



Transforming the UK Energy System: Public Values, Attitudes and Acceptability

Deliberating Energy System Transitions in the UK

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Executive Summary

This report summarises the findings from a series of deliberative workshops with members of the British public carried out between June and October 2011 as part of an interdisciplinary UKERC research project: Transforming the UK energy system – Public values, attitudes and acceptability.

The analysis provides an indication of key areas of public acceptability relating to whole energy system change, and offers insights into the factors that mediate and underpin views on transitions. Understanding the connections, associations and contextual issues that underlay public perspectives offers an important means for thinking through potential difficulties and opportunities in achieving major system change.

This report is structured around ten cross-cutting analytic themes which are interlinked.

1. Meta-Issues: Climate Change and Energy Security

Views on climate change evoked a range of responses from different forms of scepticism to high levels of concern. Energy security as a term was not salient to people but the range of concerns that it encompasses (e.g. geopolitical issues, energy shortages, black outs, unaffordable prices) did evoke strong reactions. Though discourses did encompass concerns about national level security and supplies of fossil fuels, there was a much stronger focus on the services that energy supports and personal access to energy. The key message is that views on overarching meta-issues, like climate change and energy security, while still extremely important as narratives underpinning reasons for change, may be less significant than one might expect in determining views on specific aspects of system transformation.

2. Imagining Energy System Change

Almost all of our participants expressed enthusiasm for addressing contemporary problems by doing things differently. This enthusiasm for change centred on the desire for what might broadly be termed a “sustainable” energy system. This notion encompasses naturalness, cleanliness, healthiness, the infinite nature of something (in terms of resources), but also things that do not generate conflicts/wars, or involve “waste”. These more abstract aspects or values were attached to particular technologies and processes within energy system change, such as renewable forms of energy production and efficiency. Indeed, renewable forms of production were particularly desired and are notable as forming a central part of our participants’ visions of sustainable energy systems.

3. Affordability, Responsibility and Trust for Energy System Transitions

Questions relating to “who pays” for system transitions were bound up with discussions of energy bills and costs more generally, as well as with concerns regarding trust and responsibility. A sense of powerlessness regarding energy pricing and costs was indicative of views that the market does not operate in a way that allows ordinary people to exert consumer power. Though concern about bills did undoubtedly form an important aspect of public discourse, this did not translate straight-forwardly in to rejection of more costly routes to change. There was also some evidence to indicate that if the reasons for bill rises were to pay for particularly desirable aspects of transition (e.g. renewable energy) they are regarded more favourably. However cost is unlikely to be straightforwardly “traded off” against other aspects of energy system transition because of the numerous elements encompassed within concern about the issue.

4. Uncertainty, Risk Making and Risk Taking

It was deemed extremely important that technological developments across the whole system – established and emergent – are safe. Our participants articulated sophisticated understandings of the likelihood and scale of risks. Socio-political risks represented a key concern in relation to certain forms of energy generation. In particular, the potential for resource conflicts in relation to fossil fuels represented one of the underlying reasons for many excluding these energy sources from their future visions. Other issues related to the potential for land conflicts around energy system elements, such as biomass and onshore wind energy, and legacy risks (radioactive or carbon storage) that might be left for future generations. Interestingly, although micro-generation technologies (particularly solar) were desirable for many participants, talk about investing in new ways of producing energy (e.g. in transitioning from consumer to prosumer) was also imbued with a sense of personal risk.



Though concern about bills did undoubtedly form an important aspect of public discourse, this did not translate straightforwardly in to rejection of more costly routes to change.

5. Socio-technical Change, Non-transitions and Pessimism

Some technologies such as carbon capture and storage (CCS) and bio-fuels, did not fit with the public conception of what a transition should be and were therefore viewed by our participants as ‘non-transitions’; that is, they were viewed as approaches that defer, rather than solve, energy system problems. This related to a strong and widely held public concern about continued reliance on fossil fuel supply options, which evoked particularly negative responses in terms of their role in future energy systems. In general, fossil fuels were viewed as polluting, archaic, finite and as sources of global conflict. Attitudes toward fossil fuels translated into negative views about CCS and, to a lesser extent, bio-energy, which were both associated with continuation of existing (undesirable) aspects of current ways of providing energy (e.g. burning resources). There was greater uncertainty about bio-fuels and as a consequence views were more ambivalent. This was in contrast to CCS where the direct connections to fossil fuels resulted in a greater intensity and wider ranging expression of negative perspectives. In discussing complex future technologies participants also expressed considerable technological pessimism: a sense that technological failure is always possible and that if the ‘worst possible event’ is not acceptable then the action should be avoided.

6. Energy Matters in Place: Politics, In(action) and Control

The workshops identified how place is important for energy system transitions beyond concerns about changes to landscapes. Perspectives on transitions connect with a range of people’s material relations with space, both in the past, present and future, and everyday lives. Place is also associated with socio-cultural and political issues including trust, control, histories, power, regulation, imposition, and so forth. An example would be that for some within the groups conducted in Scotland, there were particular concerns with regard to CCS technology.

Centrally, these participants struggled to see what benefits this industry would bring to Scotland. Many of the participants expressed concern that Scotland would be viewed unfavourably for hosting storage facilities, or that this would pose an unfair burden on the country. Place issues also relate to the home as a private space, and for the participants this came with the expectation that it should be free from government control. As such, measures or changes proposed that were felt to erode the power and control of householders within their homes frequently met with stiff resistance. This arose with some force out of discussions around particular demand management techniques. The core message is that to ignore the multi-faceted dimensions place holds in energy system change risks generating controversy and contestation, as well as missed opportunities for learning from mistakes and building upon past successes.

7. Accessing Energy Futures: Challenges and Opportunities

In line with previous research we found that participants drew heavily upon their own experiences of, for example, existing technologies or particular aspects of social systems in order to think through into the future and generate a sense of how they might feel about different aspects of change. One area in which this was particularly salient in terms of achieving system change was in relation to electrification. Throughout the research we found a set of quite negative experiences and more general ideas around existing electric heating and cooking systems, and (to a lesser extent) electric cars, that had an impact on how transitions to electrification were viewed. This is despite the fact that future electric systems are likely to differ in quite significant ways compared with what has come before. These types of ideas about electrification (especially of heat) mark out what is likely to be an important challenge in delivering transitions toward electric systems.

There is a need to think about change in terms of reciprocity and consider how calls placed upon publics to accept changes are brought with correspondent obligations for government and companies.

8. Workers and Jobs in Energy System Transitions

There was a keen recognition in our groups of the jobs that existing energy systems provide, and of the importance of system transformation in bringing new opportunities for jobs and skills developments within the UK. Participants wanted to know whether 'cleaner' forms of energy production would produce new jobs and, the relative implications for jobs across different forms of energy production: in particular who would 'lose out' or be 'left behind' in transitioning to different systems of provisioning. This core concern was also matched by a set of discourses around the potentially positive implications of transitions for job creation and economic growth, and a need for these to be located in the UK. In general, there was a sense that growing manufacturing within Britain would be likely to improve economic stability while also helping to pay for the energy transition. Narratives about growth and manufacturing appeared to conflict with participant's views on reducing consumption and the more transformative kinds of change discussed in **Theme 2** above. However, such contradictions were recognised and addressed by participants through their discussions of the apparent paradoxical nature of energy transitions.

9. Governance Policies and Strategy in Public View

The perceived role of government is multi-faceted and not unproblematic yet, at the core, publics locate responsibility for delivering transitions with government, including local, central and wider governing institutions. It is not necessarily the case that publics think that the government should lead the way, rather that they must, as there are no alternative groups that hold enough power (e.g. industry) who can also be trusted to do so in their stead. An apparent lack of legislation and regulatory action was viewed by participants as indicative of a lack of real commitment within government to address energy related issues.

Whilst there was support for legislation to facilitate and enforce change, our participants also wanted policies and legislation to have a certain amount of flexibility to ensure they are responsive to different contexts, for example where policies might affect vulnerable groups.

10. System Links: Making Connections?

Throughout the workshops, the My2050 scenario building tool was utilised to keep the whole system in view and to direct participants to consider the implications of decisions about one aspect of change for other dimensions. Additionally, the research was designed so as to draw out connections (e.g. between high use of renewable energy and a need for improved storage technologies) that were not necessarily visible from the use of the scenario tool alone. A key way in which participants in the groups made connections was through discussion about the connectivity between their selves and others – this included other people, but also distant places and other times (pasts and futures). Fundamentally, our participants recognised not only the linkages within the UK's energy system but also how we are part of a global energy system. Though participants often made connections between energy demand and supply, it was rare that they would spontaneously connect forms of supply with the need for increased energy demand management. Participants did not raise this themselves suggesting that it is not currently part of the public conception of 'renewable energy'. When this connection was presented to them, however, this did not reduce the favourability of renewable energy technologies. Beyond this, our participants made linkages between the technical, social and political dimensions of energy systems. In essence, this represented recognition of the ways that possibilities for change were constrained or facilitated not only through what is technically feasible, but also – and perhaps more importantly – through social and political factors (e.g. public acceptability, existing institutional interests, or political support).

Final Conclusions

We found the notion of ‘trade-offs’ between different components of energy system change unravelled somewhat with careful analysis of the data. Whilst trade-offs had less explanatory power than we had anticipated for understanding public attitudes, exploring the values that underpin people’s perspectives proved a much more successful strategy. In developing understanding of the values and ideas that underlay people’s views and preferences

we offer insight into what could be the basis for a new social contract. Central to this will be the need to pay attention to existing social contracts and the extent to which proposed socio-technological changes interfere with them. In these cases there is a need to think about change in terms of reciprocity and consider how calls placed upon publics to accept changes are being met with correspondent obligations for government and companies

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Introduction



Energy system change bears upon multiple long-term national policy goals, including the transition to a low carbon economy, energy security and affordability, and mitigating wider environmental impacts. Significant interrelated transformations in the way the UK supplies, manages and consumes its energy will be essential if these aims are to be attained (Ekins et al., 2013; Department of Energy and Climate Change, DECC, 2011a). This major process of transformation entails considerable uncertainties and contingencies. One aspect of change about which there are wide-ranging uncertainties is that of public perspectives and engagement. Public values, attitudes and acceptability will be of critical importance in processes of whole energy systems transformation, with the potential to present both opportunities and challenges for the delivery of energy policy and change across multiple areas.

Though there is existing research evidence pertaining to public attitudes toward single aspects of energy system transformation (e.g. nuclear energy, behaviour change), there is little understanding of public responses to whole-system transformations. The research presented here begins to fill this evidence gap, reporting findings from one stage of a programme of novel empirical research that delivers insights into what the public think about whole energy system change.

At the outset it is important to draw a distinction between research that engages with questions of how public(s) are likely to respond to transitions or techno-scientific developments, which are enacted or initiated in the main by others (e.g. government, energy companies, scientists), and those that seek to understand why public(s) do or do not themselves enact changes in lifestyles and actions toward more sustainable ends. This first area of interest can be seen as related to debates about public participation and the importance of characterising diverse forms of concern that pertain to various socio-technical developments (e.g. see Macnaghten, 2010).

The latter set of questions, by contrast, arise out of divergent social science research traditions that are concerned more with issues regarding the factors or complex processes that shape, shift and stabilise actions with consequences for sustainability (e.g. see Nye, Whitmarsh, Foxon, 2010; Shove, 2010; Shove, Pantzar and Watson, 2012). The research reported here is primarily situated in the first area of research, aiming to build insights that contribute to a characterisation of public concerns pertaining to envisioned future energy systems. It does, however, also deliver some findings that pertain to the latter area, for instance, in offering explanatory power for understanding elements of inaction. The focus, then, is not primarily on how to engage public(s) in undertaking transitional actions themselves but on how they view proposed changes, which have major implications for their own lives and lifestyles.

We aimed to draw out the types of issues and concerns which emerge across a diverse sample of people.

This report provides a summary of the findings arising from work package 2 of the wider project, for which in-depth deliberative workshops were held with members of the public from across the UK. The goal of this phase of the research was not to attain a representative picture of public opinion. Rather, we aimed to draw out the types of issues and concerns which emerge across a diverse sample of people. In this regard, the deliberative approach allows us to develop insights regarding not only the different kinds of issues that members of the public raise, but crucially, the conditions, values and concerns that underlay and help to explain views on different aspects of change. Here we report our findings organised around 10 interrelated themes created through an analytic process that was data driven. These themes are set out on the contents page. They offer a way of ordering or making sense of the data, and represent areas of public discourse about system change that were identified as most important through the analysis, both in terms of their prevalence in the discussions and their relevance for contemporary debates.



1.1. Research Objectives

Transforming the UK Energy System: Public Values, Attitudes and Acceptability aims to contribute a rigorous and systematic picture of public values and acceptability with regard to energy system change. The project as a whole has overarching research objectives to be fulfilled by three interlinked work packages outlined in the boxes.

The objectives of the work package 2 Public Deliberative Workshops are to:

- Highlight key points of agreement and contestation regarding tradeoffs including the conditions of acceptance relating to different energy systems scenarios.
- Reveal the values which underpin people's decisions and attitudes towards whole energy system change scenarios.
- Develop insight into public perspectives on everyday lifestyle changes implicated in different energy system scenarios, both in terms of demand side and supply side changes.
- Generate a major qualitative data-set giving insight into the processes of preference construction about energy system transformation.
- Before outlining the methods used for Work Package 2, we give a brief discussion of the literature and set out the background for this work.

1.2 Research Background: Technology, Public Engagement and Social Contracts

What is lacking is not just knowledge to fill the gaps but also processes and methods to elicit what the public wants, and to use what is already known. To bring these dimensions out of the shadows and into the dynamics of democratic debate, they must first be made concrete and tangible. Scattered and private knowledge has to be amalgamated, perhaps even disciplined, into a dependable civic epistemology. (Jasanoff, 2003 p. 240)

The core aims of this work package centre on developing understanding of public values, characterisations and acceptability, paying particular attention to what underpins views and the conditionality attached to expressed preferences. The goal therefore is to contribute to an amalgamation of the kinds of 'private knowledge' that Jasanoff refers to in the quote above. This notion of private knowledge, as an important but often neglected dimension of democratic debate, emerges from a long history of research and analysis concerned with the relations between science, technology and publics.

Research Objectives of Transforming the UK's Energy System

1. Identify the degrees of public acceptability of whole energy system transformation, in particular identifying important trade-offs
2. Build knowledge and understanding of public attitudes, values and acceptability in order to support development of sustainable transitions in the energy sector
3. Create qualitative and quantitative data sets for examination of the perspectives of varied publics across the UK on whole energy system transitions
4. Develop and utilise innovative methodological approaches for examining public values, attitudes and acceptability

Transforming the UK Energy System: Public Values, Attitudes and Acceptability – Project Work Packages

WP 1: All Parties

Scenario Adaptation, Expert Consultation and Material Development.

WP 2: Butler, Parkhill & Pidgeon

Deliberating Energy System Scenarios and Trade-offs

WP 3: Demski, Spence, Pidgeon & Whitmarsh

Innovative national survey on whole energy system transformations

In essence such work engages with a concern that the technocratic and highly specialised nature of scientific and technological decision-making is at odds with the principles and dynamics of democracy. From this central point, a wide-ranging literature has examined the cultural contingencies of scientific knowledge and sought to value different kinds of knowledge framed within other cultural assumptions, meanings and life-worlds (e.g. Leach, Scoones and Wynne, 2005). One important consequence of this pursuit is the emergence of public participatory research – a form of research which seeks to engage (and represent) public perspectives, knowledges and concerns in relation to a wide range of present and emerging techno-scientific issues.

Such research is underpinned by a fundamental questioning of ‘the well-entrenched linear model of science communication and its embedded values’ (Felt and Fochler, 2010, p. 220), and critical engagement with modes of deficit thinking within decision-making processes. This research tradition has sought to open up alternative possibilities for engendering improved quality of decisions. Wynne (1992), in particular, has highlighted the significance of expanding the sources of legitimate knowledge and recognising the value and importance of lay knowledge (Wynne, 1992; 1993; also see Fiorino, 1990; Pidgeon, 1998).

Jasanoff suggests that what is needed is a move away from positions that privilege science as the authority on mapping out future impacts and development trajectories, toward inclusion of those, which ‘would engage the human subject as an active, imaginative agent, as well as a source of knowledge, insight, and memory’ (2003: 243). In this regard she argues that such a shift would allow for ‘plural viewpoints and collective learning’ (Jasanoff, 2003, p. 240) – a kind of ‘co-intelligence’ (Hartz-Karp, 2007, p. 2). For this report we wish to situate the analysis with reference to these ideas and concepts. We thus aim to bring into view plural viewpoints on future energy systems and their possible (re)configurations with a view to developing the knowledge base for decision-making in this area.

Public Engagement: Challenges and Debates

A number of key challenges have been identified in relation to the development of research which aims to highlight different viewpoints and perspectives. First, critical attention has been given to how publics form their views and develop their knowledges, particularly in relation to issues that do not have immediate or obvious salience for everyday life (e.g. see Zaller, 1992). In this respect, there has been concern about the role of media and vocal public figures in shaping the perspectives of wider publics.

Though the media clearly have an impact and represent an important source of information, the extent of this impact is tempered by the now widely recognised

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understanding that people do not passively receive information from media and other sources but are interactive in their role (e.g. see Bucchi, 1998; Allan, 2002; Butler and Pidgeon, 2009). For example, we know that people selectively read and pay attention to media that confirms their existing views or corresponds with existing values. This means that while the ways that issues are reported and framed in wider public discourse are undoubtedly important, they are certainly not all encompassing (see Gamson and Modigliani, 1989).

This line of argument brings us to the significance of value positions, world views, anchoring, and interpretative frames (e.g. see Moscovici, 1984; Douglas, 1992; Wynne, 1996; Jasanoff and Wynne, 1998; Miller, 2000). These concepts, in quite distinct ways, describe how we make sense of the world around us in relation to existing values, sets of ideas, positions or feelings. They refer to the ways that people translate observations about the world in relation to their particular values and frames, connecting the things they see happening with the kind of happenings they would like to see (Miller 2000). One consequence of this insight is the understanding that new information does not act to fill blank holes; rather it is incorporated within and in relation to existing frames. Significantly, this means that though opinions may appear superficial and amenable to change with every new frame or piece of information, they can often be quite deep-seated and anchored in strongly held pre-existing cultural values and knowledges. This takes us to our second core challenge – the future oriented nature of the issues that are the focus of this research.

In unpacking this dimension of public engagement, a related line of research dedicated to what has been termed ‘upstream engagement’ (e.g. see Pidgeon and Rogers-Hayden, 2007) provides a useful point of departure. This body of work has focused on new and

emerging technologies that often only exist ‘in terms of future-oriented promise rather than as material reality’ (Macnaghten, 2010, p. 24). Though the research reported here is not focused on “upstream” technologies per se, it raises some similar issues that the upstream engagement literature addresses. First, the purpose of future oriented engagement work has been given attention.

For example, Stirling argues that upstream engagement should not be pursued as a means for ‘legitimising technological choices’, nor should it be a method for ‘closing down’ public contestation (Stirling, 2007). Instead, he suggests that ‘the truly innovative potential for “upstream engagement” lies in “opening up” broader attention to the full range of potentially viable choices’ (Stirling, 2007, p. 293).

Second, issues have been identified in engaging publics with the “not yet” and “accessing” futures. In this regard, research has shown that with careful critical reflection on both the aims of engagement and ways to promote ‘meaningful interaction’ with interested parties (Jasanoff, 2003, p. 238), opportunities can be created whereby publics feel enabled to take part in discussions ‘offer opinions, discuss the issues, and reflect on future politics and their contingencies’ across technical and socio-cultural dimensions (Macnaghten, 2010, p. 24). We contend therefore that publics, as ‘scientific citizens’ (Irwin, 1995), are able to critically reflect on the claims put forward regarding processes of socio-technical change and the particular technologies that such transitions encompass.

Social contracts, Public Engagement and Energy System Change

The scale of the challenge in transforming the UK’s energy system is one that necessarily involves some level of engagement between state and civil society. That is to say, that without the active involvement of both state and wider public(s) it is difficult to envision transitions of the kinds necessary to address contemporary energy related issues. In this context, the concept of ‘social contracts’ has gained increasing appeal as a way of understanding the role of reciprocal rights, responsibilities and obligations between state and civil society and what changes to these might be implied in transitions (e.g. see O’Brien, Hayward and Berkes, 2009). In sustainability debates we find increasing interest in the notion of creating a new social contract for change (e.g. see German Advisory Council on Global Change, 2011).

The concept of social contracts originates in the philosophy of Kant but has found form in a number of different writers over many years (e.g. Kant, 1959; Rawls, 1971; Rousseau, 1973). It has been used both to explain what appears as a consenting relationship between state and society, and, in a more normative sense, to inform the development of modern democratic states. At its core it relates, then, to the ideal of ‘government by consent’ and to some form of agreement as to the rights,

responsibilities, duties and obligations of civil populations and the state. For example, citizens explicitly or implicitly accept obligations or responsibilities, such as working and paying taxes, and in turn the state offers benefits like education or health services, and protection, for example of civil liberties.

Such agreements are of course not neutral and in some formulations of the concept ‘social contract’ theory has been argued to obscure the significance of power relations and the differential possibilities for consent. Indeed, the notion that lack of active protest or apparent acquiescence amounts to consent has been heavily critiqued. Equally, that social contracts are continually contested and challenged has been highlighted as indicative of the problematic nature of ideas of consent and agreement.

As social contracts have evolved so too has the role of private businesses in taking up aspects of provision (energy being a good example) but without the corresponding formal responsibilities embedded within relations between state and citizens. Indeed, the advanced liberal state is one that, arguably, works to shift responsibility onto private citizens and corporations (see Miller and Rose, 2008). The changing role of the corporation within social contracts is thus important and must form part of the thinking about their transformation.

With these critical assessments embedded, the notion of social contracts can form a useful tool for thinking through the relations of responsibility between state, wider society and (increasingly) corporations, and how these might need to change in processes of transition. Crucial to this thinking is a recognition that transformations of the energy system are likely to intersect with existing social contracts and that change affecting one side of a contract must necessarily take in consideration of the other side. Through this report the concept of social contracts forms an analytic lens for exploring multiple aspects of transition. The analysis draws out what energy system change of the kinds envisioned might mean for the (re)creation of new relations of responsibility between state, citizens and companies.



