



Engaging People with Energy Technologies

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Energy Generation
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Energy Generation & Supply Knowledge Transfer Network

The Energy Generation and Supply Knowledge Transfer Network (EG&S KTN) is a Technology Strategy Board initiative. The role of the EG&S KTN is to simplify the UK energy innovation landscape by providing a clear and focused vehicle for the rapid transfer of high-quality information on technologies, markets, funding and partnering opportunities.

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1. Introduction

The public will have a crucial role to play in reducing CO₂ emissions to the level required by UK policy; this role extends beyond the public being mere consumers of energy and users of energy technologies, they can also act as prosumers, as citizens with voting powers, and as active protesters or proponents of infrastructures. As a result, the public will be key to the successful implementation of change processes.

With the support of a number of experts in this area, the Energy Generation and Supply Knowledge Transfer Network (EG&S KTN) has produced this report, which provides an overview of the current research on public perception and engagement with energy technologies and how this may impact on the energy industry.

Although the content of this report is relevant to all organisations active in the energy sector, it has been tailored to small and medium enterprises (SMEs) who may not have had exposure to this research or who may not have previously engaged with the public to any great extent.

The report aims to provide the energy industry and policy makers with:

- A common understanding of the terms public perception, public acceptance and public engagement and the differences between them;
- Case studies on public engagement at varying technology scales;
- Examples of where a lack of public engagement has been detrimental to emerging energy markets; and
- A means to improve engagement throughout the technology development process.



The objective is to provide a common vocabulary and highlight to the energy generation and supply community that engaging people with technology is not only important from the perspective of user satisfaction, but can provide market advantages and increase both speed and scale of market penetration.

With this in mind the key research questions the report is envisioned to answer are: “Why should the energy industry be concerned with public engagement with energy technologies?” and “What are the associated benefits of engaging people with energy technologies?”

2. Public engagement: Adding value to today's and tomorrow's businesses

The UK Government is committed to promoting investment in the low-carbon economy and wants the UK to be a benchmark for the rest of the world. The Government's *Plan for Growth* [1] makes it clear that decarbonising the economy offers significant opportunities for UK businesses.

In 2009/10 the global low-carbon market was worth more than £3.2 trillion and is projected to reach £4 trillion by 2015, as economies around the world invest in low-carbon technologies across a broad range of sectors. The UK share of that market was more than £116 billion in 2009/10, but it could be much larger. UK businesses can be at the forefront of the transition.

The case for public engagement with energy technologies

There are few people who believe that future energy demand can be delivered by a 'business as usual' approach, with most predictions indicating that a mixture of technologies will be required; some mature (e.g. oil and gas, nuclear), some at the early stages of deployment (e.g. wind, solar) and some still to be fully proven (e.g. CCS, smart grids).

The inherent uncertainty associated with change, if handled poorly, can lead to negative responses from stakeholder communities and potential consumers, who have consistently proven their ability to effectively express their opposition (Lewis [2], Beaulieu-Denny [3], Balcombe [4]).

The influence of public opinion on businesses, investors and policymakers should not be underestimated. Increasingly people have the potential to determine the success or failure of energy technologies and can play an important role in influencing community payments and environmental regulation of such technologies.

Over the last few years, public perceptions, acceptance and engagement with energy technologies have become increasingly important in the energy sector (see the vocabulary section of this report for definitions).

"Moving to a green economy presents huge opportunities for British businesses not only to reduce their environmental impact, but also to transform products and services, develop cleaner technologies, and capture new international markets."

– UK Government 2011 [5]

More and more people are personally acting in the energy landscape, as the rise of 'prosumers' shows. The rise of prosumers presents new scenarios for energy technology development. For example, the spread of localised energy generators or the widespread deployment of 'smart grid' technology has the potential to create a new generation of energy prosumers with corresponding market opportunities and communication challenges.

Engaging people with energy technologies is essential to both enabling technology diffusion and reducing energy demand to meet reduction targets.

