR ISSUES TO DISCUSS?

THANK YOU FOR PARTICIPATING!