Methods and Methodology

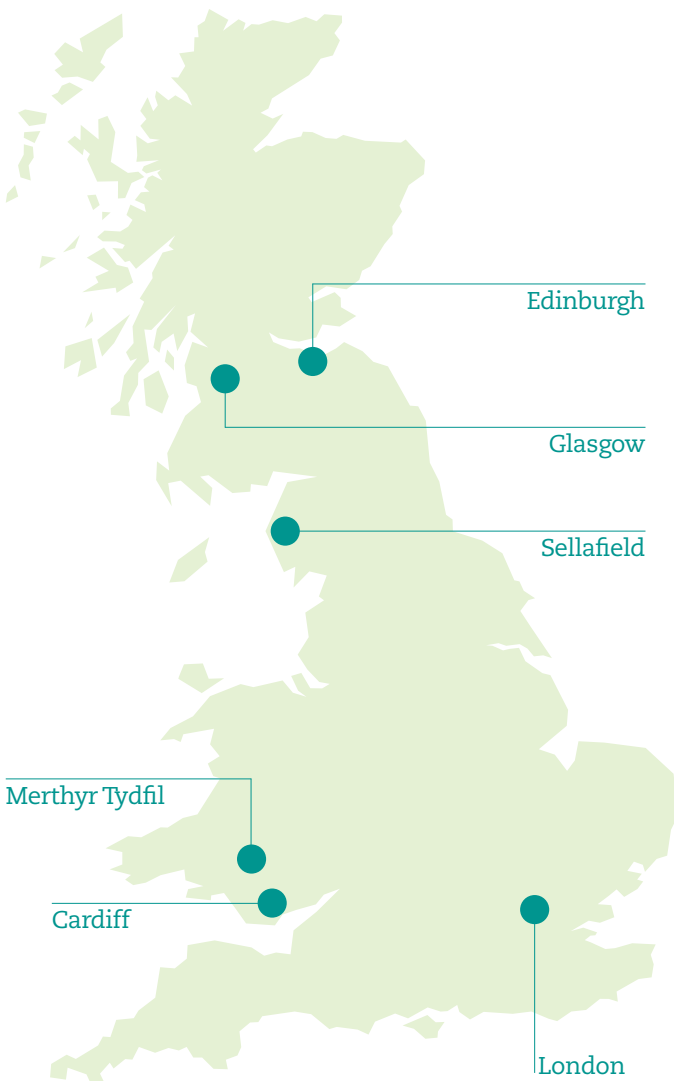


This research employed an innovative deliberative workshop design to engage members of the public from across the UK in reflection on energy system transitions.

2.1. Sampling and Locations

Deliberative workshops were undertaken in London, Cardiff and Edinburgh and three other sites selected for their specific characteristics with regard to energy and ways of living. These were Cumbria as the site of Sellafield nuclear facilities, Merthyr Tydfil as an area with a long history of coal, as well as recent contestation around new energy infrastructure (e.g. waste incinerators, wind, open cast mining), and Glasgow with sampling from settlements near to Whitelee onshore wind farm (see Figure 1). For all of these sites with particular

Figure 1. Map of locations



energy infrastructures in their vicinity we further specified sampling from rural locations.

The workshops were designed as a one day format with 11-12 participants in each group (total participant n=68). In addition to sampling from very different locations across the UK, participants were sampled to ensure a diverse mix of gender, age, ethnicity, socio-economic grouping, household tenure (denoted as of particular importance with regard to views on household level transitions), and educational qualifications. The process of sampling for qualitative research of this kind involves a core aim to ensure that a diverse set of perspectives are represented.

To achieve this, the research builds from the theoretical proposition that differential characteristics (such as age, where you live etc.) will be linked to different kinds of life experience. In turn, different forms of life experience are expected to result in the emergence of varying perspectives, values, worldviews and standpoints. This is not to suggest that there will be homogeneity in the perspectives of those that share similar characteristics, rather it is to anticipate diversity emerging from differences. In sampling across a range of social characteristics, then, we can expect a diverse set of views and perspectives. As such, the presence of themes in discourse across such diverse perspectives can be regarded as indicative of broader public concerns.

2.2. Approach and Design Innovation

Three pilot workshops were undertaken to develop and refine the design and approach. The final design is informed by the outcomes of the piloting and extensive team discussions, as well as consultation with stakeholders and experts in energy system change. For the first part of the workshops the research team gave presentations and facilitated participants in large group discussions on the key policy issues underlying thought about whole energy system change (e.g. infrastructure renewal, climate change, energy security, affordability), as well as the meaning of 'whole energy system change', and the purpose of scenarios. The research team described whole energy system change as encompassing all aspects of technical infrastructure (e.g. different forms of supply, grid and network infrastructure), demand infrastructure (e.g. change to houses, transport infrastructure and so forth), and social elements (e.g. changes to ways we live our lives, policies and governance). The definition thus included both technical and socio-cultural aspects of energy systems.

The presentations and the other informative materials used during the workshops were informed by earlier work undertaken in Work Package 1. This work package involved expert interviewing, review work, and collaboration with project partners that brought expertise in engineering and energy system transitions (i.e. Cardiff University Schools of Engineering and Architecture – see

acknowledgements), to build a picture of current expert understanding of energy system change. The information gathered through this process was utilised to ensure accuracy in the informative materials, presentations, and protocols used in the workshops.

Following initial presentations and whole group discussions, participants were divided into two smaller groups of five-six. Each smaller group was then guided through a structured discussion designed to prompt deliberation as participants collectively created their own energy system scenarios using a scenario building tool – My2050 (see Figure 2).

The scenario tool represents a simplified version of a detailed scenario calculator (see the Department of Energy and Climate Change 2050 Calculator) that shows the impact of different system changes on carbon emissions targets and energy security aims. This encompasses both supply and demand side changes but does not cover all aspects of plausible transitions currently imagined. The workshop discussion thus included prompts on aspects of system change not encompassed in the scenario tool. This allowed an opportunity to achieve a sense of public views on forms of system change deemed important by wider sets of stakeholders.

Participants were also given additional information to that provided within the scenario tool to facilitate their engagement with and understanding of the various aspects of system change. One example is information pertaining to the number of homes in the UK now and the number anticipated in 2050 – this gave participants an understanding of the retrofit agenda (as opposed to just focusing on new builds) with regard to energy efficiency.

The final aspect of the workshops involved participants in discussion of ‘scenario narratives’ created specifically for this research and designed to reflect three plausible future energy system scenarios. The first narrative reflected a “do nothing” scenario and depicted continuing reliance on fossil fuels along with associated impacts relating to climate change and energy security. The second narrative involved a highly technological response to energy issues depicting use of technologies like Carbon Capture and Storage (CCS) and nuclear energy along with some renewable energy deployment and a small amount of change on the demand side. The third and final narrative centred on high levels of renewable deployment and correspondingly higher levels of change to the demand side. These were written from the perspective of the first person and were intended to generate a greater sense of the implications of energy system change for everyday life (see appendix). The narratives were developed from a range of scenario sources and from information attained through interviews with expert sources.

2.3 Analysis

All discussions were recorded and transcribed verbatim by a professional transcription company. Transcripts were subsequently rechecked against recordings to ensure accuracy. Transcripts were then uploaded to a computer programme for qualitative data analysis (Nvivo). This computer package facilitates management and organisation of data into codes. Codes take the form of analytic themes arising from the data or alternatively represent “ordering” codes (e.g. all talk about heating was coded to a file on heat). Once coded the resulting data files contain all parts of the discussion pertaining to the particular aspect of interest. These are then read and re-read and treated to several iterations of sense making. For this process the key messages that arise from the code in terms of public views are extrapolated and then re-examined against the data to ensure they reflect the data. This process is iterative and continues until the analyst is confident in their assertions.

It is possible to ask multiple different questions of data in the analytic process. The questions that have been asked for the analysis reported here are not exhaustive but were derived from academic literature, policy consultation, expert interviews and through input from our advisory panel (see appendix). Additionally, emergent concerns that arose through discussion and appeared as particularly salient for members of the public were treated to analytic scrutiny. It is important to highlight that this form of research and analysis allows for insights into the values and concerns that underlay expressed preferences.

Figure 2. My2050 Scenario Tool



The report is structured around the following ten themes:

Theme 1 Meta-Issues: Climate Change and Energy Security

Theme 2 Imagining Energy System Change

Theme 3 Affordability, Responsibility and Trust for Energy System Transitions

Theme 4 Uncertainty, Risk Making and Risk Taking

Theme 5 Socio-technical Change, Non-transitions and Pessimism

Theme 6 Energy Matters in Place: Politics, In(action) and Control

Theme 7 Accessing Energy Futures: Challenges and Opportunities

Theme 8 Workers and Jobs in Energy System Transitions

Theme 9 Governance Policies and Strategy in Public View

Theme 10 System Links: Making Connections?

In writing this report a process of further analytic refinement was undertaken whereby different lenses (e.g. social contracts) were applied to the data to generate a set of useful and important insights with regard to public characterisations of whole energy system change. In the following, the findings are reported through ten cross-cutting analytic themes intended to give insight into the breadth of public understandings obtained through this in-depth research. The creation of the themes was data driven but they also represent areas of particular relevance for contemporary debates about energy system change.

It is important to note that the data quotes provided throughout the report are illustrative and represent examples of the kind of discussion prevalent in the workshops from which the wider points are drawn. The selected quotes have been taken from across all of the groups and across the full range of participants



Findings and discussions



T1. Meta-Issues: Climate Change and Energy Security

Concerns about climate change and energy security underpin policy debates about energy system change and as such public views about these issues are of key interest. There is a wide ranging literature that addresses public engagement with climate change (e.g. Zehr, 2000; Lorenzoni and Pidgeon, 2006; Butler, 2010; Spence et al., 2010a; Whitmarsh, et al., 2011; Wolf and Moser, 2011) along with a developing literature on energy security (e.g. Demski, 2011; Corner et al. 2011). The analysis in this first theme examines our key findings with regard to how public(s) engaged with these issues, focusing particularly on the points of connect or disconnect between views on these concerns and attitudes toward energy system change.

To begin with climate change, the findings are consistent with previous work in this area showing a wide range of public responses, from different forms of scepticism (see Poortinga et al., 2011) to high levels of concern. For our participants, 'carbon' or 'low carbon' as ways of characterising different aspects of the energy system (e.g. fossil fuels, renewable energy) were not particularly salient terms but that is not to say that they are not salient in a more general sense. Members of the public in our groups tended to relate ideas of carbon through more general notions of cleanliness and pollution. These thus offer public frames through which carbon emissions are interpreted; that is, emissions are understood to be bad even if the specifics of the science is not known.



Notably, concern about climate change was heightened for many participants when a narrative scenario that introduced some potential effects of climate change for the UK was introduced (see appendix). In particular, participants that had expressed sceptical viewpoints earlier in the day, voiced concerns during the discussion of the narrative that had hitherto not been mentioned. Below are illustrative examples of the types of responses the narrative provoked.

M: What about you? Has it made you reflect on any of the things we've discussed today?

P1: Well as I said, I'm, my old fashioned way has come back to it anyway but, and I suppose that doesn't help this scenario but I mean, I can see the point in, it makes you think twice when you think, look at grandchildren, you know... it does make you think about, you know, what you are doing to your environment...

M: Yeah okay, and you...?

P2: It is definitely an eye opener because I'd probably agree but I would say my two grandweans [grandchildren] it's being, you hear and you're reading, and all these things are happening and, it is a worry, definitely a worry. (Glasgow)

P1: I didn't like any of it

P2: It's a bit frightening isn't it?

P3: I think it is a bit frightening, yeah.

P4: It's business as usual

P5: It is as everyone says quite frightening and something we need to sort out. (London)

This is suggestive of the potential for climate change concern to increase when the impacts are made more visible or salient (see also Spence et al. 2011).

Centrally, we found views on climate change did not translate straight forwardly into views on the various aspects of energy system change. For example, scepticism about climate change did not prevent engagement with mitigation policies and practices.

P: I'm not overly concerned [laughter] mainly because I watch a lot of programmes on it and everyone says there are major concerns with climate change, but there are a lot of programmes which say that historically climates have changed anyway.

[LATER]

M: So I guess how would you feel about having a carbon tax on goods then?

P: That would be fuel tax isn't it? Tax on fuel, or import tax on fuel the more fuel you'd use the more you pay. I certainly agree with that. (Cardiff)

Such apparent disconnects are indicative of discourse about climate change science, in particular, as occupying a separate discursive space – one that is quite distinct from discourse about the multiple aspects of energy system transition. This means that on the one hand sceptical discourses regarding the science of climate change do not automatically translate into negative views on aspects of change for mitigation, while on the other hand, strong acceptance of climate science and deep concern equally do not necessarily translate into positive views on such forms of change. This is perhaps not surprising given previous analysis which has pointed to the importance of values as significant in determining views regarding what (if anything) should be done, over and above knowledge about the specifics of climate change science (Thompson and Rayner, 1998).

Energy security as a term was not salient to people but the range of concerns that it encompasses (e.g. geopolitical issues, energy shortages, black outs, unaffordable prices) did evoke strong reactions (see also Demski, 2011). Though our public's discourse encompassed concerns about national level security and supplies of fossil fuels, there was a much stronger focus on the services that energy supports and personal access to energy. This manifested in a number of different ways – one of which saw energy security issues reformulated in terms of ensuring a kind of personal level security by having diverse forms of energy within the home or (to a lesser extent) in personal transport.

P: I think it's nice to have a little flexibility. If you have got an open grate somewhere - and in the future we may have to consider that the electric might go off more often - then [with] central heating systems which are powered by electric, no matter what you use as the other fuel, you have got no heating anyway so unless you have a little grate where you can chop up some logs or have a supply of something for emergencies, you are going to freeze, and it's nice to have that versatility of belt and braces or belt, braces and something else as well. (Cumbria)

This type of discourse tended to arise from participants that lived in rural areas and experienced power cuts more regularly than those living in urban settlements. There was, however, a corresponding narrative within city dweller's talk about energy security, wherein they positioned themselves as vulnerable in the sense of having little control over 'shocks' to their energy supply, such as power cuts or blackouts (on energy security 'shocks' see Smith and Stirling, 2010).

A further way in which energy security was located at the personal level arose through discussion of energy affordability. We found that the notion of energy becoming unaffordable evoked considerable concern amongst participants – this is indicative of the close links between cost, affordability and energy security that arose in our participant's discourse.

P: ...the thing I would be more concerned with would be the electricity becoming unaffordable because we rely on it a lot and of course [other participant] was saying that it is going to be a bit frightening for the younger generation, because we rely on it. We don't really think about the terrorist attacks and all that kind of stuff, because we're not, we are not aware of it... we don't pay much attention as to how it will affect us, we rather want electricity there. (Glasgow)

Affordability as a dimension of energy security forms a significant part of official definitions as well as featuring strongly within academic characterisations of the issue (for discussion see Chester, 2010). As Chester (2010, p. 891) points out, however, 'affordability, or the 'reasonableness' of prices, are relative notions with meanings subject to considerable variation'. While in official definitions absolute notions of market supply and market price dominate, in public conceptions affordability is a more relative notion that incorporates concern about inequality and injustice. Discourse about affordability is discussed in more detail in Theme 3, for now the point to be made is that public discourse about energy security is closely connected with concern about energy affordability.

Where discourse about energy security as a national concern arose, issues related to insecurity of fossil fuel supplies were bound up with negative attitudes toward these forms of fuel in a more general sense (see Theme 5). This meant that geopolitical issues relating to securing supplies of fossil fuels represented just one in a wider range of problems that were seen as related to fossil fuel dependency.

At a general level, supply of energy was largely viewed as a social good (see Stern and Aronson, 1984). In this sense, the expectation that supplies of energy would remain affordable and that access to services reliant on energy (car driving, lighting etc.) would be largely uninterrupted, or at least quickly restored, formed an important part of existing 'social contracts' – i.e. the mutual consent between civil society and the state (see introduction for a more detailed discussion of social contracts).

In terms of the connections between energy security concerns and views on various aspects on energy system change again the connections were not linear. For example, energy security – when linked to energy affordability – did not translate straightforwardly into rejection of more expensive routes to change. This is understandable when we take into account the ways that costs for energy system transitions were positioned in our participant's discourse, i.e. as a shared responsibility that should not fall in the main to consumers (see **Theme 3** for detailed discussion).

In this section we have introduced the core findings relating to the ways that energy security and climate change were perceived by our participants. In particular, we have highlighted how concern or lack thereof with regard to these issues does not translate straightforwardly into perspectives on energy system change. These findings offer explanatory power in terms of understanding outcomes of quantitative research which indicate there are no simple connections between views on meta-issues and views on energy system development (e.g. see Pidgeon et al., 2008; Spence et al., 2010a; Corner et al., 2011; Shuckburgh et al., 2012; Poortinga, et al. 2012). The findings presented here thus point to the importance of recognising that public acceptability is complex and is influenced by multiple factors in combination with one another, rather than being linearly influenced by views on one issue in particular.

Though perceptions of climate change and energy security are important, we found that the acceptability of different aspects of energy system transition was mediated by a wide range of other considerations. This means there are not straightforward relationships between concern about these issues and views on the acceptability of energy system changes. As such, while climate change and energy security are important as meta-narratives underpinning reasons for change, they may be less significant than one might expect in determining views on system transformation.

T2: Imagining Energy System Change

An important set of questions arises for this research project around how public(s) view processes of and possibilities for change within energy systems. For this theme the focus is on the ways that public(s) engaged with change in a wider sense, rather than in reference to more tightly defined elements of energy systems or specific technological options. The section explores different dimensions of change including at this more abstract level, what is desired, how it can be encouraged, when and how it can be engendered, and elements of responsibility.

Collectively we are often guilty of talking about change and transition as if it is a novel process. We sometimes talk as though we are moving from one fixed state to another. Whilst low carbon transitions do tend to coalesce around particular ways of doing that are novel, clearly transformation in and of itself is not a socio-cultural artefact belonging solely to contemporary societies. This recognition of change as an ongoing process was evident within our participant's discourse. Indeed, the inevitability of change was an ever present underlying assumption that connects in important ways with the formulation of views on different aspects of envisioned transitions (see **Theme 3** for an illustration regarding change assumptions about cost).

This sense of the inevitability of change is different, however, to the desire for particular forms of change, especially things that might be regarded as more disruptive. In this regard, what is so striking from the research is the enthusiasm our participants had for addressing contemporary problems by doing things differently. Not just the means by which we produce and use energy, but also with regards to the ideals and motivations that underpin the ways we live our lives. That is not to say that change was unproblematic, for example at times our participants struggled to imagine change, or more precisely how it might manifest (also **Theme 7**). The general desire for change was matched by an equally strong concern about the consequences of doing nothing.

P: I'm sure we would have done something about it in 40 years. It is a depressing thought that we are going to continue with the way we are without doing any changes. (London)

The enthusiasm for change centred on the desire for what might broadly be termed a "sustainable" energy system. This notion of a sustainable system encompasses at the core ideas, experiences or things that people value and would like to see within future energy systems. These include naturalness, cleanliness, healthiness, the infinite nature of something (in terms of resources), but also things that do not generate conflicts/wars, or involve "waste". These more abstract aspects of value were attached to particular technologies and processes within energy system change, such as renewable forms of energy production and efficiency. Indeed, renewable forms

of production were particularly desired and are notable as forming a central part of our participants' visions of sustainable energy systems. The ways that people envisioned transitions to systems of renewable energy was not idealistic but rooted in a sense of pragmatism about the scale of change. For many it represented a long-term future that should be the focus of efforts with regard to energy system transitions.

P: Well all the installation of the electric and solar panels, the bio fields, it is not going to happen overnight, all of this is gradually going to come into our lives, but it is a really good vision. (Cardiff)

The desire for renewable forms of production was also connected with more negative views about fossil fuels.

P: ...when you hear the people with the doomsday theory that it's [fossil fuels] going to run out and we have nothing left, that would be a worry in the back of my head, because I know that I'll have to deal with it at some point, and I know that my kids will definitely have to deal with it...that's how I prefer the renewable forms, knowing that it's always going to be there. (Glasgow)

Of course, what the quote above also reveals is how renewable forms of energy are able to potentially attenuate fears surrounding issues related to depletion of energy sources. Important in this regard, is that when questions were posed to participants about unconventional fossil fuels and the possibility that they may not run out soon, this did not allay concerns. Instead the underlying issue was that fossil fuels are finite and thus will inevitably run out at some point (even if in the long term future).

Though there was a strong desire to move away from fossil fuel-based systems, this was also juxtaposed with discourse about the desirability of fossil fuel-based heating sources. For example, the efficacy and controllability of gas central heating systems, or the forms of sensory experience produced by gas and coal fires (see **Themes 6 and 7** for a fuller discussion of the reasons underpinning this juxtaposition).

Important is that when questions were posed to participants about unconventional fossil fuels and the possibility that they may not run out soon, this did not allay concerns.

P: I love my coal fire, especially when it is pouring down rain outside and you come in and you have got your candles on and your lamps on and you've got a coal fire, there is nothing better. (Glasgow)

Our participants did not rest at just advocating renewable forms of production and expressing preferences for reductions in fossil fuels. Many of our participants recognised that current regimes of accumulation (i.e. our high consumption-based economy) sat in counterpoint to sustainable ways of living, and as such a move to a sustainable energy system.

P: I don't want to sound like an old hippy but if you go producing more and more and more you just have more and more rubbish, and more and more environmental problems, but our system, our economy is based on producing so that is a real problem, unless we produce things that aren't environmentally detrimental, but that would mean you would have to change the way people think. (London)

Clearly such sentiments are outlining the not-insignificant challenges ahead in transitioning to a low(er) carbon society. This type of talk also highlights, however, the awareness amongst publics of the need for change to go beyond technological innovation in the ways that we produce and use energy. Instead, there was awareness that for a successful transformation we must challenge our ways of living in a more fundamental sense.

P1: If we were only judging on the insulation, but there are so many social things I'd find that almost...I can't make a call on that [reducing household temperature]

P2: Yeah the social aspect side of it is...

M: What are you referring to?

P1: Well as I was saying, if you're looking to 2050, another 40 years down the line, all the people that we were saying, like all our grannies and us older ones that make do and put on jumpers, that's gone and people are not used to thinking outside the, you know, the warm box... And also we're such a big consumer society that you've got more stores with more refrigeration units, more things with short lives, and planned obsolescence... (Merthyr)

For some, a move to a lower carbon society meant, in some senses, going backwards to a "simpler" time. Interestingly, though notions of going backward at times held negative connotations, this was not necessarily always the case.

M: When you say it's like looking back on how we used to live, is that a good or bad thing?

P: I suppose it's a good thing because...when you look at your parents, and they lived a great life, if that's the way they used to live, and they were watching everything, watching the energy, watching the money and all that so, I think it would be a good thing. (Glasgow)

Whilst our participants were aware that large changes were important, there was also particular support and desire for little changes, in both attitudes and ways of doing. In this regard, though participants recognised that little changes were no substitute for the larger ones, to ignore smaller changes was highly problematic.