Driven by the assumption that the root of opposition is lack of understanding, significant effort has been expended on improved communications and engagement with the general public. While this has seen some change in attitudes, it has become clear that other factors are at work and that there is a need to view engagement in terms of two-way dialogue and mutual exchange.

The case studies presented in this report provide examples of the latest research insights around these bilateral dialogues and highlight key recommendations for organisations interested in engaging people.

3. Case Studies

3.1. Domestic scale engagement: In-Home Displays (IHDs)

Dr Tom Hargreaves, University of East Anglia

Background

Over the last four decades, sustained attempts to reduce domestic energy demand have struggled to produce significant or lasting results. Getting people to engage with and reduce their energy use has proven extremely difficult. A key reason for this lack of engagement is that, for most people and most of the time, energy is ‘doubly invisible’ [6]. It cannot be physically seen, and current billing and payment systems also mean it is very hard to connect energy use to particular activities. A popular response has been to provide forms of feedback on energy use through a range of in-home displays (IHDs).

IHDs provide real-time information to householders, letting them know exactly how much energy they are using second-by-second, as well as how much this costs. The intention is that this feedback will enable householders to identify where and when they are using the most energy and thereby take steps to reduce their use.

Studies suggest that IHDs can help people realise financial savings of up to 15 per cent [7], with better results achieved where the feedback is frequent, sustained, appliance specific and given in a clear and appealing manner [8]. These encouraging findings have supported the policy decision to give IHDs to all UK households by the end of 2020 as part of the UK government’s £12.1 billion smart meter roll-out.

What’s the problem?

While IHDs have considerable potential to help people learn about, and reduce their domestic energy use, a large-scale trial of IHDs in 60,000 homes in the UK, including 18,000 equipped with smart meters, observed no statistically significant savings from standalone IHDs, and just 3 per



cent savings when IHDs were combined with smart meters [9]. In either case, these results fall someway short of potential savings.

More in-depth and long-term studies have also cast doubt over IHDs overall effectiveness. While it is recognised that, when used, IHDs do help people to learn about their energy use, it has also been shown that they have only short-term effects, typically just 3-4 months, with people often then becoming bored of them and packing them away [10], that they can negatively influence household social dynamics causing conflict about energy saving as often as cooperation [11][12], and that they may make matters worse by legitimising energy-intensive practices and overlooking those considered non-negotiable [13].

The central lesson from research on IHDs is that many of their problems and limitations derive from over-simplistic assumptions about household behaviour. It is too often assumed that, when given

new and better information about their energy use, individuals will make rational decisions and choose to cut their consumption to save both energy and money. The reality, however, is that decisions about household energy use are not made by individuals but must often be negotiated with others. Such decisions that are made are far from rational, but rather involve numerous aesthetic, emotional, pragmatic and other forms of household 'logic'.

Finally, instead of being able to choose freely about how to reduce their use, householders are often constrained by societal expectations about what is normal and non-negotiable.

What's the solution?

Some simple measures may help improve IHDs overall effectiveness. It is clear that, on their own, IHDs are unlikely to achieve substantial and sustained reductions in energy use. Rather, householders must be supported to get the most out of them. For example, IHDs should be carefully explained at installation, and further help and advice should be given to encourage and enable people to act on the information they provide.

It is clear also that a long-term approach is required to keep householders engaged beyond a 3-4 month 'honeymoon' period. For example, IHDs could potentially receive regular upgrades that offer new and more detailed information to ensure that they remain interesting and useful to householders. Further, householders should be encouraged to use IHDs to reflect on what they consider to be non-negotiable to ensure that underlying trends towards rising energy use do not go unchallenged.

Perhaps most importantly, though, getting the most out of IHDs – and of other interventions to reduce domestic energy demand – requires a more in-depth understanding and appreciation of how energy is used in the home. In short, attempts to reduce household energy use should start by trying to understand the realities of everyday domestic life and how energy fits into this, rather than the other way around.

3.2. Local opposition to wind farm development

Dr Christopher Jones, University of Sheffield

Background

Local opposition to wind farm development is a simple issue of selfishness on the part of their opponents. This often paraphrased belief underpins many people's explanations about the reasons why people choose to object to local wind farm development, while simultaneously recognising the value of wind power in general. While popular, this NIMBY (not in my back yard) explanation, makes a number of assumptions about the roots of such opposition that are not necessarily fulfilled when formally assessing the opinions of opponents. Specifically, it assumes that:

- (a) the opponents' issue is with the wind farm;
- (b) there is a gap in people's attitudes towards wind farm development in general (positive) and locally (negative); and
- (c) this gap is largely motivated by ignorance and/or self-interest.

While it is sometimes the case that opposition to proposed wind farms will meet with these three criteria, it is more often the case that one or more of these assumptions are not met, leading to a misclassification of people as 'NIMBYs'.

What's the problem?

Notwithstanding the negative nature of the term, if the assumption is that people are locally opposed on the grounds of self-interest then a natural policy response would be one of 'paying off' opponents. Granted such a policy might work to appease some opposition (particularly among those who are really self-interested); however, for those whose concerns are grounded in something other than self-interest, such a policy is likely to be ineffective, could undermine trust and/or backfire as perceived attempt to coerce or bribe.

What's the solution?

The root of the solution is in better understanding the problem; in this case embracing the diverse nature of wind farm opposition. By better understanding the make-up of opposition (and support) formed in response to a proposed wind farm, it is possible to better design and target engagement activities so that they formally address the issues relating to specific developmental context. In fact, engagement alone could prevent some of the concern arising in the first place – provided it is done in a sustained, responsive and (ideally) participatory way [14].

Understanding responses to proposed wind farms is helped by asking the following questions:

- (a) Is the opponents' issue with the proposed wind farm? Where the siting of a wind farm causes controversy, it might not be the wind farm that is controversial but rather the threat of change more generally or the process by which the change is occurring. For instance, recent research has implicated people's identification with place as a potential cause of opposition. If a proposed development (e.g. wind farm) threatens a person's sense of place then this can motivate place-protective action (e.g. protesting) [15]. Thus, while the wind farm is the vessel for change, it is the threat of change that motivates resistance. In such cases people should not be treated as NIMBYs.
- (b) Is there are a gap in people's attitudes? If the opposition is tied to the wind farm, it is still not necessarily the case that the objection is unique to the local context. Some people just don't like wind farms (i.e. they are general opponents) and they would object to their construction further afield too if motivated to do so [16]. Moreover, attitudes are dynamic and can be modified and strengthened by experience. Therefore it is possible that someone who is generally positive towards wind farms initially can become more generally negative over time (e.g. as they learn more about wind turbine technology). In both cases, however, opposition arising from these individuals is rooted in a more general rejection of the technology and they should not be treated as NIMBYs.
- (c) Is this gap motivated by self-interest? If people's opposition is tied to the wind farm and there is a gap between their general and local attitudes, it is still not necessarily the case that their opposition is motivated by self-interest. For example, communities will often have specific environmental, ecological and cultural sensitivities that can be affected by wind farm development. Opposition grounded in a protection of such sensitivities could be seen to transcend self-interest and thus should not be treated as NIMBY. Furthermore, even if a dispute does boil down to something that is evidently related to self-interest (e.g. concern about house-prices) is it fair to vilify or dismiss residents as NIMBYs, even when sources exist to corroborate some of these concerns?



Conclusions

This case study has aimed to highlight the diverse roots of opposition to proposed wind farms (and other developments). In some cases opposition is not a matter of technology but of process and taking steps towards more inclusive participatory forms of planning should help to quell some opposition based on such grounds. In other cases, the objection might not be local but more generally held.