P: It is the same as hospitals, they always have the heating on, it is such little changes, how difficult can it be for some utility man or boiler man in a hospital to think we don't need the heating on today let's turn it off. It is the same, public buildings, schools, they always have the heating raging... What a complete and utter waste, little changes are needed... If people took it from the ground up as it were and we started making small changes, it would push companies into making those changes... (Cardiff)

The types of things characterised as smaller changes were often those where the action was viewed as being located at a distance from government (e.g. in this example heating controls of particular buildings). Importantly for policy makers and other stakeholders we found that to favour larger changes without also engaging and facilitating engagement with “smaller” ones, risks engendering feelings of frustration and ultimately disengagement with processes of change. Core in this regard is that change is experienced within daily life and that (in)action can be seen “on the ground” (see Wynne 1996, on body language). This relates to a further finding indicated by the latter part of the above quote – that is, the importance placed on generating momentum for change. Our participants envisioned that making small changes could not only have a cumulatively large impact in and of itself, but would also provide the impetus for making larger changes; i.e. change stimulates more change. Those participants who tried to suggest there was little they could do as individuals or that small changes were not meaningful were met with fierce resistance.

P1: That's part of my stumbling block. I could make so little difference by myself, in a sense, why should I bother?

P2: If we all thought that way... I'm not saying everyone will get on board, but I'm just saying if we all have the same attitude, nothing will get achieved, nothing will get changed. So one small change could snowball and make things a lot better for our future generations. (Cumbria)

Although there was a clear appetite for change, not all of our participants understood or necessarily felt it was something they would have to deal with – change was located in a distant future time or as something “others” would enact. In this regard, it was recognised that gaining consensus for action was unlikely to ever occur – some parties would always resist making a change even with the strongest encouragement. Rather than seeing this as a means to derail transitions, it was consistently argued that consensus was not needed to make meaningful changes and instead those resistant to change could be “worked around”.

A key concern for many related to the difficulties they saw associated with enacting changes, particularly with regard to large scale infrastructure (such as electrification of transport). This led them to question how transitions could be enacted both in terms of getting the support of publics and developing the necessary material changes (e.g. charge stations replacing petrol stations). Such difficulties in transitioning were also highlighted for changes to ways of living, like demand shifting. Indeed, some of our participants described material realities that would not be sympathetic to the types of changes being discussed, even if they themselves were – e.g. for those living in flats putting washing machines on at off peak times would be disruptive because of noisy appliances (also see **Theme 6**).

In this regard, changes that interrupted the existing rhythms of everyday life were viewed as problematic even for those who were enthusiastic about transition. Forms of transition that could be integrated with current rhythms and ways of doing were thus viewed as more plausible and possible for more people living in diverse circumstances. For example, there was greater enthusiasm for the idea of “battery-exchange stations”, rather than charging points, when thinking about recharging electric vehicles. Such endorsement is perhaps the result of our participants being able to envision how this way of charging could occur, marking the change as being different to current ways of refuelling vehicles, yet at the same time familiar.

Thus far we have discussed the type of future our participants are enthusiastic about (i.e. a sustainable energy system based on particular values, for example the infinite nature of resources, underpinning system development) and discussed some of the challenges envisioned for energy system transformation. We now turn to the aspects of our findings that show how our participants felt change could be encouraged and supported.



Perhaps the most obvious, yet nonetheless important way our participants suggested change could be encouraged was by ensuring that what we are changing to is both available and works. For example, much of the remaining hesitation surrounding renewable energy technologies (which our participants supported) was about whether or not the form under consideration could provide enough power for present and future needs, if and when it was needed. Concerns about efficacy were, however, wider ranging than this and extended beyond forms of energy production into both demand-side aspects and energy infrastructures. For example, concerns about electric cars included their cost, performance and how they would be charged; i.e. whether charging infrastructures would be available (also see **Theme 4**).

Participants in the research volunteered, and were encouraged to think about, a number of different measures that could stimulate action on change. These included voluntary measures, regulation, coercion and force, restrictions, incentives, grants and promotion/guidance measures. It was rare that any of the options were seen as being enough – in most cases participants preferred a combination.

P: There are always going to be a lot of people who don't care about this... they want to get in their car, do what they want to do. They want a big powerful car because it makes them feel great... We talked about it earlier, it is about educating people, but some people don't want to be educated or don't care, so sometimes you have to force them... incentives and grants are a good idea, and giving us options... (Cardiff)

Force and penalties were thus seen as a potentially necessary part of the solution but our participants also cautioned against its overuse. In terms of restricting options, recent measures to prevent the sale of incandescent bulbs was held up as a positive move, whereby a clear example over what is inappropriate had been set. Yet caution was also advised as there was considerable concern about draconian imposition and loss of freedoms. When it came to incentives, participants emphasised it was absolutely necessary that the benefits to the individual should be made clear. In this regard, an example of best practice was the “reward” of a lower car tax for buying a smaller sized, more efficient vehicle.

A central element of public discourse about stimulating change related to education and calls for more or improved education about what is required. Our analysis would indicate that this is not necessarily just a call for more information or indicative of a need for greater understanding.

Creating possibilities for engagement may be important in developing a firm basis for change and a new set of relations between state and civil society.

Instead, it represented a response to the recognition that they were not encountering indications of the imperatives for energy system change within their daily lives. In this regard, participant calls for “education” were connected to an identified need for sustained, repeated, and sometimes subtle, promotion of how things should be changed and of the options to make a difference that are available to people.

P: It's things like the number of people that watch things like Coronation Street and EastEnders. If you, if those makers inserted certain things in there like when they get up and turn the light switch off, or they do this, you're not being told to do something you just recognise something. (Cumbria)

This connects with a core concern that our participants noted with regard to their opportunities to find time to think about and reflect upon the topic of the workshops. Indeed, some of our participants suggested that a lack of spaces for reflection on energy matters may be a key stumbling block for both engaging publics and enacting change.

P: Today has given us the opportunity to think about it and discuss it really in depth and it's something a lot of people won't get the chance to do, but it has obviously taught us something even just by talking with each other and that is what a lot of people are perhaps lacking. (Cardiff)

Finding ways to make space for reflection on current ways of doing and creating possibilities for engagement may thus be important in developing a firm basis for change and a new set of relations between state and civil society. Integration of new approaches within daily life as suggested in the quote above could form an important part of these processes of space making.

Beyond the types of transition that were preferred, the challenges, and the possibilities for stimulating change, our participants expressed particular viewpoints on the best time to enact change, both for individuals and at a national scale. In this regard, opportune times for change were identified as arising when something needed to be repaired or replaced, so as to minimise disruption to everyday life. In many senses, this suggests that intermediate actors in energy system change, such as sales people (e.g. car dealers and retail managers) and trades people, may be particularly important in encouraging the uptake of certain pieces of kit or approaches. At present this aspect of transition is potentially lacking in terms of the attention that may be needed. Our participants gave examples of times they had wanted to implement changes (such as new forms of heating system) and were met with hurdles in terms of securing the necessary expertise or being able to find advice and information. This results in the perpetuation of certain technological pathways as illustrated in the quote below with reference to gas central heating systems.

P: We looked at all sorts of things, we looked at ground pumps and all the eco stuff and Weismann boilers, and all these wonderful systems and we asked about 9 heating engineers around and nobody would put anything else in other than this type of boiler and system. Basically, you couldn't find anyone to do anything at all so that was what we ended up with by default. What we'd looked at in the beginning and gone all round the houses and all these wondrous systems, which would have been more eco-friendly maybe, and we ended up with the bog-standard combi-boiler. (Cumbria)

Such occurrences highlight the importance of intervention initiatives being targeted at a range of scales and stakeholders. They also underscore the importance of ensuring that there are training opportunities for those who will be responsible for physically installing new forms of technology. A notably trusted source for the transmission of different ways of doing (including the installation of kit as well as changes in practices) was that of friends and families who have already installed the intervention under consideration. Again this points to the need to be far more dynamic in the scales at which, and ways in which, interventions are targeted.

Of key concern to our participants was that any change suggested should be worthwhile, for example in terms of its impact on the issues (monetary and energy), and viable, for example in terms of ability to find information or finance changes. The absence of either of these things could undermine support for any intervention. In the following illustrations two different examples of this type of concern within public discourse are given.

P: It doesn't seem worthwhile all that land, I'm sure we could put that land to better use to be honest, to grow crops that make money and build more turbines as well, it doesn't seem like we are getting enough back from using all that land. And again what that's gonna do in these areas that you're using that land, that would outweigh what we're actually getting back from using all that land. (Edinburgh)

P1: Probably not only because we've gone through that change once. You've gone through your wooden windows to your PVC windows, which are double glazed. You've made that one big move and they are guaranteed for 20 years, really you're not going to change them within that 20 years as it's only a slight advantage [to triple glaze].

P2: Yeah, you can see the big advantage when you go from your draughty sash windows to double and you can't imagine that bigger jump again. I mean I can't hear noise anymore it's not going to get any better. (Cardiff)

Throughout this theme we have shown how our participants discussed a range of groups, stakeholders, and individuals, as playing important roles in the enactment and delivery of change. This is indicative of the perception that responsibility for change does not reside with one single group. Given that public(s) have been found in prior research to often position responsibility for environmental issues with government (e.g. see Poortinga et al. 2006; Butler and Pidgeon, 2011; Eurobarometer, 2011), it is interesting to reflect on the ways that the roles and responsibilities of government were viewed, particularly regarding their role for engendering and enacting change.

For our participants, government was perceived to have an important role in developing an overall vision to work towards. This included creating the policies and structures needed to encourage change (e.g. improving public transport) and being clear with regard to the available options. In addition, participants expressed concerns that government continued to convey mixed signals and that existing measures being taken to address energy issues appeared limited. This latter point was not just about policy trajectories but also arose as related to the individual behaviours of MPs and other government officials. Indeed, there were repeated calls for government to lead by example and move beyond what was sometimes perceived as pure rhetoric. Clearing up seeming inconsistencies in policies and legislation was identified as a further responsibility of government.

P: People seem to get penalised for doing that as well, some people have changed their cars or converted their cars to run on old cooking oil which they get taxed on... so they are trying to make changes but it is not easy and as the Government can't control that, they can essentially run the car for free but people will get penalised, so its mixed messages. (Cardiff)

Participants expressed concerns that government continued to convey mixed signals and that existing measures being taken to address energy issues appeared limited.

This section has navigated through the ways that our publics imagine change, including the changes that are preferable or desirable (e.g. sustainable energy systems – see earlier discussion), how it can be engendered (e.g. mixture of instruments including voluntary, force, option provision), when it can/should be enacted and by whom. Through this discussion we have also touched upon some of the difficulties (e.g. efficacy of interventions, knowing our options and finding skilled trades people), constraints (e.g. mixed signals and positive qualities of current systems), and perceived limits (e.g. the need to move beyond a regime of accumulation). Ultimately, the key message is that whilst there were some reservations over the particular form transitions might take, our participants were enthusiastic about, rather than resistant to, the opportunity for making a significant change.

Members of the public are positive about and enthusiastic for change, both in terms of the ways that we produce and use energy, and in terms of wider cultural ideas that are related to energy systems (e.g. cultures of high consumption). This is paralleled by deep concern about the prospect of ‘doing nothing’.

There is recognition of the potential need for regulation and regulatory measures in order to deliver transitions, particularly as a means to ‘kick start’ change and send clear signals about its importance. Incentives are, however, preferable as measures to generate new ways of doing.

T3: Affordability, Responsibility and Trust for Energy System Transitions

As a key aspect of policy discourse about energy system transitions, affordability represents a deeply contested and multifaceted issue. Questions about cost and affordability span multiple interrelated aspects of concern in energy system change that operate across different scales. They encompass issues regarding infrastructure development; investment and subsidy; consumer purchases and investments; financial (dis)incentives and running costs associated with things like personal transport; energy bills and affordability of energy in the home – this in turn relates to issues of fuel poverty, energy saving and demand reduction. In this theme we unpack public discourse relating to cost and affordability in energy system transitions. The theme explores the different ways that issues about cost were characterised by participants and gives insight into key public concerns regarding affordability and the financing of transitions. The discussion pertains to views about cost with regard to both current energy systems and the development of future ones.

In the research, costs were treated carefully due to the high levels of uncertainty and contestation which arise out of the multiple factors that influence calculations; such as ruling market conditions or the commodity prices for fuels and carbon (see Mott Macdonald, 2010), and disagreements over aspects of calculation like discount rates (e.g. Harrison, 2010). Additionally, there is complexity in calculating the impact of energy system transition costs on customer bills adding a further layer of uncertainty (see DECC, 2011b). As such, discussions of cost were approached through a series of “what if” prompts and probes. For example, “what if that was substantially more expensive – would that affect your view?” was posed in cases where people were particularly positive about an aspect of change, or the converse if they were particularly negative. Additionally, when participants asked about costs, we probed on why they were concerned about cost, and what underpinned that concern. We also posed some key hypotheticals, such as scenarios for higher but stable bills contrasted with potentially lower but fluctuating bills.

Through the analysis we found that questions relating to “who pays” for system transitions were bound up with discussions of energy bills and costs more generally, as well as with concerns regarding trust and responsibility. As such, though trust and responsibility forms a lens that has relevance across many of the themes in this report and is discussed elsewhere, we give this aspect of discourse more detailed treatment in this section.

The first dimension of public discourse we wish to discuss relates to public views on energy affordability and concern about rising bills. In this regard, energy affordability and increases in costs for energy (across home, transport and business) evoked very high levels of concern, particularly in the context of current economic difficulties and austerity.

P: I generally worry about the price because the way things are going, is like you know you wake up the following day and the energy company will just tell me that there will be an increase in price, and there is nothing you can do about it so most of the time I tend to worry about the price.

M: Is that a concern for other people?

P: Definitely, price is a major concern... (London)

This quote also signals a sense of powerlessness regarding energy pricing and costs, which can be seen as indicative of public views that the market does not operate in a way that allows them to exert consumer power (e.g. through purchasing from a different supplier at a lower rate). Connected to these findings are results regarding public perceptions of the reasons for price rises. In the main, public perceptions about this were not linked, as might be anticipated given media coverage in recent years (BBC News online, 2012; The Guardian, 2011; The Telegraph, 2011), to concern about investment in renewable energy or government policies. Instead, they focused on energy companies as profit making entities.

P: They (energy companies) are making so many huge profits off the energy we are buying from them... They won't reduce the cost of our energy though they are paying less, like British Gas, even when the cost per unit for them goes down they don't drop our prices. (Merthyr)

Though concern about bills did undoubtedly form an important aspect of public concern, this did not translate straightforwardly in to rejection of more costly routes to change. Interestingly, there is some evidence to indicate that if the reasons for bill rises were to pay for particularly desirable aspects of transition (e.g. renewable energy – see also Spence et al. 2010b) they are regarded more favourably.

P: I think it definitely does just make more sense to use the renewable form...

M: Okay, even if it meant prices going up now?

P: Well if it went up now, like to cover the costs and things like that, I mean the price of like gas and stuff like that now, is rising anyway, so either way we are going to see prices going up... so if it is going to go up, we may as well bite the bullet with the renewable forms as opposed to the gas and that. (Glasgow)

Electricity you've used this period.			
Meter number	Energy Discount Plan 5		
Reading period 21 Jul 09 to 24 Jul 09			
	previous	latest	unit
Electricity used	46313 C	46339 C	2
21 Jul 09 to 24 Jul 09			
Total before VAT			
Electricity charges			
VAT at 5%			

These two positions (i.e. concern about bills coupled with preferences not contingent on costs) may appear, at a superficial level, to be contradictory or even unreasonable. Examined in the context of discourse about how to pay to for transitions, however, and with attention to what underpins such views, they become far more understandable. The more positive positions on consumer bills in some way providing a basis for financing different elements of transition were tempered by a fundamental distrust in energy companies regarding the opaque nature of energy bills and markets, and scepticism about their efforts to deliver fair pricing (see also Ipsos MORI, 2012).

P: It's gone up by about 19%, we just got that in the last week or something like that, [murmurs of agreement from group] and they are all doing the same thing. Now they're not asking us, they're just imposing it on us, and that's an unfortunate thing that when you do get things imposed like that and you don't know why, you don't know the reasons, I mean they just come up and say this is what we are going to make it, and that's the increase. (Edinburgh)

P: ...they blast you with jargon, blast you with all sorts of figures and kilowatts and whatever, and you don't know what you are paying for. (Cumbria)

In this context, then, though we found some support for bill increases to pay for the forms of transition that were desirable (e.g. renewable supply technologies), we anticipate that this is unlikely to be meaningful in real world contexts because many other things enter into the formulation of views on this issue. For example, our participants raised more fundamental questions about whether transitions should be financed through consumer bills at all. To unpack this further, it is necessary to discuss the complex narrative of responsibility that was evident across the dataset.

Though members of the public took on a level of responsibility themselves in enabling, fostering and, crucially, paying for transitions, this was disrupted by a sense that these transitions were fundamentally a social good that should be financed in a way that distributes costs fairly. In this regard those that had benefitted most from the existing system of fossil fuel production and sale were seen as having higher level responsibilities for contributing toward the financing of transitions.

P: It just occurred to me that at the end of the day these are the people that are making the money and are the source of producing the carbon... electricity companies obviously. So they have to have some ownership of it as they have had so many years of profit making and offering us gas and electric, definitely they have to take some responsibility for it themselves. (Cardiff)

This was confounded by a sense that energy companies were not, at present, contributing to what was ultimately viewed as an undertaking that must be reciprocal in process and outcomes.

P: We would give a little bit more if we saw where their profits were making an impact as that would make us want to help a little bit more. (Cardiff)

There was, then, a strong emphasis on the significance of companies making different investment decisions and, rather than raising bills, reinvesting profits. This position should not be regarded as naïve, however, as this was how people thought things should be and it was strongly tempered by a sense that this was not how things are or how they are likely to be in the future. It offers some explanatory power though, in understanding why there were strong preferences for potentially more costly routes to change despite deep concern about rising costs.

In addition to these concerns about responsibilities for financing transitions, publics discussed responsibility for ensuring energy is kept affordable. In official discourses affordability tends to be positioned, in the main, as an outcome of a properly operating market and is related to questions of market price. At present, high dependency on fossil fuels (particularly gas) means that their wholesale price forms the focus as the most significant factor with regard to varying energy bills (see DECC, 2011b). This way of thinking about affordability and variation in pricing, however, represents a narrow characterisation of the issues when contrasted with public views, which signal a much wider range of concerns as important (e.g. trust in energy operators). In this regard, official discourses do not indicate clear responsibility for the delivery of affordable energy but relegate this to something that ‘the market’ delivers. In public discourse, by contrast, responsibility for ensuring affordability represented a key aspect of concern.

Here, similarly to the findings discussed in **Theme 2** we found that responsibility was distributed and not located with any one group. At one level, participants expressed a personal sense of responsibility for reducing or controlling energy use in order to keep costs low.

P: I am concerned about it [energy costs], but it's just knowing what else can we do and what else can everybody else do - it's almost like taking personal responsibility. (Cumbria)

At another level, they positioned government as ultimately responsible for ensuring energy remained affordable. This was despite energy companies and their ‘untrustworthy’ practices being the focus of perceptions relating to the reasons behind bill increases or ‘unfair’ prices. This finding can be made more understandable if we analyse the different characterisations of the relationships between state and citizen and between company and consumer. Here the concept of social contracts offers a useful lens for interpretation.

The notion of social contracts refers to an agreement of reciprocal responsibilities, rights and obligations between state and citizens (e.g. citizens pay taxes, vote and obey laws in return for the state maintaining order, fostering citizen wellbeing, and providing education, health services and so forth – O'Brien et al., 2009). In our participant's formulation of responsibility for ensuring energy affordability, it is possible to see how a sense of reciprocal obligations underpinned their views on the roles of state and citizen. That is, public(s) took on a degree of personal responsibility for keeping costs down (not using energy wastefully and so forth) and government was expected to ensure energy continued to be available at affordable prices. By contrast, energy companies were regarded as principally profit oriented and as having no social reason to keep prices low or ensure affordability as a dimension of well being. Additionally, participant's perceived the competitive function of energy markets as inadequate and, as such, the market was not perceived to be an effective mechanism for ensuring fair prices.

P1: ...part of the problem is that they have opened up the market place and the market place now dictates what we pay whereas before it was centralised and government-led and a fair price for all, now we swap and the next week they put their prices up and you wish you stayed with that one.

P2: I think it does need to be uniform because at the minute we are playing in a monopoly and we are losing because they are getting mega big bucks from the profits. (Cumbria)

Though participants felt energy companies should be taking responsibility for ensuring affordability, the nature of the relationship between company and consumer was not viewed as one with a basis for reciprocal responsibility. Instead, it was characterised as one based only on the person paying their bill and the company ensuring available energy supply – an exchange between customer and company with no wider sense of moral obligation. The relationship of rights and reciprocal responsibilities is thus conceived as one between state and citizen. While the relationship between business and consumer is one of contractual agreement and financial payment.

This latter relationship is one which has become intertwined with social contracts with regard to the energy system but is qualitatively different in its formulation. Perhaps problematically ‘corporations, unlike governments, are not accountable to citizens, who have no authority to install or dismiss them if they feel aggrieved or violated’ (O’Brien et al., p. 3). Responsibility for ensuring affordability was therefore located with government precisely because people felt they had recourse to call on government to meet this obligation in a way that they did not with companies. This conception of how responsibility operates within energy systems was not, then, viewed as positive – nor was it normative in the sense of being how people thought things ought to be – but it emerged as a pragmatic interpretation of how the system operated. This raises an important set of questions in thinking about change to social contracts, as corporations have become increasingly involved in important ways but without development of the corresponding societal responsibilities to underpin such involvement.

This difference in the ways that corporations and government were ultimately viewed is also connected to public views on their trustworthiness. In this regard, our participant’s discourse did confer some level of what might be regarded as trust in energy companies. Given that relationships with energy companies are contractually based and involve exchange of payment for energy to support services, companies have a self interest in providing this service as they are profit making entities. In this sense, companies are trusted to deliver energy services in exchange for payment. That is to say, they are trusted to undertake things that appear to align with company interests, as their actions are therefore understandable, even if not liked.

The other side of this, however, is that mistrust and suspicion arise with regard to actions that appear to be against company interests (see also Terwel et al. 2011). In this regard, though there were widespread calls for energy companies to take a role in paying for transitions, they were not trusted (or anticipated) to do so under current business models and approaches.

P: The energy companies are profit making concerns. I don’t know what incentive there is for them to encourage people to save energy that reduces their profits... so obviously they are going to be politically campaigning against it... (London)

Equally, whilst government was expected to take a strong role in the delivery of fairly and adequately financed transitions, it was not necessarily trusted to do so. Of particular concern were the wider actions of government in terms of public spending. This was fundamentally related to what Wynne (1996) has referred to as the ‘body language’ of institutions (also Otway and Wynne, 1989). Participants in the research noted various elements of such institutional body language, which called into question the trustworthiness of government and/or the credibility of information about the urgency and severity of energy issues. Seeming contradictions between formal communications and political action represented one element of such ‘body language’ but so too did spending decisions seen to be at odds with imperatives of energy system change.

P: Perhaps stop wasting hundreds of millions of pounds on failed world cup bids. That would have insulated a hell of a lot of houses. Realistically things like that could go a long way. (Cardiff)

Ultimately neither government nor energy companies were trusted to ensure fair financing of energy system transitions. In this regard participants anticipated that changes would be required, both in the ways that companies are formulated and in the ways that government behaves, to create a context for reciprocal responsibility in the delivery of affordable energy through transitions. Crucially, efforts to bring the requirements of energy system transitions in line with energy company interests were seen as potentially essential for changes to be successfully enacted.

P: That difference between profits and what is best for the country is something that I think is a problem with business and it is going to be extremely hard. You might force people, you might make these companies, which already have so many things they have to do, but are they going to invest as much? ...It has to be for their own good... (London)

In this section we have examined the ways that questions of cost and affordability with regard to energy systems and prospective transitions are negotiated by members of the public. We have aimed to highlight how cost is formulated as a multi-dimensional concern with a wide range of things being brought into consideration in the construction of public preferences. These include public(s) feelings about energy companies and the liberalised market system, their feelings about government, their concerns about equity, and their views with regard to trust and responsibility. We have explored public characterisations of the major issues connected to energy costs and paying for transitions, including how responsibility for financing transitions is and should be configured, how this relates to responsibilities for ensuring energy remains affordable, and how far public(s) trust energy companies and government to deliver on their responsibilities.

Centrally, we highlight that cost is unlikely to be straightforwardly “traded off” against other aspects of energy system transition, such as moves to renewable energy supply technologies, because of the numerous elements encompassed within concern about the issue. For example, publics may not believe that bills are going up in order to fund energy system development of the kinds they want because current energy costs and bills are perceived to be opaque and unfair. Equally, they raise more fundamental questions about why they should pay through their bills for something that is considered to be a social good – something that does not correspond with the consumer-supplier relationship as it is currently configured.

All this points to an important set of questions about the relationships between public(s), government and energy companies and the distribution of costs and benefits in paying for 2050 transitions. It suggests that changes may be required with regard to the ways that these relationships are currently configured; particularly the embedded forms of reciprocal responsibility upon which rule by consent rests. It does also suggest that any renegotiation of social contracts may need to be time sensitive, explicitly considering debts to the past as well as obligations to future citizens (see O’Brien et al. 2009).

This is a complex area of public attitude research and further study of public engagement with cost represents a key issue for future research. Central to this research would be the necessity to address the multiple dimensions of concern about costs (e.g. existing market structures, perception of energy as a basic need, trust, motives and responsibility). This is particularly important as there is a danger of simplistic interpretation with regard to public responses to questions about cost. For example, publics will frequently reference the importance of cost ‘off the cuff’, but, as we indicate here, this aspect of public discourse is far more complicated and nuanced than can be revealed through straightforward questioning about higher or lower bills.

Concern about bills and increasing energy costs is high. This concern is not related to ‘green’ government policies but to perceptions of energy companies as profit-making entities and as untrustworthy in their management of energy costing.

There is some evidence to suggest that higher bills would be accepted if it was to pay for desirable forms of transitions (e.g. renewable energy). However, distrust toward both government and energy companies is likely to mean that members of the public will not believe monies levied through bills are being spent to this end. This means such findings are unlikely to manifest as acceptability in ‘real world’ contexts.

T4: Uncertainty, Risk Making and Risk Taking

Numerous commentators have noted an increased concern with risk and the management of uncertainty in the governance of socio-technical issues over the past few decades (e.g. see Beck 1992; Slovic 1998; Lupton 1999; Power 2004; Pidgeon et al. 2008). In this context, there has been increasing interest in the ways that members of the public characterise risks and uncertainties associated with particular energy system technologies (e.g. see Wynne, 1992 and Parkhill et al. 2010 on nuclear energy). Thus far, however, there has not been research examining public characterisations of risk and uncertainty related to whole energy systems and processes of transition. In this theme, we navigate through our participant’s discourse exploring the ways that “risk” emerges and analysing the implications of views on riskiness for public perspectives on system transformation.

Over the last several decades, socio-cultural risk researchers have shown that meanings of risk go beyond realist framings of risk as objective hazards or probabilistic technical definitions. Instead, interpretive risk researchers have shown that ‘meanings of risk are discursively negotiated, dynamic and part of a wider set of social relations’ (Parkhill et al., 2011, p. 324; also see Wynne, 1991; 1992; Eyles et al., 1993; Simmons and Walker, 1999). In an effort to neither under nor overstate the importance of risk, there has also been a shift toward research that examines risk within the context of everyday life (Tulloch and Lupton, 2003; Henwood et al. 2008). The challenge with the present study is that the everyday lives we are interested in do not currently exist and so we are exploring participants’ imaginings – technical, social, geographical – of potential future risks (see ‘Introduction’, ‘Methods’ and **Theme 7**).

This section is organised around an analytic distinction between risk making and risk taking. Risk Making involves exploration of talk that is related to the implementation of some form of intervention by others (e.g. the building of a new nuclear power station), which our participants felt could leave them vulnerable to risk. Risk Taking entails analysis of discourse regarding either a change they themselves have chosen to enact, which nevertheless brings feeling of vulnerability to risk, or a change they may wish to avoid as they feel it would put them “at risk” (e.g. installing solar panels).

In terms of Risk Making, it was deemed extremely important that technological developments across the whole system – established and emergent – are safe. In particular, that human health should not be affected now and in the future was of deep concern. In the following excerpt, the focus is on Carbon Capture and Storage (CCS) but this was equally true of other energy system technologies.

P: What happens if it [carbon dioxide] escapes? ...I don't know much about these things, could it cause an explosion or something like that or what would happen if it leaked in to the atmosphere or whatever, what would happen? (Merthyr)

Issues such as these might be met with responses that point to assessments of the likelihood of an incident as highly improbable. This form of response, however, neglects that which is at the core of such questions and statements – i.e. deep seated concerns about the uncertainties and unknowns regarding the potential consequence(s) in the event that an incident does occur. Concerns, in this regard, were not limited to health issues they also encompassed potential impacts on the environment (for example, wind turbines causing ecological damage).

Our participants articulated fairly sophisticated understandings of the likelihood and scale of risks. In this regard, low probability events with high consequences (e.g. a nuclear accident) were of concern because of the scale of the impacts rather the frequency or likelihood of occurrence. Whilst for a rare few this was an acceptable risk, for many the scale of the potential impacts was enough to bring them to omit technologies, like nuclear, from their imagined futures.

P1: But I am a bit of a gambler, and I would be willing to gamble that that nuclear power plant blowing up against having this lovely lifestyle, but that's...

P2: So did the Japanese probably and Chernobyl and that they probably done that gamble.

P1: Exactly, but the chance of that happening are probably 10,000 to 1 and I would be happy with the odds.

P3: Would you be happy with you or your family living next door to it, 'cause somebody's got to live next door to it?

P1: Absolutely, if there was no detriment to my health and safety absolutely no problem with that. But that's what I'm saying, I would take that gamble. I could walk out there today and get run over by a double Decker and there is probably more chance of that happening than a nuclear power plant blowing up. I would take that gamble.

P2: Cross at the traffic lights and you'll be fine [giggles]. (Cumbria).

In the above quote, participant 1 points to other activities which he regards as riskier thereby normalising the risks of nuclear power (see also Parkhill et al., 2010). Yet the other participants work hard to shut down this discourse by pointing out the incongruity in the terms of the consequences should an event occur. Ultimately, however, it is the humorous parting jab from participant 2 that punctuates the difference between the two risk events at the centre of the discussion – whilst participant 1 can perhaps take some mediating action to avoid being run over by a bus, he does not have the means of control to avoid a catastrophic nuclear incident.

Some components of energy system transition were less likely to be incorporated in future energy system visions due to concerns about the risks of being stigmatised. Stigma has been defined as 'an attribute or token of infamy, disgrace, or reproach [which] reduces the possessor ... from whole and usual, to marked, violated, and damaged' (Wakefield and McMullan, 2005, p.301). Though stigma was originally conceptualised as relating to a person's individual attributes, it has been extended to incorporate consideration of the ways that 'negative affective responses' can transfer from technologies or objects (e.g. places, industries) to people (Walker, 2001, p. 354; also see Fischhoff, 2001). In this regard living in an area where a particular energy system infrastructure is located can confer a form of what has been termed 'geographic stigma'. This type of stigmatisation formed the principle focus of concerns:

P: Just one of these things, you look at one or hear about it and you are just like no, I don't want one of those near me, with radiation and stuff. The thing as well, if they put it in Edinburgh people would be like "I'm not going there". (Edinburgh)

In part, such concerns about stigma are related to participants' mediated experiences of previous incidents (for example, Fukushima), but in other ways they are connected with wider concerns about the technologies (for example, nuclear has been found to be uniquely dreaded – see Slovic, 1987). Whilst feelings of dread and uneasiness are in many senses unique to nuclear power, we also found some striking similarities between the perceived risks of nuclear power and carbon capture and storage. Both shared a similar logic: they involve the generation of power and the production of a waste product that needs transporting away and storing indefinitely.

Socio-political risks represented a further key concern in relation to certain forms of energy generation. In particular, the potential for resource conflicts around fossil fuels represented one of the underlying reasons for many excluding these energy sources from their future visions. Other issues related to the potential for land conflicts around energy system elements, such as biomass and onshore wind energy. While some voiced concerns connected to the legacy risks that might be left for future generations (see also **Theme 5**).

P: The only plus of capturing it is that you maybe hope that they discover some technology further down the line, but that's sort of putting the problem onto other generations anyway. (Merthyr)

A final element in terms of risk making that we wish to focus on related to choice and the extent to which choice was available to people. Broadly speaking, our participants felt it would not be up to them to decide whether or not we should pursue some of the larger supply-side options and that they would have little say or sway in the decisions. In the following excerpt the participant is

responding to a question about their views on different forms of energy supply. Their quote encapsulates a dichotomy that was drawn between perceived lack of choice over large interventions and the ability to choose or take up options on a smaller scale.

P: See that choice though, is that not kinda out of our hands mainly, 'cause on the other things it was personal to our homes, whereas that one it depends on what the government choose, if they choose to keep a nuclear power plant or if they choose to open one of these biomass. (Edinburgh)

The presence or absence of choice in terms of risk has been found in previous research to be significant in the formation of people's sense of risk (e.g. see Slovic, 1987; Wynne, 1996). In short, when the risk involved arises as a consequence of personal choice (e.g. sky diving), the risk is not negatively perceived in the same way as it is when a risk is imposed. The notion that large scale supply technologies are not an aspect public(s) have choice over, as the quote above highlights, may thus result in a greater tendency for risk to be viewed more negatively with regard to these aspects of system change.

This leads us on to think about our second analytic thread risk taking. The above reasoning may lead us to conclude that elements of transition involving voluntary action by publics will be less likely to engender anxieties and concerns about risks. However, we found that many of our participants articulated an underlying sense of vulnerability when discussing changes to their personal practices. In this regard, such actions were characterised as involving risk taking.

P: I used to bike to college and out of college every day...I was quite happy to use a bike. But traffic has increased enormously and that's what worries me especially around country lanes. (Cumbria)



Across the dataset a lack of appropriate infrastructure arose as a key reason as to why greater use of lower carbon forms of transport were thought unlikely to occur – be it using public transport or cycling more.

In the illustration above, the participant, who is an older gentleman, is talking about when he was a younger man and felt comfortable cycling but explains that now, due to increases in traffic, a rather mundane activity has been transformed into a risky endeavour. Although this example pertains to rural life, across the dataset a lack of appropriate infrastructure arose as a key reason as to why greater use of lower carbon forms of transport were thought unlikely to occur – be it using public transport or cycling more.

Although micro-generation technologies (particularly solar) were desirable for many participants, talk about investing in new ways of producing energy and transitioning from consumer to prosumer (i.e. someone who uses the energy they themselves produce) was also imbued with a sense of risk (on prosumers see Potter, Archambault, Westrick, 2009).

P: To be honest with you, I think part of it is as well that if anyone sticks their head above the parapet to try and do anything, you know like, if there was a river like running in the back of your garden, people are so frightened to do it because they think if they try and do that the council is going to block me. I'm frightened that I am going to get... into trouble by doing something that's slightly different. (Cumbria).

P: I'm concerned about my roof. My neighbour had solar heating on his roof, and he complained about the roof leaking. The main damage to slate roofs is caused by people who put up television aerials and people who do things on your roof who aren't roofers, so I am hesitant about putting solar cells up. (Cumbria).

Both of the quotes above are indicative of the uncertainties and potential risks that are perceived in moves to the production of energy within homes and locales. For the first participant, this related to the difficulties of navigating complex and unknown governance structures, rules and regulations. The second quote is indicative of concerns about the risks of poor installation and maintenance issues that come with making changes to your home.

Being an early adopter of new technological forms and ways of doing was also seen as being potentially risky. In part this was due to a perceived lack of existing infrastructure to support and facilitate its use in everyday life – for example, the electric car and lack of EV charging points leading to the now well-known ‘range anxiety’ issue (e.g. see Franke, Neumann, Bühler, Cocron and Krems, 2012). However, it was also clear that participants felt that technologies take time to develop and iron-out any issues or flaws. In this regard, being an early adopter was viewed as leaving one vulnerable to technical problems and disruption associated with technological failures.

P: The other thing I have noticed with a friend of mine – they have one of the new hybrid electric cars and they used to have a petrol car before, and they saw the immediate changes, but they’ve only had the car 18 months and the electric car is actually having more problems than the old car they got rid of. (Cumbria)

For some, then, it was important to be cautious in the potentially premature introduction of a “not quite [there]...pseudo technology” (Cumbria), or in changing ways of doing until it is possible to be more confident of the efficacy. Others, however, saw early adopters as taking on an important and necessary role related to the further enhancement of measures. The current economic climate also served as an important backdrop for adopting new practices and roles, particularly in relation to uptake of new technologies. Economic investments were seen as more precarious with the recession putting increased pressure on the need to make less risky investment choices – both in terms of capital and maintenance costs.

An additional dimension to risk taking is related to a concept we introduced earlier in the discussion of risk making, that of stigma. Some participants spoke of a reluctance to take up new pieces of kit or different ways of doing due to a risk of being seen as different.

P: One of [the] important things is you don’t want to make it look like you are a special case necessarily...Personally I want to be normal, I don’t feel I need to make that statement. (Cardiff)

This runs counter to the idea that the adoption of new technologies adds positively to a ‘sense of self’ and can be seen as fashionable (Katz and Sugiyama, 2005). Perhaps what excerpts like this reveal is a legacy of fear associated with stereotyping of environmentally conscious forms of action as being undertaken by ‘the hippie tree-hugger, the radical tree-spiker, the self-absorbed, ... [or the] haughty green consumer’ (Delaure, 2011: p. 452). Such concerns about the risks of early adoption brought a recognition that the success of innovations often rest on a delicate balance between adoption and development.

P: I wouldn’t buy electric cars unless I was sure that I would never run out. It’s what comes first - if the infrastructure isn’t there first, people won’t buy electric cars, but they won’t make electric cars unless they are convinced people are going to buy them. So it’s like a cycle, what comes first? (Cumbria)

The sentiment of this quote can be summed up as “who is willing to take the risk first?” – this clearly represents a significant challenge in enacting low carbon transitions. It would be easy and erroneous to come away with the image that our participants were paralyzed by risk and thus reluctant to embrace change. As **Theme 2** has already depicted, this is simply not the case. Whilst some risks were to be avoided, change more generally was not. Indeed, some of our participants suggested that the biggest risks do not arise from taking action, but rather from inaction.

P: People don’t realise though what is going to actually happen if they don’t [change] though. They think oh yeah it’s gonna carry on going and carry on going and everything’s going to be alright, they don’t [/won’t] realise until it actually happens. (Edinburgh)

In this theme we have maneuvered through two key aspects of risk talk around energy system transitions: risk making and risk taking. In the discussion of risk making there were key developments that made the participants feel vulnerable to risk and thus generated a desire to avoid them. By way of contrast, in the analysis of risk taking, whilst risks were clearly acknowledged and significant, there does seem to be a greater openness to living with the risks involved. This is perhaps indicative of the previously discussed difference between imposed risks and risks that are taken by choice evoking greater and lesser degrees of concern respectively.

Due to concerns about the scale of potential impacts in the event of something going wrong, many participants desired to omit technologies like nuclear power from their imagined futures.

For some of our participants the biggest risks do not arise from taking action, but rather from inaction.

T5. Socio-Technical Change, ‘Non-Transitions’ and Pessimism

Through other themes discussed thus far in this report we have offered insights into some of the parts of system change that are most (un)desirable in public energy system futures. In this theme we unpack further the underlying values and concerns that relate to aspects of change found to evoke discourses of contestation. In particular, we focus on carbon capture and storage (CCS) and biofuels as two energy system components that play significant roles in many existing expert or policy energy system scenarios and envisioned futures (e.g. see DECC, 2011; Committee on Climate Change, CCG, 2011).

Interestingly, discourses about both CCS and biofuels were characterised by similar underlying logics that formed the basis for views on these system components. This arises largely because in public discourse both were associated in different ways with fossil fuels and the negative perceptions attached to these energy resources. This section thus addresses the options of biofuels and CCS together, exploring public characterisations of these concerns and offering insights into the possibilities that exist for contestation as these approaches are developed.

In the introduction to this report we foreground the notion that views and opinions are formed through processes of connecting up new information with existing values, world views and positions – this is particularly true of issues that are unfamiliar or relatively unknown to people (e.g. Wynne, 1996). For this reason, examining what underpins people’s views is important as it gives insight into the more general positions that underlie particular concerns. Put another way, if one is to understand emergent public attitudes, it is necessary to pay attention to the ‘underlying frameworks and dynamics that are likely to structure their development and evolution’ (Macnaghten, 2010, p.24).

The key finding was that where concerns arose they were often underpinned by conceptions of CCS and biofuels as, what we term, ‘non-transitions’– that is, they were viewed as approaches that defer, rather than solve, energy system problems, and as ‘short-term’ in their outlook.

In this regard, the key finding was that where concerns arose they were often underpinned by conceptions of CCS and biofuels as, what we term, ‘non-transitions’– that is, they were viewed as approaches that defer, rather than solve, energy system problems, and as ‘short-term’ in their outlook. They were ‘non-transitional’ to the extent that they did not fit with the public conception of what a transition should be; i.e. it should involve change that addresses the root cause of issues. This combined with an underlying set of expectations that could be described as something akin to technological pessimism (defined below), as opposed to the optimism characteristic of engagements with some technologies (on optimism see for example Jasanoff, 2003; Welsh, 1990).

It is important to state that this section focuses on factors that underpin discourses of contestation and concern and should not be taken to suggest that there were no positive narratives around these components of energy system change. The interest here is to explicate and interrogate the basis of negative responses as these give insights in to the potential for future contestation. In the following, we first discuss narratives of non-transition before moving on to navigate through discourses of (technological) pessimism.

Central to the notion of non-transitions is a strong and widely held public concern found across the groups about continued reliance on fossil fuels (oil, gas and coal). Fossil fuels, as supply options, evoked particularly negative responses in terms of their role in future energy systems. In general they were viewed as polluting, archaic, finite and as sources of global conflict.

P: Hydrocarbons should not be used - not as a source of energy. Burning stuff to make energy is the wrong thing to do. (Cumbria)

Such views also extended to unconventional fossil fuels (e.g. shale gas, deep sea oil), where the research indicates that further potential for extraction does not alter negative views with regard to their future role (see also **Theme 2**). Attitudes toward fossil fuels translated into an intuitive negativity about CCS and, to a lesser extent, bio-energy, as they carried either direct connections (as in the CCS case) or associations (as in the bio-energy case).

In relation to bio-energy, similarities were perceived in the ways that both energy sources entailed processes of burning natural resources.

P: I think it’s because in my mind, I think burning rain forests and burning trees or whatever, so it is that association, and even though you’re replanting, and they are only planted for that reason, I’m still like... it doesn’t sound healthy. (Edinburgh)

Fossil fuels and bio-energy were also related in discussions of the potential requirements for international imports – this opened up perceived possibilities for competition, global conflict, and injustice arising over the resource, akin to those associated with oil.

P: It's another business. It's another oil producing business that then becomes paramount to any other needs and bio fuels just become another monster. (Cumbria)

Connections to fossil fuels were thus important in the manifestation of 'non-transitions' discourse around bio-fuels, as they were seen to hold potential for perpetuating similar problems.

In the context of CCS the connections to fossil fuels are clear given that a key envisioned application of the technology is for fossil fuel power stations. In this regard, the non-transitions narrative involved the characterisation of CCS as 'short term' or as an approach that defers, rather than solves, existing problems associated with energy systems.

P: We have been using oil and gas and coal for years and years and we all know it creates smog and all the rest of it... It (CCS) is a cleaner version of that, but the issue is, as far as I see it, we are still using materials that will disappear if we carrying on the way we're using them... it is a difficult one as we are still looking for oil and we may find some big new oil fields that will keep us going for a hundred years, but we are using the Earth's resources which will run out, so although it's cleaner it feels like it is a short term option... maybe just cleaning up as opposed to let's look at this again and let's look to the future longer term even beyond 2050. It will take a long time to build this infrastructure and all these resources are being eaten whereas there are other energy sources around us which feel a bit longer term, like the sun. (Cardiff)

P: I think if we go, start down that route of carbon storage, forever we will be down that track because it's easy isn't it? It's an easy solution... but actually for me its cutting corners and forever we'll be you know enslaved to it... (Cumbria)

This notion of a "short-term solution" was also salient for biofuels, though not to the extent found in the CCS case.

P: Yes, it feels like come on guys, we can do something better than that. I don't know what it is about it, maybe it is because it's just burning stuff, it doesn't seem very sophisticated or sustainable and it seems like they have just panicked and said we'll just burn stuff. (Cumbria)

It is important to highlight that in general there was greater uncertainty about bio-fuels and as a consequence views were more ambivalent (i.e. people expressed conflicted or opposing ideas). This was in contrast to CCS where the direct connections to hydrocarbons resulted in a greater intensity and wider ranging expression of negative perspectives. A further key difference between the characterisations of CCS and bio-energy was that bio-fuels were seen to have potential in substituting fossil fuels. In this sense, when bio-fuels were contrasted with fossil fuels, rather than associated with them, a different narrative emerged – one that characterised concerns about bio-energy as a trade off with deeper concerns about fossil fuels.