Again, more inclusive forms of engagement could help here; providing a valuable forum for exchange of information, which may help to counter the spread of mis-information that could serve to negatively affect general attitudes. In other cases, people might fulfil the NIMBY criteria; however in such cases refraining from registering such a classification may be prudent bearing in mind the derogatory and dismissive tone it incites?

Finally, with much of the attention and resources directed towards addressing the concerns of opponents, the often overlooked groups in wind farm siting controversies are the supporters and those who have yet to make up their minds.

In a democratic society these groups should have equal opportunity to express their opinions but, as they often remain more quiescent, they tend not to be heard. The challenge for developers and SMEs working in this field is one of engaging this often silent majority [17].

3.3. Public opinion of Carbon Capture and Storage (CCS)

Dr Paul Upham, University of Leeds

Background

Although Carbon Capture and Storage (CCS) is a relatively centralised technology, this briefing provides a short background on public opinion aspects for UK SME suppliers.

CCS involves the removal of CO₂ from fossil fuel combustion or gasification emissions and then transportation of this to a storage site, typically a geological reservoir such as a depleted oil and gas field or saline aquifer. Forms of above ground storage (e.g. mineralisation) and re-use (e.g. algae production) are also being considered, with climate impacts dependent on the duration of storage and the extent of any fossil fuel substitution. Work is on-going to reduce the significant energy penalty of CO₂ capture and compression.

In policy terms, CCS is controversial because it has the potential to permit the continued use of fossil fuel for heat and power generation beyond the point in time at which adequate alternatives are perceived to exist. Public perceptions may draw on not only local considerations, but also broader policy issues. This was highlighted in focus groups undertaken by the NearCO₂ project [18] in six European countries, including the UK.

The results concurred with much of the previous work on attitudes to energy and CCS, showing: public preference for renewable energy; perception of CCS as a temporary solution; concern about increasing energy costs and distrust of large power firms in respect to CCS; and a high level of concern about the safety implications of CO₂ leakage (primarily in relation to onshore storage).

In the NearCO₂ research project, concerns about safety grew as more information about CCS was provided. Moreover providing further information on the difficulty of rapidly installing high levels of renewable energy supply infrastructure had little influence on opinion. The organisations and technologies were seen as tainted and the information provided was interpreted in the light of this pre-existing set of opinions.

It is possible to take a group of people through an educational and/or deliberative process that results in their viewing CCS more positively. Work as part of the UK CASSEM (CO₂ Aquifer Storage Site Evaluation and Monitoring) project held a series of citizen panels [19] in Pontefract and Dunfermline.

The public met with a range CCS experts over two days and the trust engendered proved central to the development of participants' generally positive opinion of CCS. Nonetheless, participants remained distrustful of the ability and willingness of both government and business to implement CCS safely. They were also concerned about the potential cost of CCS, despite overall opinion of CCS becoming more positive through the course of the panels.

In general, studies indicate that if a population has doubts and anxieties about a technology, particularly if there is a history of low trust with the organisations involved, then substantial and sustained effort has to be expended on communication and engagement processes, without guarantees of a 'successful' conclusion.

Conversely, where a power plant has a good, long-term relationship with a local community, built over years or decades, particularly in terms of providing local employment, then the process may be easier. It is likely, for example, that Total's long-term history in Lacq, France, helped the company implement its CCS pilot project. Nonetheless, despite operating in the region since 1938, Total understood the importance of early and sustained communication and engagement with local people prior to seeking regulatory approval [20]. Conversely, where a community already feels over-burdened by development and engagement by companies falls short of expectations, severe problems can occur – hence Shell's experience at Barendrecht [21] in the Netherlands.