P: If the necessity came to it then we wouldn't have much to say about it actually because when you point out that it is an absolute need or the alternative is offshore drilling, sea pollution like the Gulf of Mexico you know could happen here so if you spell out the alternatives to this you would have some sympathetic hearing. (Cardiff)

There were further notable differences in perspective that arose regarding CCS when the idea of using the technology for emissions arising from industrial processes was introduced, and when notions of reuse were brought into view (see also Shackley, McLachlan and Gough, 2004). Discussion about CCS in this context saw the technology dissociated from fossil fuels and instead associated with industry. Industry, and manufacturing in particular, were viewed (almost universally) as an important and necessary part of the UK's economy and preferences on the whole were to increase manufacturing in the UK. This is discussed in more detail within Theme 8 but for now the point to be made is that CCS in this context represented a solution to a problem arising from something that was otherwise regarded positively (i.e. industry). By contrast, in the case of CCS for the fossil fuel power sector, it addresses only one element (i.e. climate change) amongst a wide range of concerns relating to fossil fuels.

The next explanatory theme of this section focuses on the notion of technological pessimism or, what has been termed, technological realism (Adam, 2010). This refers to an attitude which contrasts with that of technological optimism (see Jasanoff, 2003; Macnaghten, 2010; Markusson and Shackley, 2012) and relates principally to a sense that technological failure is always possible and that if the worst possible event is not acceptable then the action should be avoided (Adam, 2010). Technological pessimism (or realism) took a number of different forms in the data. For CCS, it related in part to expectations of inevitable technological failure.

P: See, I worry about that whenever humans try and transport something dangerous they always make an arse of it somewhere along the line, like oil. The damage we have done with big oil tankers spilling out, we would have to transport this (carbon dioxide) and store it and obviously I don't know how that gets out, is it like a vapour or liquid or ice, I don't know, but if you leave humans to transport something from a to b at some point of them doing that they will make a balls up and it could end up back in the environment. That is just my opinions on humans, but we always make an arse of it somewhere. (Edinburgh)

Beyond this sense of inevitable technological failure, there was pessimism surrounding the processes of technological development for CCS and concerns about the inclusion of undeveloped or undemonstrated technologies within system scenarios.

P: If the technology's [referring to CCS] not even available yet, even if you put that onto this calculation board or whatever [referring to the DECC my2050 calculator], it's going to create a false reading isn't it? Because it's not actually available yet. It might perhaps be that in five years time we say, "Oh no, we can't do it." (Cumbria)

Pessimism about socio-technical issues is connected to trust in the institutions and organisations responsible for control, regulation and so forth (see Wynne, 1996; Terwel et al. 2011). In this regard, historical experience of poorly managed risks, and problems associated with the wider energy sector, were drawn upon in the formulation of public characterisations of CCS and bio-fuels. For example, the deep sea oil disaster in the Gulf of Mexico or oil spills in general, formed one such point of reference.

Bio-energy shared these forms of more pessimistic reaction but in different ways – i.e. expectations were for risks associated with biofuels to manifest but these were not necessarily about technology per se. Instead, pessimism related the social and political governance processes for bio-fuels grown specifically for energy purposes.

P: It depends where they get it from. I understand they're growing certain crops which took up farmland for growing food - that's not the way to do it. (Cumbria)

Such reservations about the use of land for growing energy crops were compounded by issues relating to trust (discussed in detail in **Theme 3**). In this instance, distrust toward energy related businesses, regarding particularly their profit driven motivations, resulted in mistrust about the extent to which biofuels would be managed in ways that did not create negative impacts associated with changes in land use.

P: If it is recycled I have no problem with it, but if it is a crop that's specifically grown for fuel then no, not when you've got starving Ethiopia or wherever else.

M: But what if it wasn't on food crop land?

P: I think the figures would be fudged again because companies want to get wealthy. If everything is fuelled on this thing and then more land is needed... it is too dangerous to go down that route. (Cumbria)

Though quite different from its emergence in talk about CCS, this type of discourse can still be seen as a form of pessimism, with the expectation for “things that can go wrong to go wrong” in the future of bio-energy. The key difference here, however, is that the pessimism is related not to socio-technological failure but to the expectation for failure of socio-political decision-making, regulation and industry in ensuring responsible growing, sourcing and supply.

Discourses of trust have long been recognised as important in public engagement with socio-technical or environmental risk issues (e.g. Wynne, 1996; Poortinga and Pidgeon, 2003). Wynne for example, has argued that responses to socio-technical issues are often rooted in judgements about the trustworthiness of expert institutions – characterised as ‘those that are supposed to control the risk processes involved’ (1996 p.57). In discussing CCS and bio-energy participants frequently related their more negative conceptions to feelings of distrust in both government and industry.

P: I think it would be the safety aspect, we don't know enough about it, except what the government tell us, the government won't tell the ordinary punter anything that they don't need to know. (Glasgow)

In processes of deploying bio-energy and CCS within future energy systems, trust is thus likely to be an important issue in the emergence of contestation.



In this section, concepts of ‘non-transitions’ and ‘socio-technological pessimism’ have formed an organising principle for unpacking our participant’s discourse with regard to CCS and bio-energy. The analysis offers insights regarding how within public understandings links are formed between fossil fuels and these energy system options, which contributes to a sense that they represent a short-term “fix”. We also show how a sense of pessimism about both socio-technical and governance failure runs through public discourse, contributing to concern about these proposed elements of system change.

As noted at the beginning of the theme, this analysis does not incorporate discussion of all the characterisations of these issues that arose through the analysis. Rather, we focus on the underlying concerns that foregrounded the more negative public perspectives across the groups. That said these aspects of system change were notable for their potential to evoke contestation and for the connections that were made with fossil fuels. Nuclear and wind energy can also be included in the list of energy technologies that evoked contestation, but these were not related to fossil fuels and brought a different set of concerns (discussed elsewhere – e.g. see **Theme 4** and **6**). The general conclusion to be drawn from this theme is that, any socio-technical options, beyond bio-energy and CCS, that entail high consequence risks (technological, political and/or social) and also hold non-transitional qualities, have the potential to evoke contestation and public concern.

Some elements of energy system change (e.g. CCS) were intricately associated with notions of inevitable technological failure. There were concerns about the inclusion of undeveloped or undemonstrated technologies within system scenarios.

Bio-energy is viewed differently to other renewable forms of energy. At times it was more closely related to fossil fuels as both energy sources entail processes of burning natural resources.

T6: Energy Matters in Place: Politics, (In)action and Control

One of the aims of the project has been to explore the relevance of place and context for public perspectives on energy system transitions. This was connected to the objective of developing insights into public views on everyday lifestyle changes implicated in different energy system scenarios. In this theme, we thus bring a focus on those aspects of our participant’s discourse pertaining to how they considered transitions might manifest within their everyday lives, and the issues they foresaw that were particular to the places in which they lived. Discussion centres on the ways that place may facilitate or disrupt the implementation of an intervention, ranging from infrastructure siting to demand side management. We explore whether or not our participants felt the intervention in question was suited to their area, how socio-cultural histories of place are relevant to views on transitions, and the implications of social constructions of the home for enacting change. As such the spaces and places in question are at multiple scales, including national, regional and the very local.

To talk of transitions as a singular united event or vision grossly simplifies the complexity of change and obscures the importance of understanding how they will manifest in place. Choosing areas with different characteristics from more rural to more urban, and participants with varied lifestyles and circumstances allows us to explore whether or not publics feel the changes being proposed are suitable to their area and way of life. Participants from both rural and urban areas felt, at times, that the proposed change was either not suited to their area or, perhaps more crucially, threatened their way of life. For those living in more rural areas, one example was the envisioned shift toward using more public transport:

P1: It [increased use of public transport on the DECC My2050 tool] is not very feasible for any of us... And that’s not us passing the buck – it’s horses for courses, we don’t have that option but if it was available we would.

[...]

P2: In my case 20% of journeys would be a hell of a change.

P1: But we are talking about UK as a whole and not us as an individual special needs area.

P2: It will still be difficult in a rural area – we’ve got to rely on bus services, as you say, or arrangements with our neighbours.

P3: I think cities can definitely be public transport if they sort the systems out, put in electrical trams... you know... Edinburgh [laughter from group]. (Cumbria)

A second transport related example was the concern raised by rural dwellers that electric cars would not be able to perform adequately in hilly areas. Such anxieties about the performance of electric vehicles are distinct from other concerns, such as the more well known “range anxiety”, which our participants also engaged with (see **Theme 4**). Both forms of anxiety underpinned the perception for some that electric vehicles would be ill-suited to rural areas, conversely they were often deemed as most appropriate for travel within cities.

Urban dwellers would, by contrast, point to building forms more typical of city life – including flats, apartments and tenements – and suggest that some envisioned changes are more suited to private detached or semi-detached buildings. There were two sets of reasons for this assertion. First, our participants argued that changes, such as installing insulation or solar panels, would be intractably difficult due to the sheer number of owners or occupiers that would need to be consulted in, for example, an apartment complex. Second, the compressed and more intense living arrangements per capita typical of urban dwelling was seen as a key constraint for implementing certain types of demand side management techniques.

P: ...as I say I wouldn't mind putting mine on during the night but just with the fact the girl that stays upstairs has a wee baby about 3, so I wouldn't even dream of putting the washing machine on because it sounds like a rocket taking off at 2 o'clock in the morning... (Edinburgh)

In both rural and urban locations, some participants pointed to the importance of preserving our built heritage. It was noted, however, that policies and regulations aimed at conserving our built environment may be at odds with those implicated in energy system transitions.

P: You would imagine that new builds will have it [insulation] as standard, but they will probably have to start cutting out the red tape for people that want to insulate homes, like for instance in Edinburgh where almost every home is listed, and you can't do anything to them, so they need to cut the regulations and say insulation is top priority. (Edinburgh)

This connects with the earlier discussions in theme 2 and 3 about institutional body language (Wynne, 1996) and the messages that public(s) perceive from government with regard to energy system change (i.e. experiences in everyday life do not correspond with formal messaging from government about transitions). Currently, building regulations that prioritise heritage over energy efficiency may be seen by some to imply that policy makers do not consider retrofitting to be a priority.



It is important to note that the materialities and infrastructures of place did not only serve as a perceived constraint on change. Participants would also point to specific examples of “places” that represented good examples of how a change could be implemented. For instance, London was for many a positive example of a well-developed public transport system, this included references to “Boris Johnson’s cycle thing” (Cumbria). With regard to siting, even participants who classed themselves as anti-onshore wind farms impressed that there are appropriate locations for onshore wind developments (i.e. where the turbines add to, or at least do not detract from, the visual amenity or character of the area). This was particularly true of the participants that were sampled from around Whitelee wind farm.

P1: They can be very intrusive, the wind farms if you live in a small community, they can be very intrusive. That's just my idea.

P2: Well I actually think like yourself that the Fenwick Moor is a desolate place and as far as I care, they can put as many wind farms as they like [murmurs of agreement from others].

P1: That's okay on Fenwick Moor, yes but where my relations live it's very intrusive. (Glasgow)

Understanding the ways in which different places and particular developments are socially constructed is vital to interpreting what people view as appropriate for their areas. Previous research has shown how social constructions of place can act to informally regulate space (Cresswell, 1996; Parkhill, 2007). That is to say, space is regulated as much by what we consider as appropriate in particular places, as it is by formal governance procedures (e.g. think about the differences between what is deemed appropriate in a club environment and what is appropriate in a library). Such processes of informal regulation permeate multiple aspects of everyday life and are relevant for thinking about spaces, from landscapes to homes.

If an act or development is perceived as contravening or transgressing these unwritten rules about what is appropriate within particular spaces, then contestation is likely to occur. Social constructions of space (i.e. the meanings, perceptions and ways we think about spaces and places) are developed not just through our experience of the space now, but also through the socio-cultural histories of the place and our experiences of other areas (on space, place and relationality across time and space see Massey, 2005). We now wish to explore the important ways socio-cultural histories of place impacted on our participants' thoughts about energy system change.

We have discussed in **Theme 5** negative perceptions of CCS in general but there were concerns with regard to this technology that were particular to our participants within the groups conducted in Scotland. Our participants in Scotland had reservations about some of the proposals for CCS, specifically the idea that carbon may be stored in the now depleted oil reserves off the Scottish coast under the North Sea. Centrally, participants struggled to see what benefits this industry would bring to Scotland. Rather than viewing it as an opportunity to develop further an existing industry, our participants expressed concern that Scotland would be viewed unfavourably for hosting storage facilities.

P: I really don't think we want to be the dustbin of the world for that kind of thing... [several lines omitted] ... keeping all this carbon for the rest of the world. (Glasgow)

Indeed, some Scottish participants expressed the view that Scotland is repeatedly treated as a "guinea pig" (Glasgow), marginalised by the English through the imposition of unfavourable developments and policies. Such participants called upon a range of examples as evidence of marginalisation including: nuclear waste repository proposals; piloting of the poll tax scheme in the 1990s by the Conservative Government; and stories of toxic waste dumping stemming from the London Olympic games.

It was not only CCS that engendered concerns of marginalisation and, environmental and social injustice. There were also issues in this regard connected to onshore wind development in Scotland.

P1: I think that is Scotland's heritage that's getting destroyed for these turbines. I know everyone is saying that it's for the electricity and that it'll save in the long run but, you know, these trees, some of them have been here for...

P2: ...hundreds of years...

P1: ...hundreds of thousands of years, you know and if they're taking them down and destroying them for these great big ugly monstrosities of things...

P3: [shaking head] I'm quite sure the trees will be rolling and greetin' [meaning crying] when he sees the man with the chainsaw. (Glasgow)

Welsh participants also suggested that Wales has been marginalised, particularly in relation to the siting of onshore wind. A key source of contention for participants in both Scotland and Wales is that many of the policy decisions appear to be taken by Westminster, rather than their devolved governments.

P: ...so maybe they would have a bit more thought for the Welsh people... we are second-class citizens...when we became one with England we lost, we became the poor relations, and they are making decisions in London for Wales. They are not living in Wales, how the heck would they know what Wales needs, they are just making assumptions on what they think we need, on what really is what England needs, not what Wales needs. (Merthyr)

Beyond issues related to the important questions raised about environmental and social injustice, such narratives have significant consequences for policy development and implementation. Possibly the devolved governments of Scotland and Wales need to do more to distinguish whether or not they support policies flowing out of Westminster, including delineating how they envision such policies might benefit their constituents. Equally, this would also suggest that the UK government must make clearer how their energy strategy incorporates concerns of citizens living in devolved administrations.

Transitions were not only viewed as holding potential for negative consequences in terms of how a region or person may be disempowered. Some of our Scottish participants also saw some proposed system changes as a means to transition out of marginalisation. This included, by way of contrast to the concerns discussed above about impacts on Scottish natural heritage, positive perspectives on the continued development of wind and wave power as an exportable resource to England. Indeed, the technological development of wave and wind power was seen as a means of stimulating Scottish industry and generating perceptions of Scotland as a European force.

P: Wave power and wind power, these are the big thing now for Scotland, they are massive [murmurs of agreement from others] so I don't know what England is doing but we are into it big time... Now the [wave] technology is not complete or anything but they think they could take over Europe that's what Alex Salmond [Scottish First Minister] is talking about. (Edinburgh)

So far in this section we have discussed how our participants deliberated on energy matters and energy system transformation at the meso and macro scale. We now wish to turn to the micro and explore how the potential transformation of energy practices in the home was viewed.

Central to social constructions of the home was the

notion of it being a private space, and for our participants this came with the expectation that it should be free from governmental control. As such, measures or changes proposed that were felt to erode the power and control of householders within their homes frequently met with stiff resistance. This arose with some force out of discussions around particular demand management techniques. For example, demand management that could lead to more automation, with those outside the home – be it energy companies or another body – able to access ‘private’ information or manipulate the running of certain appliances, provoked strong negative reactions from most participants. Indeed, participants characterised the type of society that would allow such penetration of the private sphere as being, for example, “draconian”, “sinister”, “autocratic”, “intrusive”, a “police state”, “nanny state”, “1984” or “Big Brother”.

P: I'd quite object if somebody else had that control...I find that a bit draconian actually...It's a bit like George Orwell, that..."It has decreed you must have", that really annoys me. (Glasgow)

In essence, for those that had concerns about demand management, the proposed hypothetical measures were seen as an intrusive imposition, leaving householders vulnerable to potential abuses of power by those in control. This latter point represents a core element of the concerns that arose with regard to demand management – i.e. that it evoked imaginings of potential futures whereby the forms of power it would facilitate come to be used for purposes other than that intended in their inception. This connects with issues around trust, (discussed in other themes) as our participants felt energy companies in particular may abuse the situation, for example by trying to maximise the amount of energy used given their current business models and profit making orientation (see **Theme 3**).

A further key concern of participants was that such a system would not be flexible enough to account for the patterns of everyday life. Earlier in this theme we noted how the different materialities of place are sometimes seen as not being amenable to shifting some patterns of demand (e.g. washing clothes late at night). Participants suggested there was potential for the neglect of such concerns within energy system change, if variation in living contexts and the dynamism of everyday life as it is experienced are not taken into account.

Despite the presence of these more negative discourses about automation, it was not necessarily always opposed. Indeed, some participants felt further automation (e.g. in relation to turning things on and off) could be helpful in the co-ordination of their everyday lives. Important, in this regard, was that householders were afforded autonomy and the ability to override control of the automation – that ultimately they, rather than an ‘outside’ group, had control. In sum, automation with limits was regarded as far more preferable to externally controlled demand management.

P: I agree, the thought of putting our washing machine on

Measures or changes proposed that were felt to erode the power and control of householders within their homes frequently met with stiff resistance.

overnight is not difficult, but as long as you had the option to be able to run it at other times if you wanted to, you know, you weren't only restricted to using it overnight, and as long as you had safe appliances because my husband's nephew and his wife recently lost their home when their tumble drier caught on fire in the middle of the night. (Merthyr)

The preferred method of demand management was one that would allow householders to maintain a level of control. Interventions that assisted people in shifting their own energy use patterns were supported, for example, being advised to use an appliance when energy supply was predicted to be plentiful. In part, our participants seemed resistant to ceding responsibility for demand management.

P1: I think we need to be educated about energy levels, electricity levels rather than having to knock them off – you know?

P2: I think it's a trust thing.

P1: Saying, you'd be educating everybody to be conscious of the amount of electric that they're using in their household, rather than think "ah we needn't bother I'll go to bed and let the company knock it off".

M: So you're being more responsible?

P1: Yeah you'd feel a better sense of responsibility thinking well no I'm not going to let them do it, I'm going to do it myself and I'm going to make sure it's knocked off... (Cumbria)

A slight reservation about this form of demand management was, however, whether or not information on predictions would be reliable regarding for example levels of wind generation. Participants questioned if weather forecasting was reliable enough to base a demand management system on and, if not, who might be penalised in the event that things go wrong.

P1: So maybe they'll say there's going to be a lot of wind and it doesn't turn up and then you put your washing machine to use low energy...

P2: And it uses more –

P1: ...and it's not. It uses more because the wind hasn't arrived, you know. [laughter from the group]. (Merthyr)

The reliability of the service and issues around safety of

appliances are illustrative of reservations and concerns about the technologies and services underpinning some of these ideas (also see **Theme 5**), rather than the idea of demand management in general. As a final point, it also became clear that some of the proposals regarding demand levelling were seen as similar to services available today (e.g. broadband limits, sensors turning computers and TVs off). As such, this relative familiarity may, in part, account for some of the qualified support we found for such measures.

Often the importance of place and space in discourses surrounding energy system change is reduced to ‘siting’ issues. Whilst not dismissing the importance of siting at multiple spatial scales, in this theme we also wanted to show how place is important for energy system transitions beyond concerns about changes to landscapes. With this in mind, we have examined how perspectives on transitions connect with our material relations with space, both in the past, present and future, and how they relate to our lives and ways of living. The theme has further explored how place is associated with socio-cultural and political issues (including trust, control, histories, power, regulation, imposition and so forth), and how they are, in turn, connected to places. The core message arising from this theme is that to ignore the multi-faceted dimensions of how place matters is to risk controversy and contestation, as well as missed opportunities for learning from mistakes and building upon past successes.

Participants from both rural and urban areas felt, at times, that the proposed change was either not suited to their area or, perhaps more crucially, threatened their way of life.

The devolved governments need to do more to distinguish whether or not they support UK level policies; including outlining how they envision such policies might benefit their constituents. Equally, the UK government must make clearer how their energy strategy incorporates concerns of citizens living in devolved administrations. To do otherwise risks some people and places being marginalised.

T7: Accessing Energy Futures: Challenges and Opportunities

The ways in which people imagine their socio-technological futures can have the powerful effect of enabling or constraining new ways of thinking, acting, and being in the world. Wide-ranging works across different disciplines have highlighted the significance of how we imagine and think about future change in setting the parameters for what can and does happen (e.g. Mcdowall and Eames, 2006; Mason, 2006). Though this work has often focused on the imaginaries of scientists, policy makers or industrialists in driving technological innovation, there is some evidence that directs us to consider the importance of public imaginaries in making possible particular forms of change. For example, Jones (2011) has pointed to the importance of the circulation of ideas about and experiences of anthracite coal as time saving, more convenient and cheaper in the uptake of the fuel source in the US residential sector. Importantly, Jones also points out that the residential sector formed a key, if not the primary, market for the development of the coal industry in both the US and Europe, and was thus integral to this historical transition.

Given this, people’s imaginaries, expectations, experiences and ideas about technological futures can be seen as highly important in understanding the challenges and opportunities that exist for new transitions being envisioned now. This theme takes in discussion of our participant’s ways of characterising future systems and future change, the difficulties they found, and the resources they drew upon to make sense of futures and formulate their views. Importantly the section also examines some of the implications of these public imaginaries for key aspects of energy system transitions.

Within existing research several different concepts have been developed to describe the ways that people draw upon familiar cultural and social resources in order to make sense of new phenomena. In particular notions of frames, framing (e.g. Schon and Reid, 1994; Miller, 2000; Jasanoff and Wynne, 1998) and anchoring (Moscovici, 1984) have earned popular appeal. In the first part of this section, the analysis is focused on the frames our participant’s used for imagining futures (e.g. thinking backwards in time to think forward, and the use of science fiction), and the existing social ideas they used to anchor views about things which are yet to be (e.g. Economy 7 for electric heating, petrol cars for electric cars).