Other points to note

1. Public awareness and understanding of CCS in the UK is low, though increasing.
2. Providing information on CCS, its rationale and its risks should be only one element of an engagement strategy. In a three country comparison, CSIRO found that face to face discussion may help with information credibility [22], though in the European NearCO₂ project [23], groups remained sceptical.
3. Experience suggests that trust is enhanced [24] by perceptions of competence, preparedness and accountability (should things go wrong); fairness regarding the distribution of the costs and benefits of the project; and openness and transparency through planning, implementation and operational processes.
4. Local stakeholders are likely to be as important as the local public for their opinion-shaping role. Maintaining relationships with stakeholders, including opponents, is considered important by developers [23].

Conclusions

CCS is an unfamiliar, potentially controversial technology with uncertainties for both publics and experts. Onshore, proximate storage may have to deal with a sceptical public. Concerns may reduce where storage is offshore (non-proximate) and/or where there is an on-going relationship between local people and the advocate organisations.

3.4. Whole Energy Systems: Public values, attitudes and acceptability

**Dr Catherine Butler, University of Exeter
& Prof Nick Pidgeon, Cardiff University**

Overview

This briefing offers a summary of key lessons derived from research into public engagement with whole energy system change. The research builds from existing debates about public engagement wherein it has been asserted that there is a need to consider the ethical and social dimensions of technological innovation in ways that move beyond so called 'deficit' thinking [25]. Such concerns have led to a greater prevalence of public engagement in the UK, with the aims of such activities being broadly divided across those that:

1. Are conducted because involving publics in debating the path and nature of technological development is seen as being a 'good thing' in and of itself;
2. Seek to open up insight into public characterisations and concerns in ways that might then feed-back into key decisions or the activities of scientists and engineers; and
3. Aim to build legitimacy and or secure consent for developments.

The research summarised here has aims consistent with the first two rationales. The project was both innovative and methodologically challenging; very few other studies have attempted to gauge public views on energy system change as a set of interconnected transformations in energy demand and supply. The project set out to address the following key questions:

1. Are there particular scenarios or pathways which attract more support than others?

2. What and where are the key trade-offs, barriers and points of inducement that raise acceptability issues for members of the public living in different contexts and how might they be addressed?
3. Which processes could potentially form the basis for a social contract for rapid change?
4. How do publics envision future energy system configurations and their governance?
5. How do these compare and contrast with different 2020 and 2050 scenarios?
6. What are the values and perceptions that inform public evaluations of energy scenarios?

The research involved day-long deliberative workshops across Great Britain and an online nationally representative survey to examine public views. A scenario tool developed by the Department of Energy and Climate Change (the My2050 tool) was utilised in both phases [26].

In methodological terms, it was assumed that very few of the workshop or survey participants would know about the full range of system change issues (on energy supply and demand) and the policy drivers (in particular around energy security, climate change and affordability) that were to be considered. Accordingly considerable care was taken to ensure that the design and piloting of materials and procedures provided sufficient information to prompt debate, without overly constraining that debate.



The research findings sets out core public values underpinning public reactions to proposed energy system change and emphasise the importance of thinking about the values which underlie peoples' preferences, rather than focusing solely on the technology [27][28][29]. Critical to this argument is the notion that public perspectives are not about technologies alone, they are about what the technology symbolises and represents. To illustrate, our findings show that there is a strong public preference for solar energy in the supply-side of our energy system (85 per cent were found to be favourable toward solar energy).

The research finds that the values which underlay this favourability are those associated with it being perceived as 'renewable' 'fair', 'just', 'clean', 'safe' and 'secure', and as delivery benefits in terms of 'affordability'. We assert that if solar power was deployed and developed in ways that do not correspond with the underlying characteristics that people value, it would no longer fit with the public preference for this energy technology.

To clarify, we might imagine a solar energy development supplying the UK, but residing in North Africa, being revealed as causing local environmental contamination and land-use territorial disputes. This version of solar would not fit the public preference for this form of energy provision, not because it is no longer renewable but because in this instance it would no longer be seen as 'fair', 'just' or 'clean'. As such, importance is attached to the inclusion of renewable, clean, fair, just and affordable elements in future energy systems, not solar energy technology in itself.