In line with previous research on other areas of socio-technical change (cf. Brown and Michael, 2003; Macnaghten, 2010), we found that participants drew upon their own experiences of, for example, existing technologies or particular aspects of social systems in order to think through into the future and generate a sense of how they might feel about different aspects of change. One area, in which this arose as particularly salient, in terms of the implications for achieving system change, was in relation to electrification.

Given current understanding of the significance of familiarity in visions of acceptable transitions/developments (e.g. see Butler et al. 2011; Parkhill et al. 2010), we might expect that existing experience of electricity would be a positive factor in moves to electrification. Through the research, however, we found a set of quite negative experiences and more general ideas around existing electric heating and cooking systems and (to a lesser extent) electric cars that had an impact on how transitions to electrification were viewed. This is despite the fact that future electric systems are likely to differ in quite significant ways compared with what has come before (e.g. heat pumps compared with Economy 7 electric wall heaters). In order to situate the idea of transitioning to all electric systems, participants in the research frequently invoked experiences of existing electric and gas central heating systems.

P: I had that [electric heating] in a previous home and I thought that was terrible, it wasn't cost effective, it wasn't quick enough...The gas is effective, quick and that is what you need in this day and age, to use what you need. (Glasgow)

This last extract also hints at how electric heating was framed as a technology of the past, rather than the future, and though 'going back' was not necessarily viewed negatively (see **Theme 2**), it contributed to a wider sense that it may not be an improvement on current systems. Overall, the research findings are indicative of the circulation of ideas about electric heating systems, in particular, as expensive, not controllable, non-responsive and ineffective.

P1: You see when we were little we had the storage heaters, the brick in. And the electric used to take 24 hours to heat the blooming things up.

P2: Yeah.

P1: And I think that that image is ingrained in people's heads and they don't want to go backwards, that puts them off, the electricity aspect. Because gas is quicker, it comes out quicker, it heats up quicker... (Cumbria)

These types of ideas about electrification of heat mark out what is likely to be an important challenge in delivering transitions toward electric systems. This should be regarded as particularly important given the significant role that the circulation of such ideas is likely to play in the uptake of new forms of residential heating systems. Historical examples provide an indication of the importance of new forms of heat provisioning being viewed as 'improvement' in processes of household level transitions (e.g. on historical heat transitions see Jones, 2011; on 'improvement' see also **Theme 2**). The perceptions found in this research of electric heating as expensive, poorly performing and lacking the controllability of gas fired systems, could well prove deeply problematic in efforts to move to electrified systems.

In some senses we might see such discourse about gas central heating as conflicting with the data presented in previous sections where fossil fuels (in general) were viewed negatively and shifts away from oil, gas and coal were seen as necessary. Important in this regard is that it is the characteristics of any given system (e.g. cost, controllability, responsiveness, safety and so forth) that are central to the construction of preferences, rather than the energy source itself. Crucial to transitions, then, is the delivery of similar (or ideally improved) characteristics in heating, transport or cooking systems regardless of the particular energy source.

P: I'm easy if it is gas or electricity, I'm not really bothered where the source of my heating and everything comes from. I couldn't care if it came from a pile of shite outside to be honest, as long as I have still got the same autonomy over when it's hot and when it's cold, as long as everything's exactly the same as what I have got now with the reliability and when I can put it on or not, I'm happy and I'm not really bothered where it comes from as long as it's cheaper and better for the environment. (Edinburgh)

There is still significant work to be done, however, in developing future imaginaries of different modes of provisioning that carry these ideas of improvement. At present, though technologies may be developing in ways that can offer the characteristics on which importance is placed, the ideas that exist about such technologies are not yet aligned. Bringing more positive ideas about the characteristics of electric systems into circulation represents an important challenge. The research is indicative of a lack of these positive future imaginaries in public discourse at present.

In current policy greater efficiency in gas central heating is being pursued along-side promotion of electricity (see DECC, 2012; also Hoggett et al. 2011). Though this is consistent with ideas embedded in scenarios, which depict continuing improvements in efficiency up to 2020 with more significant moves to electricity in the 2030s, it does not yet incorporate consideration of the work required over time to bring long term visions about electrification into public consciousness. Given the juxtaposition between gas and electricity that many made throughout the groups, the continuing emphasis on greater efficiency for gas central heating systems could work against longer term efforts to develop uptake of new forms of heating system, particularly for the retrofit agenda where replacement is likely only to be undertaken based on necessity.

P: I think [refers to other participant] is right, people are being told different things. I watch a lot of home improvement shows and they always say upgrade the

boiler to an energy efficient combi-boiler. If you are trying to encourage people to go to electric shouldn't they be telling them to do that rather than install something which will cost 5-6 grand to have it installed when 20 years down the line you might not have any gas to use it? It is mixed messages getting people to actually understand why they should be doing something with the bigger picture. I doubt most people will actually sit down and talk about it properly, they will just take what they think are the facts like in the 70's electric was more expensive but perhaps they don't know. (Cardiff)

Existing experiences and ideas were, in general, an important part of the processes through which participants in the research made sense of energy system transitions. We find further examples of similar processes of anchoring in discourses around other technologies, like carbon capture and storage (connected by some to nuclear waste storage), and in the construction of views about transition more generally. In the example below, the participant uses the analogy of a gastric band to anchor his views on carbon capture and storage and approaches to transition more generally.

M: But to avoid climate change, is it worth having bit of carbon capture and storage? Would you relax on that a little bit?

P: If the other stuff wasn't working but only as a last resort? ...I wouldn't, because it's not, I don't think it's, it's not, you're not changing. Like if you were super obese and they say to you like they give you a gastric band or whatever but if you keep eating a lot the stomach stretches and you're back to where you were. Whereas if you learnt to eat healthily and make changes in life... (Cumbria)

A closely related sense making tool that participants frequently used to engage with futures involved thinking backwards in time in order to think forward. This included the use of examples from the past (such as the technological development of televisions) to reference how the future might manifest, how transitions might (or might not) happen.

P1: ...a flat screen TV, which most of us have now, we don't have these big clumpy things, five years ago you wouldn't have, even though they were around. They have now become cheaper as they are making them mass produced and the components become cheaper and more accessible and that is where the [electric] car is.

P2: Yeah but I can go into a supermarket and see the latest television as they are there in front of me, I wouldn't walk around a garage and see what cars were available if I wasn't going to change it. (Cardiff)

In the quotes above we find examples of past change being used to imagine the possibilities for future change. We also find discourse that problematises change when Participant 2 highlights the difference between buying cars and buying televisions. Here this participant denotes how expensive items like cars are (for most people) rarely changed and are a special purchase, inferring that the time required for change of transport systems is likely to be significantly longer than that of televisions. In this way they raise issues with comparison across technological forms in imagining the possibilities for transitions. This mode of future engagement also found form through reference to science fiction and its manifestation in "real life".

P: ...a lot of the things that I've read in [science fiction] books years ago are now fact (Cumbria)

Anchoring in this way thus provided a source of optimism, but it also represented a basis for expression of views related to the limits of technological development.

P: Surely, by then [2050]... We haven't got pills for our meals yet and that was promised to us [laughter from group]. We've got mobile phones that are all-singing and all-dancing and can do everything but make a phone call because you haven't got a signal... (Cumbria)

Thus far we have discussed the role of anchoring and framing in how people formulate views about futures. This directs us to consider a number of more general issues with regard to public attitudes and acceptability of system change. First, visions of change need to resonate with and respond to existing cultural frames and ideals about futures in order for them to be taken up. Second, it is important to pay attention to the ways that different processes of transition and particular technological forms are anchored and understood by publics – novel approaches are not 'filling a hole' but are entering into existing meanings and frames. This means that framing something in a particular way through the information provided or the marketing of an approach will not always have the intended effects because it is incorporated into prior frames and linked to existing ideas that circulate in any given society.

The analysis now turns to discourses that pertain explicitly to imagining different types of futures. We found discourses of apocalyptic futures, of draconian futures, open futures, and highly technological futures. We also found slipperiness between imaginaries of utopic futures and dystopic futures. Indeed, futures of the kind depicted in contemporary scenarios were difficult for many of the participants in the research to engage with or to anticipate as possible, plausible or probable. This manifested in difficulties people found in connecting up the present with the future and extending into distant futures.

P: ...I want that to be a better world for people but in a selfish way I feel it is so far away that it is never going to happen anyway. It is kind of like when someone says that 2012 is when we are all going to die, I know it was silly, but I still thought that is miles away. (London)

It also arose through the difficulty that people found in imagining the level of change proposed to meet the targets within the 2050 timescale.

P: That [electrification of heat] is not going to happen overnight, or even over the next 38 years. It seems an awful long way away, but... the next stage up [referring to DECC MY2050 tool level] in the time span we have got and for the whole infrastructure to have to change is a massive, massive job. (Cardiff)

These difficulties in imagining change were, as the above extracts suggest, related to the participant's understanding of the complexity of energy system transitions, the need to overcome 'gatekeepers' of change (e.g. incumbents in the energy sector), and difficulties associated with the financing of transitions (both in terms of private and public investments at all scales – from household level to power station and network infrastructure), particularly in the current economic context.

As part of the research, scenario narratives were employed as a further means of engaging publics in the workshops with different futures. The narratives were "Business as Usual" (or do nothing), "Mixing it Up" and "Low Carbon Living". Responses to the scenario narratives provoked a different set of discourses about futures. They drew out concerns about futures but also brought into view discourses relating to the different types of futures that participants could envisage. Interestingly, but perhaps unsurprisingly, the scenario narrative that depicted a world where nothing had been done to address climate change and energy issues was more easily imaginable (if concerning) for many of the participants.

P1: Parts of it are depressing because some of it can be compared to today. Some of it you can actually say is like the present time rather than in 2050

P2: Yeah we are not that far away really.

P1: I mean, looking at this it only seems as though it's a few years down the line, it doesn't seem that far away, and like reading about getting children to school and the congestion, that's already happening, I mean that's already happening now, all the different prices going up, that's already happening now, so it just goes to show it is progressively getting worse and by 2050, this sounds mild to what I envisage it should be, going from what we've said today. (Merthyr)

Though this represented an easily imaginable future primarily because of its similarity with present systems, it was a whole heartedly undesirable future and one that participants across all the groups felt either should or would be averted. In this sense it was very impactful and generated a strong reaction from participants (see also Theme 1). It is worth highlighting, however, that the discussion around approaches to future change and solutions to contemporary problems, which formed the primary focus of the workshops, proved more engaging, in many senses, than the presentation of an unchanged future.

P: ...when I sat in that other room it was so positive, we were chatting away talking about things we could fix, things we could sort, transport situation, batteries, cars, wave power, wind power that was very much what we were talking about. This took me back a little bit. (Edinburgh)

Both the "Mixing it Up" and the "Low Carbon Living" scenario proved more difficult imaginaries for people to relate to but also represented (albeit in different ways) future imaginaries that were desirable for participants. The difficulties arose primarily through the feeling for many participants that the futures represented were too sanitised or too much like "utopia" so that they aroused suspicion and a sense that something more sinister was lurking beneath the surface of the worlds depicted.

P1: a bit Stepford Wives

P2: you've taken all, it's like as if you've got, not a total Aryan regime, but it's like as if you've got this, you've got this thinking and everybody's uniform in this thinking...

P1: It is like The Prisoner [referring to a 1960's cult science fiction television programme]. (Merthyr)

P: On the surface it is very Utopian... it's almost, it is very 1984ish in certain parts where you are told you can put your washing on at two o'clock this morning, there is a slightly sinister edge to this underneath it. (London)

Equally, for some they represented too technologically driven images of the future – a consequence perhaps of basing them on existing scenario work that tends to be technologically focused:

P: It is daft isn't it, it is like it's going a bit space age isn't it? (Merthyr)

Within the scenario narratives, there were certain aspects of future imaginaries that participants on the whole resisted quite strongly. In the “Mixing it Up” scenario, many excepted nuclear energy and carbon capture and storage from their generally positive responses to the scenario:

P1: That was so much better than the last one, but it feels like the Jetsons a bit.

P2: I love this world and I want to live there

P3: Everything is good

P4: Apart from the nuclear power station [murmurs of agreement from the group]

P2: Aye

P4: I like it, apart from the nuclear power station and the carbon capture. (Edinburgh)

In the “Low Carbon Living” scenario giving up flying for leisure and eating less meat were two aspects of imagined futures presented to the participants that provoked consistently strong reactions.

P1: I think that... we don't want to just exist we want to live... we want to be able to do things like develop, we want to be able to explore, we want to visit new places. We want to be able to eat food and enjoy it you know? That's part of what living is about. And if we, if we for the sake of trying to save our environment we've robbed ourselves of life I think we've lost something that's, you know, essential.

P2: Yeah but if we don't look after our environment we've got no sense of life anyway.

P1: Indeed but what I'm trying to say is that we've got to try and bring it in balance. You know, when you're talking about like not eating meat and not flying... for me you know living and exploring and pushing boundaries is something that's really important to what makes us who we are. So I think that we've got to allow that to be part of the mix going forward as well. (Cumbria)

Feelings about flying were very different depending on whether it was for business or for leisure. Travelling to different countries and the opportunities to live in different parts of the world were highly valued by participants. Though travelling for business was viewed as important in some instances, there was a general sense that flights for business should be significantly reduced.



In contrast, notions of reducing flights for personal forms of travel were fiercely resisted. We posit that this is related to the underlying things that are embedded within ideas about this form of travel more generally (i.e. social interaction, cosmopolitanism, relaxation, ‘experience’ and so forth). Notions of giving up meat that were introduced to the participants through the workshops evoked equally strong reactions that we explain similarly as reactions to the things that meat invokes (i.e. social interaction through meal times, enjoyment, pleasure and so forth), rather than being about meat per se. Feelings about these aspects of life are also intimately linked with people’s sense of their own identity and, as such, may be difficult to shift or change.

Reactions to ideas about reducing meat and flying, then, can be seen as reactions to perceived attacks on things that are greatly valued (like cultural experiences, fun and pleasure), rather than purely being about the phenomena of meat and flying alone. Such responses can also be seen as connected to the unspoken reciprocal social contracts between state and citizens. That is to say, taking holidays, relaxing and eating form core parts of the things people expect to be able to enjoy in return for their ‘good’ citizenship – for working, for paying taxes and so on.

P: ...Tenerife, I go a lot and the States... I am a retired lady now and I worked all my life, every day of my life, and now I think, “well I should just enjoy myself” so I do. (Glasgow)

This directs us again to think of encouraging change in these areas as being about presenting ways of living that continue to encompass the characteristics of life that are valued but could be enacted and fuelled in very different ways. This is as opposed to narratives of change that might characterise food, for example, in terms of sustenance and fail to incorporate consideration of the social importance of food (on the social significance of food see Warde, 1997; Smart, 2007).

As a final point, in imagining future change participants also raised questions about who might get left behind as particular technologies, skills sets, and so forth, become obsolete.

P: The other thing I was thinking of is - if in an ideal world electricity supply is plentiful and running continually, what would then happen to the people who have gas or oil fitted - they would have to pay to have it removed so it is swinging this pendulum from one extreme to the other. It comes down to what [refers to other Participant] said, I've got my back-up plan – where's yours. If we are in this ideal world where we are going to have enough, then what is going to happen with what we already have that we actually don't need... (Cumbria)

This represents an important if rarely explicitly discussed aspect of transition that necessitates attention in processes of system change. In the following section, this aspect of discourse around transitions is explicated more fully as it arose most strongly in the discussions around business, jobs and manufacturing as an element of energy system transformation.

This section has navigated through the ways that our participants engaged with and imagined energy system futures. Through the discussion key elements of change have been highlighted as particularly problematic in terms of the possibilities that exist for engendering public support; i.e. eating meat, flying for recreation, electrified heating systems. There are more general lessons that can be discerned from the discussion of these illustrations. Crucially, it is important to identify the core characteristics of existing system elements that require change to understand resistances that may emerge. For example, in regard to heating, controllability, speed with which a warm temperature can be achieved, cleanliness, and cost, were all identified as important characteristics. Moreover, in developing new systems, the centrality of “improvement” as a necessary precursor to willingness to adopt changes was evident (see also **Theme 2**). The challenges and possibilities for imagining futures were also discussed within the section, revealing a further set of issues around how we can find ways of relating and communicating about future visions.

Existing social ideas, perceptions and experiences of current elements of the energy system could pose significant challenges for achieving energy system transitions.

Participant's sometimes found it difficult to imagine change due to their understanding of the complexity of energy system transitions, the need to overcome energy sector incumbents, and difficulties associated with the financing of transitions.

T8: Workers and Jobs in Energy System Transitions

The implications of transitions for jobs have been highlighted as an important area of research that has been generally neglected within the academic literature (Rathzel and Uzzell, 2011). Rathzel and Uzzell (2011) have pointed out that energy system transitions will, in one way or another, affect workers ‘through the loss of jobs, the changing of jobs, and the creation of new jobs’ (2011, p. 1215). This implication of energy system transitions resonated with our participants and generated a set of concerns around jobs and processes of transitioning. At the heart of this was recognition of the jobs that existing energy systems provide, and of the importance of system transformation in bringing new opportunities for jobs and skills developments within the UK.

On one level, discourse about this set of concerns arose through prompts relating to the DECC my2050 tool around ‘manufacturing growth’ and ‘business greenness’. On another level, however, issues that pertain to this arose organically through the discussions around energy system change more generally. With regard to the responses that related to the my2050 tool, participants did not engage with these aspects of transition in the ways represented by the tool. Instead, they made sense of them in their own distinct ways, for example, discussing jobs and growth of industry more widely, rather than in the specific ways depicted in the scenario tool.

This section explores talk related to jobs, manufacturing and business examining in particular, two emergent themes: 1) maintaining and developing jobs and skills for the UK through transitions; 2) notions of ‘British’ business and the relocation of manufacturing to other countries (e.g. China). Within this latter point attention will be given to the significance of energy system transitions for jobs, including discussion of so-called ‘green’ jobs. The deliberations around these issues provide an important backdrop to the public discourse on energy system transitions as they bring into view some of the ways that participants engaged with the complexity of change.

With regard to maintaining jobs for the UK, in the following illustrative quote the discussion pertains to the phasing out of nuclear power due to concerns about safety. The wider point regarding jobs is similar, however, for transitions away from other types of energy supply technology.

P1: everyone's saying that there are jobs [in nuclear energy], and these people, it's their life, oh aye. I just think if something happens... In a perfect world I would love to have all these wind farms and all this clean air and all that, but it's not going to happen if there's no jobs in it...

[...]

P2: So I don't know how many people are employed in Sellafield, say it's two or three hundred... Say a thousand, right? So it's Friday morning, they're going in and they say to the whole staff, "right, we are closing this, it is a danger", what about all these family men and the wives and the kids, and what are they going to do? So that's what I mean by catch 22 situation, some people say it's dangerous, but the people that work there, they make their living there, and I mean what do you think they'd all say on Friday morning if they said, "right, the door's closing today, and that's you" (Glasgow)

In the first part of this quote, the participant raises questions about whether 'cleaner' forms of energy production like wind farms would produce jobs. This concern about the relative implications for jobs across different forms of energy production was a prevalent issue raised by participants in the workshops. Important here was that our participants made real such consequences through imaginary positioning and empathy with those workers who may lose their jobs in transitions. The latter part of this quote pertains more to the question of who will lose out or be left behind in transitioning to less "dangerous" systems of provisioning. This represented a core concern but was also matched by a set of discourses around the potentially positive implications of transitions for job creation and economic growth.

P: But [developing tidal energy] that's all jobs. That's a new source of jobs - we have no jobs to give anybody - it's work... that is our future, isn't it, so if that is our future and it's going to be clean, safe and create jobs - because then you'll have all your engineers, you've got the builders and things... (Cumbria)

P: If we get in at the beginning, we could be selling the [wind and wave] technology to the rest of Europe (Edinburgh)

Also indicated by the above quotes, is the importance of place and socio-political histories of place (see **Theme 6**). We found that narratives about the potential for job creation through renewable energy development varied across the different areas in which we undertook the research and were particularly strong in groups undertaken in Scotland.

P: If the wind turbines are for Scotland, let Scotland make them. Not Japan or Canada or Timbuktu. (Glasgow)

Relating to the second theme we have drawn out (i.e. concerns about British business), were concerns that any potential jobs produced through system transitions should bring benefits for the UK. This entailed unease with the sense that new system components would be imported from elsewhere (e.g. China) and that many "new" jobs would be exported to other countries where labour is cheaper.

P: It [developing offshore wind] would also produce quite a lot of jobs, unless we built them in China and shipped them over. (Cardiff)

These discourses around jobs were also pertinent to views on the growing or shrinking of manufacturing and businesses, beyond energy companies, in processes of transition. Though there was concern about climate change and the polluting nature of many industries, there was a sense that the emissions were being created but were simply located in other countries. This logic led participants to conclude that in the shifting of manufacturing from the UK to other countries the principle issues of pollution and climate change were not being addressed, while at the same time jobs for the UK were being reduced. Additionally, emissions and pollution from industry were viewed as more controllable if located within the UK. In this regard there was a clear set of concerns around the decline of manufacturing and industry, matched by an equally strong desire for increased levels of business and core manufacturing industries within UK borders. In general, there was a sense that growing manufacturing within Britain would likely improve economic stability and help to revive or maintain skills within the UK.

P: Well, we want more [manufacturing], we have got to have more... to expand the economy and create jobs (Merthyr).

A further facet to this line of discourse was the notion that growing the manufacturing base in the UK would increase national revenue and provide a basis for the financing of energy system transitions.

P: And there would be more revenue wouldn't there... There would be more money to put in to do more with what you were saying... like solar... (London)



This narrative about growth and manufacturing appears to conflict with participant's views on reducing consumption and the more transformative kinds of change discussed in **Theme 2**. Such contradictions were addressed by participants in the groups through their discussions of notions like “paradox” and “complexity” (London), and their narratives around the problems of achieving “balance” (Cardiff). This represented an area where the difficulties of transitioning were most apparent – participants across all groups associated growth in manufacturing with jobs and economic stability yet, at the same time, viewed the current culture of consumerism as “wasteful” (Merthyr) and inherently problematic. Such issues were connected to questions about whether growth in manufacturing was in ‘green’ industry and jobs. Participant's views with regard to this were mixed, in part, because of doubts regarding what constituted ‘green’ industry. In general, though, there was a sense that if improvements in the manufacturing base of Britain could generate green jobs that would be preferable to traditional industry (e.g. conventional car manufacturing).

P: Yeah, I mean there's an opportunity there, isn't there? I mean, electric cars, that whole technology, there's a world waiting isn't there? (Cumbria)

It is important to highlight, however, that ultimately manufacturing and the related jobs were viewed as important to develop in the UK regardless of the particular industry. This had interesting implications with regard to things like CCS, which was viewed more favourably in the context of industrial emissions, if it allowed heavy industry (e.g. the steel industry) and the associated jobs to continue (see also **Theme 5**). In contrast, CCS evoked much more negative discourses when proposed for sequestering emissions directly from power stations. We suggest that this was principally due to a perception that energy could be generated in other ways (prompted by the whole

system framing of the deliberations), whereas some heavy industries do not have clear alternatives. Concerns about CCS remained, however, even in this context.

P: Obviously maybe if it was really essential then maybe we could carbon capture just for those essential industries and make a trade off (London)

Overall, this area of discussion in the workshops represented one where the complexity and difficulty of transitioning to more sustainable energy systems was brought to the fore. These were issues that people were strongly engaged with but found difficult to negotiate. In particular, problems of measuring emissions in terms of national territory arose as a challenging issue through these discussions (on territorial versus consumption-based emissions see Bows and Barrett, 2010). This concern, in turn, was tied to a more general set of issues perceived to have been generated through processes of global economic expansion, i.e. poor treatment of workers in other countries in places where standards and wages were cheaper. The connections that thought about manufacturing and jobs brought into view were of central importance in the deliberations about energy system change. They engendered a level of reflection and engagement with the deep roots of current systems of provisioning and with questions of more radical transformative change that are not necessarily visible in discussion focused purely on technological shifts.

This theme has explored our participants' thoughts and concerns related to the impacts of transitions on jobs and manufacturing, and vice-versa. Two broad aspects have formed the focus for discussion. First, we detail concerns that certain skills and industries may be left behind and become obsolete leading to job losses. In the second aspect, tensions between ‘green’ opportunities and the preference for increased manufacturing beyond green industries formed the focus. Overall, we have navigated through our participant's dilemma of wanting change (see **Theme 2**), while, at the same time, having deep concerns about economic growth and threats to livelihoods that transition will pose for some.

There are key concerns about the relative implications for jobs raising questions about who will ‘lose out’ or be ‘left behind’ in transitions.

There was a sense that growing manufacturing within Britain would be likely to improve economic stability and help to revive or maintain skills within the UK. Whilst there was some level of uncertainty over what constitutes green jobs, if improvements in the manufacturing base of Britain could generate such jobs this was preferable.

T9: Governance, Policies and Strategy in Public View

There is a wide ranging academic literature that addresses questions of governance in the context of energy systems transitions and sustainability more generally (e.g. see Jordon, 2008; 2009; Geels, Hekkert and Jacobsson, 2008; Shove and Walker, 2007; Smith et al. 2005). This literature has explored issues around the extent to which technological and economic systems will require governance in order to move in more sustainable directions. While analyses have shown how transitions tend to emerge in an organic and undirected manner, these works also show how governments and other governing institutions have a hand in shaping, creating and delivering historical transformations (e.g. see Jones, 2011; Geels, 2006).

Much of the focus in existing work on transitions and governance has been on industry and governments. There are, then, an important set of questions remaining about how wider public(s) view governance arrangements and relate to processes of governing for energy system transitions. This is an issue that has been touched upon throughout this report (e.g. see **Themes 2, 5 and 7**), but in this section we bring together analysis focused more tightly on perceptions of governance. This includes examination of publics' expectations with regard to governance, their views on the place of policy, statutes and guidance, and their perspectives on particular policies already in existence as well as ideas that could underpin new and emerging policy.

The perceived role of government is multi-faceted and not unproblematic yet, at the core, publics locate responsibility for delivering transitions with government, including local, central and wider governing institutions. It is not necessarily the case that publics think that the government should lead the way, rather that they must, as there are no alternative groups that hold enough power (e.g. industry) who can be trusted to do so in their stead.

P1: I'd trust the government more in that it's not a business, so that they're...

P2: But they keep changing their mind. (London)

Perceptions of where power is located were central to discourse about governance and who should govern energy systems transformations. In this regard, both national governments and industry were viewed as holding significant levels of power, to the extent that participants could not imagine how transitions could occur without these system actors taking the lead.

P: The transitions can be individually led, by individuals making those changes but there has to be an overall umbrella of information and this is the plan, the tapering off point, and it has to be a high level where decisions are made to do these things. (Cumbria).

Government, though not trusted to a large degree, were trusted more than industry and were also perceived as more accountable to public(s) (see also **Theme 3**). This is particularly the case for energy system transitions as they encompass concerns about sustainability, climate change and so forth. These issues were perceived as things that would not be addressed through profit motivated actions and therefore were unlikely to be delivered by industry and business. This was despite energy businesses being viewed as both powerful and culpable for energy system transitions. This related closely to a perception that incumbent energy industries work to hold back or limit transitions acting as gatekeepers to prevent change, rather than driving transitions forward.

P: I think they've ['things' that are better for the environment] been ready for a long time and they're in the background and the only thing stopping them (personally I think, and I might be totally wrong) is the people who own the oil, the people with the money, and the power in the whole world, who are selling the such and such, so many dollars for a barrel of oil and all that. (Edinburgh)

Despite the distinctions that were made between industry and government, participants recognised and expressed concern about the connections between them. For some, whilst business and industry were seen as profiteering entities, their motivations and agendas were well understood. Conversely, the agendas of governments were often deemed opaque, creating concern about "ulterior motives" (London). Despite this, in discussions of responsibility for change, it was government that our participants repeatedly returned to as ultimately holding responsibility for supporting, engendering, and enacting change.

That is not to say that our participants found the role of government unproblematic. Indeed, a set of concerns emerged about current governance structures and their suitability for addressing sustainability and energy issues. For example, our participants argued that the 5 year terms of office meant governments were not willing or able to take a longer-term view. Such short-termism in the electoral cycle was suggested as contributing to the creation of a culture whereby politicians were unwilling to take the risks necessary for delivering change or take a lead in advocating approaches to transition.

P: And going back to the point [refers to other participant] made where you've got that political swinging of the pendulum. It is actually knowing well, what else do you want us to do – you keep telling us this but what do you want us to do, come on give us some ideas and let's do something. (Cumbria).

In previous themes (e.g. see **Themes 2, 3 and 6**) we have discussed the importance of institutional 'body language' (Wynne 1996) and the issues that arise when formal political rhetoric is not perceived to match with actions and other forms of communication. In the context of this theme, a lack of legislation and regulatory action was viewed by participants as indicative of a lack of real commitment within government to address energy related issues, like climate change.

P: Talking about climate change is fine but at the same time the government is not doing enough to think about the wastage, the resources and the way we do things. (London).

Indeed, some participants were keen to see government "put up, instead of talking about it all the time" (Edinburgh). This type of discourse was also indicative of the perceived need for synergistic policy goals that connect in coherent ways across all sectors of policy making and government departments. Our participants, then, saw disconnects between different policy arenas, leading to the belief that an overarching strategy for policy may be needed to facilitate change. Many aspects of transitions throughout all of the discussions were expressed as needing action from government, including the development of better public transport (in terms of being more efficient, cost effective, flexible and higher quality), creation of government (and not industry) led energy efficiency programmes (e.g. installing insulation for all irrespective of financial capabilities), and laws to help prevent waste (e.g. packaging and junk mail) from being created. Ultimately, participants argued that if government is convinced by the evidence underpinning its policy aims and strategies, then they should reinforce this belief through legislation.

P: I feel if it is effective [referring to insulation] then they should put it into law. (London)



Participants in the groups often defaulted to a position that policy and regulation could and should be used to stimulate wider change. At times, force was seen as a means for kick-starting change until the imperatives or ideals held within formal rules and regulations (i.e. policies and statutes) are codified into practices, norms and behaviours. A specific example given as a piece of legislation that some of our participants have experienced, which has been perceived as successfully prompting a change in norms is the 5p single use carrier bag charge that the Welsh Government brought into effect from 1st October 2011 (also Poortinga, Whitmarsh and Suffolk, 2012).

P1: ...recently with the carrier bags in supermarkets, a lot of them charge you. When it first came in everyone would moan about paying 5p for a bag, but if you go into Asda now, you see how many people bring their own bags. People have got used to it because they don't want to pay for it. They think actually it is not that bad or that much of a difference that was just persuading people to do it.

P2: Interestingly now, people getting on that it is cool to be green. It is cool to be seen carrying a reusable bag and seen to be doing your bit.

P3: The cashier will say to you "how many bags of your own did you bring today?" and straight away if you haven't that day you start to worry. (Cardiff).

London transport policy, specifically related to the Oyster Smartcard (a plastic card that can be used to pay for bus, tube, tram and overground rail services in London), was also given as an example of a change that has successfully promoted change in transport practices.

P1: Oyster card is, you know you wouldn't believe something as simple as that would make life that much better, I never realised how wonderful it was. But I see it a bit in Wales and it is fragmented and doesn't seem to make much sense (London).

The simplicity of the Oyster card system was identified by our participants as a change which sent a clear signal that efforts were being made to improve the usability of public transport. By contrast, the London congestion charge was given by some as an example of how 'blanket' policies were in danger of allowing those with greater financial means to avoid making necessary changes.

P: I think the congestion charge in London is great but I do think then the rich people just swan about, but environmentally it is done for the right reasons, but all of a sudden outside the congestion charge becomes really, really congested. (Cardiff).

Indeed, there was a general sense that relying on financial charges, or sanctions, as the means to engender change could be problematic precisely because money has a disproportionate value to those that are more or less affluent. Again, sustained regulatory and statutory enforcement (i.e. the 'stick') was advocated as an important means for ensuring change, which could be coupled with incentives and rewards (i.e. a 'carrot'), rather than sanctions.

Whilst there was support for legislation to facilitate and enforce change, our participants also wanted policies and legislation to have a certain amount of flexibility to ensure they are responsive to different biographical contexts (also **Theme 6**). In particular, participants were concerned that policies should not negatively affect vulnerable groups. One illustration of this concern manifested in discussion about a hypothetical policy created and discussed by a group in Edinburgh, wherein they envisioned home central heating thermostats that would not go above a certain level.

P: ...if there is a law, or we have created heaters which don't go above 20 or 30 then it is so cold, what happens to the aged, those that are disabled or something like that? (Edinburgh)

When discussing the now defunct Home Information Packs (HIPs), our participants revealed two important policy characteristics that can engender public support, or conversely generate public scepticism, with regard to legislation. First, the motivations, aims and objectives for a policy should be abundantly clear to publics. Second, the government must be committed to a policy.

P1: And also it's interesting that the home packs for when you're selling with all the energy efficiency schemes were dropped very quickly. Unfortunately I had to do mine just before it got dropped, and I looked at it as being a bit of lip service anyway. I don't see it as, it's a political thing.

P2: It's a stealth tax, they are just trying to make money out of it in any way they possibly can.

P3: There was very little thought because the people who were involved in selling them, kind of bypassed it, it wasn't taken seriously. (London)

The HIP and, in particular, the Energy Performance Certification (the latter of which is still a statutory requirement) were in and of themselves seen to engender engagement with energy efficiency. However, this success was compromised when the benefits to individuals were obfuscated and entangled with a motivation believed to be more to do with profit ("stealth tax") than ensuring an energy efficient home. This perception was further amplified when HIPs as a statutory mechanism were abandoned, leading to the perception that policy can be quite fickle.

This perceived fickleness becomes quite critical when considering models for enacting change that rely on public engagement and a more sustained agreement; for example, the Green Deal. Whilst there was general enthusiasm in principle for schemes like the Green Deal, this was coupled with substantial reservations about how such schemes could be implemented. This included concern about the role of energy utilities (see **Theme 3**). More congruent to the current theme is the discourse which revealed reservations publics had about, for

example, “the small print” (Merthyr), the interest rates of the “loan”, and about what happens “after you’ve paid it off... do they continue to service it for you?” (Edinburgh).

Discussions about government and the mechanisms of governance (e.g. policies, regulations and laws) were also bound up with notions and concerns about the level of intrusion and power that government should be afforded over our lives (also see **Theme 2**). There appears to be a tension between general support for strong governmental steers and regulation, and concerns over the power that governments are afforded.

P: I don't like to give governments too much power. Then they get overly enamoured with themselves. (Glasgow).

This theme has brought together discourse relating to public perceptions of governance, the role of government, and policies in energy system change. Whilst it has covered discussions about a broad array of past and present policy instruments (e.g. HIPs, Green Deal), the specific examples cited should be read as exemplars of more general views on policy and regulatory instruments. Clearly there remain significant concerns over power, motivations underpinning government policies, means and impacts of policy implementation, and sustaining policy trajectories. Despite these concerns, it was clear that publics felt the role of both government and formal processes of regulation, particularly legislation, are integral to engendering and enacting low carbon transitions.

Government, though not trusted to a large degree, were trusted more than industry and were also perceived as more accountable to public(s).

A lack of legislation and regulatory action was viewed by participants as indicative of there being no real commitment within government to address energy related issues.

There was also a desire for synergistic policy goals that connect in coherent ways across all sectors of policy making.

T10: System Links: Making Connections?

Previous research has recognised that the technological and social dimensions of energy systems are strongly intertwined and thus difficult to consider separately (e.g. Poumadère et al., 2011; Geels, Hekkert and Jacobsson, 2008; Shove, 2003). Added to this has been an increasing concern with notions of whole energy systems and the importance of thinking about transitions as an interconnected set of changes across different technologies, infrastructures, and resources (e.g. EPSRC, 2013). Though whole systems analysis is increasingly undertaken in energy transitions modelling, public perceptions research has in the main examined perspectives on energy technologies one system component at a time (e.g. public perceptions of CCS or wind energy, or energy efficiency). The distinctiveness of this research project is the importance placed on keeping the whole system in view and exploring how perspectives are formulated when links and interconnections between different energy system elements are made explicit.

Throughout the workshops, the scenario building tool (see Methods) was utilised to keep the whole system in view and to direct participants to consider the implications of decisions about one aspect of change for other dimensions (e.g. the implications of not reducing high demand for meeting carbon targets). Additionally, the research was designed in such a way so as to draw out connections that were not necessarily visible from the use of the scenario tool alone. For example, the connections between demand management, storage, and high levels of renewable energy in future systems.

Crucially, participants were actively encouraged to think through the potential impacts of different elements of system change for both their own lives and other aspects of the energy system. In essence, participants either volunteered or were prompted to consider interactions across the whole system, including social and technical dimensions. In this last analytic theme, we wish to explore some of the linkages that were or were not made by our participants. We discuss the forms of connection that members of the public made themselves, their responses to inter-linkages that were highlighted by facilitators, and the ways that discussion of trade-offs manifested in our participants' discourse.

The distinctiveness of this research project is the importance placed on keeping the whole system in view and exploring how perspectives are formulated when links and interconnections between different energy system elements are made explicit.

A key way in which participants in the groups made connections was through discussion about the connectivity between their selves and others - this included other people, but also distant places and other times (pasts and futures). Fundamentally, our participants recognised not only the linkages within the UK's energy system but also – as discussions around energy security illustrate – how we are part of a global energy system. In this regard, they reflected on how the impacts of our (national, group and individual) choices are often felt at global spatial scales and across different times. One element of this kind of connection arose through discussion of manufacturing (see also **Theme 8**) wherein the links between environmental and social justice, manufacturing, costs of resources, and shifting patterns of production, were expounded.

P: We were talking earlier about being self sufficient, but if the steel for instance, if it actually works out cheaper to buy it from somewhere else, then what is the benefit for us not doing that, it is such a global problem. It is very difficult to be that self sufficient, and as it's a business - the money side is always going to come into it. Whether we have a duty of care to the people who are manufacturing for us, obviously we all know the conditions in third world countries and the health and safety issues, the poverty lines and things we seem fairly happy to turn a blind eye to that, even though we are aware of it, like we can't do anything about it. Is the alternative to keep it in house but have much more expensive production. It is a very complex issue, like a big cobweb really you pull a little thread here and it sends off waves all over there. It is all so inter-connected that there's no one thing to pinpoint - whatever you say there [participant holds out his right arm], there is a balance over here [participant holds out his left arm]. (London)

In some senses, such recognition of global spatial links also served to highlight perceived inadequacies in current international and national government policies. For example, our groups were alert to the ambiguity surrounding carbon dioxide emissions related to manufacturing, imports and exports. Some understood that our emissions would be much higher if the manufacturing emissions of the goods we import were to be included in the UK carbon budget. They also differentiated between emissions at the point of energy production and embedded carbon dioxide in objects.

P1: We create waste and it has to be got rid of and you just can't keep burying it so you have to do something with it. If it [Anaerobic Digestion] is a way of creating a form of energy, it should be something to look at because how long can you keep burying things or dropping it into the sea or sending it into space? You can't just keep chucking trillions of tons of waste.

P2: Don't we have to take it one stage further back and see why we are making all this stuff in the first place? Do we need to have a new washing machine because there's a new one out? Even if only one person buys one and the others go down the chain it's still creating a waste one at the bottom of the chain, so it's the consumer society that creates the waste. Just think of junk mail – you opt out but it's relentless, it still comes through. You put it in the recycling and you feel good about recycling it but it is still waste as it was a resource to start with – it's still wasted. (Cumbria)

A further important way in which members of the public in our groups made connections related to changes in the way we use energy (e.g. electrification) and means of producing power. At times, this manifested through discussion that highlighted issues with making changes to demand side technologies without corresponding changes to the means of supplying energy.

P: I take the bus in London, I have a little car but I keep that where my mum lives in North Wales, and I love the idea of electric cars, but you do essentially plug them in and that electricity is probably coming from a coal fired thing. (London)

In the previous quote, the suggestion is that a 'good' change in energy demand technology (e.g. a move from a petrol vehicle to an electric one) is negatively affected by the means of supply being 'bad'. Conversely, at other times participants implied that a 'good' source of power could be negated by a 'bad' form of usage (where increased demand was seen as 'bad'). These forms of discourse around energy demand and supply led in some cases to discussion of the need for, and importance of, balance in delivering successful energy system transitions.

P: So if we are manufacturing more here, which means we are using more energy, but then surely we're doing the solar panels, the wind turbines and it balances out... (Glasgow)

Though participants often made connections between energy demand and supply, it was rare that they would spontaneously connect forms of supply with the need for increased energy demand management. As we have reported in earlier sections of this report, our participants were often extremely keen to pursue renewables forms of energy production. There remained a need, however, for facilitators to pose the idea that there will likely be a need for (some forms of) renewable energy to be coupled with changes on the demand-side in the form of demand management or levelling. Though participants did not raise this themselves suggesting that it is not currently part of the public conception of renewable energy, when prompted by facilitators the notion of demand management did not lead to decreases in support for renewable energy. Instead, participants engaged with proposals for demand management in considered ways, highlighting approaches that offer a greater role for public(s) as preferable to externally controlled demand management (see **Theme 4**). A further way in which some of our participants engaged with demand management was to question whether there were possibilities for technological development that could enable balancing of demand, such as through the advancement of batteries or other forms of storage.

P: I think there must be a way round that, you know actually store it [electricity produced from wind power] in the house, the power that you get, surely? So you could use it at a time convenient. Cos you're not always in the house to do the washing in the wind to use it at a time which is convenient. (Glasgow)

Overall, then, the public(s) in our groups did not reject renewable energies in light of the need to balance demand. It is possible that demand management in this context was seen as enabling (i.e. facilitating a preferred form of supply), rather than prohibitive (i.e. in restricting energy use). This 'enabling' frame that appeared to underpin engagement with demand management suggests openness to compromise in public thinking about energy system change. This is particularly interesting when we consider some existing assumptions that circulate regarding expectations for public(s) to be resistant to change that can be characterised as creating 'inconvenience'. Whilst in this report we have, in some detail, explored some of the perceived constraints on change (social, structural, technical and political), we

have also, throughout this theme and others, espoused numerous examples where public unacceptability of "inconvenient" change does not necessarily occur. For instance, in addition to the example outlined above, in **Theme 3** we showed how projected increases in household bills due to the capital investment needed for renewable energy, did not necessarily lead our participants to reduce their support of renewables.

A further way in which our participants made links across the energy system was in terms of the different forms of connecting and network infrastructures. There was an understanding that a shift in service provision (e.g. a move from gas central heating to electric) would have resultant impacts not only on forms of supply, but also on the infrastructure that connects supply to demand.

P: A whole electrical system for heating, would that be pylons? ... You hear talk about this electrical system that has the frequency waves that can cause ill health... (Cumbria)

In this case, the links made with regard to the potential requirements for new network infrastructure generate concern about the potential health risks of pylons. As previous themes have shown, other key concerns that emerge out of the links made between the provision of new forms of supply and use, and infrastructure changes, were related to the difficulty of providing the requisite infrastructure needed to support services (e.g. EV charging points).



Beyond the connections that were reflected upon across energy supply, energy usage and connecting infrastructure, our participants made linkages between the technical, social and political dimensions of energy systems. In essence, this represented recognition of the ways that possibilities for change were constrained or facilitated not only through what is technically feasible, but also – and perhaps more importantly – through social and political factors (e.g. public acceptability or political support). Indeed, our participants suggested that, at times, whether energy system changes were enacted or not would be overwhelmingly dependent on political will and on decisions taken by others at different scales.

P: See that choice though [between fossil fuel or low carbon forms of supply] is that not kinda out of our hands mainly, 'cause on the other things it was personal to our homes, whereas that one it depends on what the government choose... (Edinburgh)

Points of connection were also evident across different issues, with such links forming points of comparison that enabled our participant's to formulate and “anchor” their views.

P: One of the problems is I think you look at the news any day of this week and there are areas of Africa which are having the worst droughts in 60 years so there is an example of a topic relating to this, then you have the gunman going on and all this doom and gloom and if it was on your doorstep then it would be horrific and it is horrific, but you see so much of it, it's not that you become immune to it, it is just you hear it and a few day later it is gone so until it really impacts you right on your doorstep your issues are more to do with you and what is going on under your roof and on your doorstep. (Cardiff)



In this illustrative quote the participant explicates their feelings about energy system change and the global issues that were under consideration in the workshops (e.g. climate change), by relating them to their thoughts about global issues more widely. In this case, they use this mode of connecting up to make sense of a disjuncture they perceived between their everyday life and local environment, and their sense of the wider issues scrutinised in the group discussions. The temporal rhythms associated with media and news coverage are in this instance highlighted as potentially problematic for engendering engagement with long term social and environmental issues (see Adam, 1998).

Additionally, this extract is indicative of issues associated with the contrasting temporalities of everyday life, and those of global environmental problems. The differing temporalities of daily rhythms and longer-term environmental change can serve to create a disjuncture between practices that are seen as involving immediate responses and those that are deemed necessary to meet moral responsibilities for more distant futures (see Shirani et al., 2013). This observation brings a set of questions around how to engage people with longer term concerns, like those of energy system transformation, in ways that connect with their everyday lives. In this regard, communicating about more concrete forms of change for which support exists to allow their ready enactment may be core to processes of public engagement with system change.

The final aspect to be discussed with regard to system links is that of trade-offs. A key way in which energy system change has been discussed within expert discourse is in terms of trade-offs between different aspects of system change (e.g. cost versus environmental sustainability). The workshops were designed to facilitate public engagement with such possible trade-offs and throughout the report these issues have explored. For example, in **Theme 5** we explored how when biofuels are contrasted with fossil fuels, concerns about biofuels are traded off against greater concerns about fossil fuels. In this regard connections were made between different aspects of system change in order to contextualise viewpoints. That is to say, views on different aspects of energy systems were formed in relation to other components of system change. This represents, then, a further key way in which system linkages were made, but also used, within public discourse – i.e. through juxtaposing and comparing different elements of the energy system.

Communicating about more concrete forms of change for which support exists to allow their ready enactment may be core to processes of public engagement with system change.

In this section we have discussed the multiple ways that our publics made connections across different aspects of energy system change, including inter-linkages between supply and demand, and the social, political and technical aspects of transition. We have also shown that when publics were less able to make connections (e.g. between renewable energy and demand management), prompting discussion of such linkages produced discussion that offered explanatory power for understanding public responses – i.e. demand management was principally treated by participants as something that could enable development of renewable forms of energy production.

The links our participants made were not limited to how decisions over supply may impact on demand-side services (e.g. electrification on heat and transport). Our participants were often alert to the different ways their choices may potentially, positively or negatively, impact themselves and wider (present and future) society. This included both direct impacts of having a certain supply-side technology (such as those associated with having new infrastructures sited nearby), and more indirect impacts (for example with regard to energy costs). Other forms of interconnection, such as across different issues (for example global poverty), across space, and through time, were also frequently made by participants. Additionally, contrasting and comparing different elements of system change represented a further way in which system links emerged as important within the research.

The discussion in this section bears more directly on the core benefits of using a whole system lens – that is, the ability to bring into view the interconnections between different aspects of energy system change. The whole system lens also facilitated a more open frame for discussion and allowed participants opportunities to situate UK energy system transitions within the wider global socio-political and economic context. Investigating public perceptions using a whole system lens does, however, also present distinct issues and challenges. For example, some of our participants after a full-day deliberating the whole system were in danger of feeling overwhelmed.

P1: I'm sorry I feel so depressed!

M: Oh, sorry [laughter from group]

P2: That's it we're heading home now

P3: That's it, that's the end of us. Can I have some Vodka? (Merthyr)

Ultimately we would suggest that this section and the research overall serves to exemplify the opportunities and need for interrogating system interconnections. Centrally, it highlights the potential for such research approaches to generate evidence that can help underpin 'more coordinated and effective governance' (Poumadère et al., 2011, p. 714) of complex issues related to energy system change.

Our participants recognised not only the linkages within the UK's energy system but also how we are part of a global energy system.

At times participants suggested that a 'good' change in energy demand technology (e.g. a move from a petrol vehicle to an electric one) is negatively affected by the means of supply being 'bad'. Conversely, at other times participants implied that a 'good' source of power could be negated by a 'bad' form of usage (where increased demand was seen as 'bad').



Concluding discussion



“Wouldn’t it be nice if it was that easy, sliding something on the computer” (Merthyr)

The complexity and difficulties of achieving change captured in the quote above represented a key recurring theme throughout the deliberative processes. This was matched, however, by an equally strong sense of interest in engaging with questions of change and the development of solutions to the major contemporary problems under discussion. Indeed, a focus on energy system transitions as the starting point for the workshops was viewed by participants as a positive opening for debate and engagement. This is reflective of one of the key and arguably most important findings to emerge from this work – that participants in the deliberative engagement processes were positive about notions of energy system change in a general sense, and indeed, that they expected change if it was necessary to avert impacts associated with issues of energy insecurity, un-affordability, and climate change.

Indeed, it was very clear from the workshops that the manifestation of impacts associated with all of these issues was highly unacceptable (e.g. floods and extreme weather events associated with climate change, unaffordable energy, and “black outs”). In line with existing evidence, energy becoming unaffordable represented perhaps the most evocative issue for many participants, particularly in the current economic context. From this research we argue, however, that it is crucial to recognise how concern about cost and affordability of energy is bound up with a wider set of issues relating to, for example, the undesirable nature of existing market arrangements, particular perceptions of energy (i.e. as a basic need not simply another consumer product/service per se), and current governance arrangements (e.g. ineffectual market regulation). Overall, there was a widespread perception that fair, transparent pricing is not being delivered through the current liberalised system and that changes to address affordability should be centred on ensuring these characteristics within energy pricing.

We began this report by outlining the objectives we aim to fulfil through doing this phase of research. Whilst many of our findings cut across several or all of the objectives (for example those we outline above), the rest of this chapter will speak more specifically to each of our stated objectives.

Objective 1

To highlight key points of agreement and contestation regarding tradeoffs including the conditions of acceptance relating to different energy systems scenarios.

On the surface trade-offs appear to be representative of the ways publics and stakeholders decide between different options, such as those “apparent” within energy system change. Though our data in many cases speaks to questions of ‘trade-offs’ (e.g. see **Theme 5** – the discussion about biofuels and oil), it also reveals core problems in terms of characterising transitions in this way. Centrally, such problems relate to the fact that many aspects of change, which might be characterised as being a trade-off, are not in actuality likely to manifest in this way. That is to say, questions of system change are rarely either/or questions and simplifying them in this way may obscure more than it enlightens. For example, for some bio-energy is not acceptable but it is regarded as better than oil; for this reason the negative things associated with bio-fuels may be traded off and accepted if it facilitates transition from oil based transport systems. The reality is, however, that future systems are likely to continue to use oil and bio-energy not one or the other, meaning this is not really a trade-off. The fact that our participants recognised that framing options and choices as trade-offs was in a sense problematic, is a key analytical insight that speaks to the ability of publics to fully engage in the deliberation of complex energy issues when they are given the opportunity.

The fact that our participants recognised that framing options and choices as trade-offs was in a sense problematic, is a key analytical insight that speaks to the ability of publics to fully engage in the deliberation of complex energy issues when they are given the opportunity.

Whilst the notion of trade-offs between different components of energy system change unravelled somewhat with careful analysis of the data, this did not diminish the importance of juxtaposing system components to compare and contrast, and to facilitate the exposition of the acceptability of transitions. Indeed, we maintain that the whole systems framing utilised in this research had a significant impact on the ways that participants engaged with questions of energy system change.

This was particularly evident in relation to aspects like carbon capture and storage where the rationale for developing it only seemed to be acceptable in the event there was no other transitional option. This manifested as a “why do that when there are other options?” response. This was also reflected in the more favourable responses to CCS for particular forms of emissions; i.e. from industrial processes where there was a perception that other options were not available.

Objective 2

To reveal the values which underpin people’s decisions and attitudes towards whole energy system change scenarios.

Whilst trade-offs had less explanatory power than we had anticipated for understanding public attitudes, exploring the values that underpin people’s attitudes has been a much more successful strategy. For example, as **Theme 3** discussed, affordability of energy is often positioned by the media as a trade-off with certain forms of energy system development, the assumption being that publics will prefer a low-cost pathway and reject a high-cost pathway to energy system change. Accordingly, it is often anticipated that publics will reject high-cost pathways due to concerns about personal energy security which is intimately connected with issues around affordability. If we follow this logic, support for a system premised on large amounts of renewable energy may be diminished due to concerns about the large amount of capital investment needed for this sort of system to be realised and the potential for such investment to cause consumer

Our research gives insight into the values characteristic of systems of provisioning that are regarded as favourable across both demand and supply.

to increase. Yet our analysis shows that this is not necessarily the case. Concerns regarding affordability and financing of transitions relate more to issues associated with the perceived actions of energy companies and their profit-making orientation.

Within the context of such concerns, our participants expressed the desirability of a shift to an energy system imbued with values including ‘fairness’ (in terms of the distribution of cost and responsibility for paying for transitions), ‘trustworthiness’ (of energy utilities and other stakeholders responsible for setting, for example, prices or “green” taxes) and ‘transparency’ (in for example, how profits from consumers are used and the reasons underpinning the price of energy). The implication of these and other findings here is that the bigger barrier is not cost *per se* but public trust in the actors who have key roles in using resources to deliver transitions. Considerable work is therefore needed to develop trust in energy system companies, operators and regulators before we could really expect to see manifestation of acceptability regarding bill increases for particular forms of transition in “real world” contexts.

Beyond financial aspects, a core finding of the research with regard to transitions relates to the idea of “improvement” as a necessary underpinning for engendering support for different routes to change. Our research gives insight into the values characteristic of systems of provisioning that are regarded as important and favourable across both demand and supply dimensions (e.g. clean, natural, controllable, and efficient). Understanding these characteristics and how to develop and envision transitions that will be viewed as “improvement” is likely to be of utmost importance in the realisation of system transformations. The notion of “improvement” can be seen as contrasting with “non-transitions” (i.e. **Theme 5**) – approaches viewed as short term and postponing rather than solving problems. By their very nature, approaches viewed as having non-transitional qualities are not commensurate with ideas of improvement – rather than representing improved systems of provisioning they appear only to ‘cover up’, ‘fudge’ or ‘suspend’ problems.

Theme 2 revealed that our participants desired a shift to a more sustainable energy system, consisting of a supply-side predominantly comprising of renewable forms of energy and a society that consumes less. Public support for renewable energy, of course, has been demonstrated over many years through multiple studies (e.g. McGowan and Sauter, 2005) but is often contrasted with local contestation – a topic that has also been the focus of much previous research (e.g. Bell et al., 2005; Devine-Wright, 2011). Additional interesting findings from this research relate to the way that information regarding the capacity of renewable forms of energy supply for providing electricity was received, i.e. showing that renewable technology could meet a large proportion



of electricity demand further increased the propensity toward positive responses. More importantly, associated issues such as cost and demand-management did not decrease support. Centrally, participants placed value on the perceived qualities of renewable energy systems; e.g. clean, natural, infinite. These qualities (and others) are the things that publics value when it comes to renewable energy and they underlay positive attitudes toward such forms of power generation.

Throughout this report the concept of social contracts as a way of conceptualising relationships between government, markets and public(s) has been applied as a useful way to think about transitional processes. We argue that social contracts can and do change over time through processes of protest, contestation and negotiation, and formulating new social contracts is likely to be a necessary precursor to the enactment of energy system transformations. Here we have provided an indication of some of the core values which underlay people's views on energy system change e.g. fairness, cleanness. We suggest that acting in ways congruent with these values may offer a basis for the development of a new social contract. Central to this will be the need to pay attention to existing social contracts and the extent to which proposed socio-technological changes interfere with them. In these cases there is a need to think about change in terms of reciprocity and consider how calls placed upon publics to accept changes are being met with correspondent obligations for government and companies. Crucially, the role of companies in meeting aspects of provisioning that would have typically been part of government's role, means there are imperatives to clarify the responsibilities and rights of businesses in processes of reformulating social contracts.

Objective 3

To develop insight into public perspectives on everyday lifestyle changes implicated in different energy system scenarios, both in terms of demand side and supply side changes.

Numerous sections of this report have highlighted how our participants envision lifestyles to be impacted by changes to the energy system. An important finding from this research is even those impacts that could be characterised as inconvenient or negative were not necessarily rejected. As we have previously discussed, our participants recognised the need for change and this was combined with pragmatism about why and how change could be achieved. Yet this is not to say all change was embraced wholeheartedly. For instance, in discussions about supply-side technologies our participants wanted a shift away from an energy system reliant on fossil fuels. Yet in discussions about key energy services (e.g. heating and transport) it emerged that some of the most prized and cherished demand-side technologies (e.g. gas central heating, petrol cars) are reliant on the fossil fuels our participants sought to move away from. This, of course, is only one example of the way discussions embedded in everyday life seemingly contradicted more abstract level discussions divorced from personal experience. Yet such "contradictions" are highly revealing and do provide a great deal of insight into what is important to our participants and how change can be achieved. For instance, continuing the example of central heating, such discussions revealed the importance of certain characteristics of heat (e.g. high intensity and instant warmth, responsive and controllable) to our participants.

There are considerable challenges for engendering and enacting change in everyday life. Constraints, uncertainties, risks, contexts, responsibility, trust are just some of the numerous aspects of analysis that this report has navigated through to unpack discussions by our participants associated with everyday lifestyle change. What we hope to have made clear are not just the reasons underpinning our participants' views on changes to the energy system, but also the ways in which transitions can be facilitated at different scales ranging from the macro level (i.e. national government and industry) down to the micro-level (i.e. how individuals or small groups can be supported to make changes). That change needed to be targeted at all levels was both desired and understood by our participants.

As highlighted in a number of sections responsibility for various aspects of transition were located across public, industry and government, rather than pertaining to one group or sector. Our participants voiced their own responsibilities in transitions across multiple forms of change and in many senses positioned themselves as

having an integral role, which in general was one they were accepting of. They also simultaneously expressed concerns about the limits to their role and the need for wider changes to occur to create opportunities for expressions of more sustainable choices. For example, there were changes that needed to occur that were beyond their range of action, like infrastructures for electric vehicles, or in the development of possibilities for different purchasing decisions particularly for expensive items that were changed irregularly. This related to a general sense of the importance of reciprocity between state, publics and (energy) companies. In addition, publics expressed frustration with what they saw as messages from government conflicting with the actions of both the institution and high profile individuals within government. Accordingly, publics desire government to have 'body language' (Wynne, 1996), i.e. 'non-verbal cues' (Durrant, 2008), that match political rhetoric. This in turn will underscore government's commitment to change and give a clear steer to publics regarding the importance of the imperatives for change.

Project Aim

Develop and utilise innovative methodological approaches for examining public values, attitudes and acceptability

Core to the wider project was an aim to develop innovative methods; an imperative posed by the particular challenges that existed in engaging people with futures and with whole energy system change. Several different approaches and techniques were developed through this particular work package in order to meet these challenges.

The use of scenarios, or more crucially the use of an online tool which allowed participants to develop their own scenarios, was central to the methodology but this alone did not overcome the difficulties for engaging publics with the whole energy system and futures. The use of the tool was combined with a carefully designed facilitated discussion that allowed for multiple aspects of transitions and the interconnections between them to be explored with publics. This involved starting by engaging people with things that are part of their everyday experiences and embedded in their current lives (e.g. central heating systems) before moving to discuss things typically more abstracted from daily life like power stations. It also entailed situating people in 'the now' before moving them to think about change and futures; for example, we asked people to talk through how they currently heat their homes before asking them about change to this aspect of energy systems.

In order to embed system changes more fully in everyday life we further utilised scenario narratives (see Appendix). These also necessitated carefully facilitated discussions in order to help people engage. Discussions around the scenario narratives occurred in the latter part of the day following deliberations about system transitions, and as such participants had already been reflecting on processes of change. This task thus represented a further stage of discussion through which participants were asked to think about what they currently do and what is desirable. This also served as a reflective period through which facilitators prompted participants to think about views they had expressed through the day.

As discussed there are inherent difficulties in engaging participants in thinking about change including places or ways of living that do not exist at present. That being said, the approach taken in this research was highly successful in enabling participants to take on the complexities of the issues and express their views, perspectives and preferences.

After note

As briefly mentioned at the start of the report there is a quantitative phase of research linked to the qualitative analysis we have presented here.

The key findings from the survey phase of the project have been published in a separate related report. See Demski, C. Spence, A. and Pidgeon, N. (2013) Transforming the UK Energy System: Public Values, Attitudes and Acceptability – Summary findings of a survey conducted in August 2012 (UKERC: London).

There are connections between the findings of the two reports. However, points of connection and combined insights emerging out of both phases of research have been pursued through a further synthesis analysis. This analysis has allowed us to build a more detailed understanding of some key aspects of concern for publics with regards to energy system change. The synthesis analysis report will be available 16 July 2013.

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Appendix: Scenario narratives utilised in workshops

Future Vignette 2050: Business as usual

The familiar buzz of your gas boiler in the background tickles at the edge of your consciousness as you edge towards wakefulness. Running late, your partner asks you to take care of getting the kids' breakfast this morning, as they dash out the door for work. Finally up, you put the water on to boil for your morning tea (you feel a moment of triumph that you managed to ensure that your landlord installed a gas hob – you just wish it wasn't so expensive and the pipeline hadn't been run through one of your favourite areas for walking). You call to your children, who are busily surfing the internet with cartoons on in the background, to get ready.



You would like some fresh air but are reminded of the time when as a kid you opened the car window and all you got was a mouthful of fumes.

Travel mug in hand you usher the kids out of the door and begin your drive first to their school and then work, cursing the troubles which have sent your fuel prices soaring (again), almost beyond your reach (maybe it's time to sell that second car). On your commute the freight train, that never seems to end, thunders past you, containing our precious coal. You enter the city and immediately grind to a halt as congestion is now the norm 24/7. You try not to flinch as the buses smugly bumble past your inside. You would like some fresh air but are reminded of the time when as a kid you opened the car window and all you got was a mouthful of fumes (a mistake you've never made since!). The sight of cyclists gamely wearing ever more complex masks convinces you that your strategy of closed windows, whilst stuffy, is sound.

The radio blares to life with news of the latest environmental disaster caused by ever more risky oil drilling. This is swiftly followed by the latest story about the growing problem of climate change immigrants that are hitting British shores. In the next bulletin you are reminded that climate change does not just happen over "there", given the ever encroaching ocean and persistent storm surges that threaten to cause even more flooding. That last thought makes you particularly grim as you are reminded of your own eviction notice (courtesy of the Government's strategy to withdraw flood defences due to costs in some areas) sitting on your desk next to the red letter utilities bill. Water is also at a premium nowadays given the droughts the UK is increasingly victim to.

You finally get parked. Once you arrive, the building begins to power down non-essential lighting and heating. Controlled energy use like this and planned rolling blackouts are the norm, but this is far preferable to the random blackouts and energy cuts that had happened at first. After a full day at work, you return home noticing your neighbour's house is lit up; you tut to yourself wondering how they can justify and even afford such extravagant use of energy. You gather with your family to eat dinner. As you glance at a picture of your parents on your mantelpiece, you remember a time when energy and the environment didn't even cross your mind.

Future Vignette 2050: Mixing it up

After inhaling your morning cuppa you head to the bus stop just in time to hear the quiet hum which signals the approach of your commuter electric bus. As you take a seat, your attention is momentarily drawn to the solar panels nestled near to your TV satellite dish. You make a mental note that they are due for a service soon - as is your ground source heat pump system.



You have a momentary shock as the phone rings unexpectedly in your hand, noticing it's your mother you endure another rant about the solar thermal water heating; a system she still hasn't ever got the hang of.

5 minutes later you are cursing as you remember you have left the computer on and have overridden the sensors which would normally turn it off with the absence of human interaction. No problem, you grab your smart phone and access your home system smart network, enabling you to turn it off remotely, even as you chug through the countryside. You have a momentary shock as the phone rings unexpectedly in your hand, noticing it's your mother you endure another rant about the solar thermal water heating; a system she still hasn't ever got the hang of. You tap a quick message off to your partner and ask them to swing by your mothers, after they've picked the kids up from school, to lend their aid as they have the hybrid biofuels electric car today.

Meanwhile, to the left you are passing fields of gold containing crops for the local biomass power plant. To your right is a wind farm on the hill; you can't understand why there is still opposition to such schemes. Now you're passing the turn off to the local nuclear power station which is set ("ominously" as your neighbour likes to jokingly say) on the peninsula.

As your bus meanders around the suburbs and finally approaches the city, the road narrows where work continues to install the carbon capture and storage waste pipe network. Traffic, mainly other electric buses, trams and bicycles, starts to pick up, but never stagnates the flow. You yank open the bus window allowing fresh air to flow through the carriage.

As you enter your office building, lights and electronics which were lying dormant in wait of a visitor, hum to life. You are informed that the video conference you scheduled in lieu of that flight to Amsterdam is due to start in 10 minutes. For your journey home the sunny day makes you decide to opt for a public hire bike. Hopping on you trundle along the busy cycle paths to your area, leaving the bike at the local bicycle rank and walking the short remaining distance to home. You arrive back to a warm house ("Thanks insulation!") and settle in for a relaxing evening with your family.

Future Vignette 2050: Low Carbon Living

You wake in the morning and make your way to the kitchen giving a passing glance to your real time display which shows your energy usage. You feel smug as it registers almost zero at this time in the morning; the background appliances like your fridge freezer must have been powered off overnight by your energy company as “smart metering” and demand management is now the norm.



Your family congregates in the living room making sure lights, heating and appliances are off in the rest of the house.

You add the precise amount of water to the kettle required for your morning cuppa. Sipping your drink you flick on the television at source – briefly remembering the days of “standby” – to watch the news managing to grab the headlines before the kids hijack it for cartoons. You hasten the teenager out of the door to begin their morning walk along with the rest of their classmates since “walk to school clubs” are common now. Your partner will take the electric car to work today, you scamper out quickly with the toddler, as you realise you may have forgotten to set the car to charge last night... You set off along a well established and busy cycle path breathing in the fresh clean air. As you crest the hill the new massive wind farm off the coast where you live comes into view (“Powering our Nation” – you smile at the thought of their cheesy slogan).

On your return home from your brief trip to the nursery you settle in for your day’s work. Home working is now normal and you only go into a small office share building when you need to meet people face-to-face or conduct a video-conference. As you settle in you glance out of your window at a view dotted with solar panels and wind turbines, whilst far in the distance you can just make out the start of the great tidal barrage. You switch on your low energy computer and quickly scan through your emailed bills and bank statements. You notice a message from your energy supplier indicating that the forecast is for high winds tonight so a good time to run, at a lower cost non-time-critical appliances, like the washing machine, and turn your water on to heat – something you often forget to do. It’s a cold day but your heavily insulated home only requires a short burst from your electric heating system to top up the warmth generated by your ground source heat pump.

In the evening you finish work for the day and help to make dinner, casting your mind back to the days when you cooked using gas. Your family congregates in the living room making sure lights, heating and appliances are off in the rest of the house. The main topic of discussion is the family holiday to mainland Europe travelling via the high speed train. You have a brief pang of nostalgia for the family holidays you took as a child to places like the USA that your own children will likely never experience. On your way to bed you turn to your energy display and begin your nightly ritual of ensuring all appliances are turned off and the washing machine is set to run its cycle before morning – the automated system means it will complete its cycle sometime in the night (a nice trick for levelling your demand).

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