The values set out through this research relate, not only to the reasons underlying preferences for different technologies, but also to concerns about processes of development, implementation, governance and regulation. This means that the processes through which technologies are deployed, for example, whether they include genuine and early community engagement or whether they are perceived as adequately regulated and so forth, also form an important part of public view formation and response.

A major lesson from this analysis is that technologies, currently regarded favourably or unfavourably, can be formulated in ways more closely aligned with public values. For example, certain forms of bio-energy, namely grown for purpose bio-fuels provoke concerns about land conflicts, governance, regulatory failure, and pollution – these issues result in public uncertainty, ambivalence, and, in some cases, rejection of bio-fuels.

However, it may be possible to envisage a development trajectory commensurate with public values through concerted and transparent efforts to ensure bio-fuels meet these concerns. For example, developing bio-fuels in ways that do not put them in conflict with land for food production.

Key points to note

1. The British public wants and expects change with regard to how energy is supplied, used and governed. Our research shows that members of the public recognise, and are positive about, the need for energy system change. They do not favour greater levels of change on either the demand or supply side. They regard the energy system as dynamic in nature and constantly changing. If changes are going to occur anyway, members of the public saw this as an opportunity to ‘do it right’ – to make it a worthwhile change.
2. Actors involved in energy system transitions need to treat public viewpoints with integrity, valuing the contribution they make to envisioning transitions. Public preferences should not be viewed as something to manipulate, rather actors should engage meaningfully with public values and preferences. Publics are pragmatic and recognise the need for compromise but are likely to respond negatively to attempts to manipulate, persuade, and/or dismiss their perspectives.

3. For policy-makers and other actors involved in energy system transformation, it is important to be clear about how current and proposed changes to the energy system fit within a long-term trajectory. This includes showing how developments fit with wider strategies and proposals developed at different scales and by other actors involved in system development.
4. Actors involved in energy system change need to ensure that their actions are transparent and mirror rhetoric. This includes the actions of whole institutions, as well as the individual behaviour of high profile people within organisations. For industry, this includes making clear how proposals for change (e.g. assisting consumers in reducing their energy use) fit with their business models or alternatively explaining why they are undertaking actions that do not necessarily fit with business models.

Reflections on public engagement

A first lesson of this case study is that, with careful process and materials design, ordinary members of the public are perfectly capable of debating the complex issues involved in energy system change. Our participants offered sophisticated responses to the issues and, through a process design that encouraged reflection on the difficult decisions involved, were pragmatic and considered in their views.

A second lesson concerns the importance of ensuring that activities have clear objectives that are explained to participants. This relates to a need to manage people’s expectations about their participation in engagement events. Where decisions under discussion have already been taken and there is only limited room for their views to have an influence, this needs to be made clear. Equally, if engagement is to input directly to policy decisions, the nature and extent of this influence has also to be made clear to participants.

A third lesson is that patience and openness are central to public engagement, with propensities to ‘correct’ people tending to limit and close down discussion in ways that are likely to result in more negative outcomes. For engagement events to be successful there is a need to allow people time to speak and to listen. In this regard, provision of information while often necessary should always be undertaken with care to ensure that it does not close down discussion but facilitates greater engagement. Through developing open dialogic procedures, opportunities arise to gain insight into the deeper more general concerns that underlay particular responses.

Finally, it is important to recognise that there is not one public but multiple publics. We found that mixed groups were more effective in terms of generating discussion than more homogenous groups. For example, grouping those who were more and less vocal together was ineffective in producing dialogue and our recommendation is to opt for mixed groupings with skilled facilitation that ensures no one person can dominate discussion.

3.5. Opposition to transmission power lines

**Prof Patrick Devine-Wright and Dr Susana Batel,
University of Exeter**

Significant investments in electricity networks are being planned in many countries worldwide, in response to the increasing deployment of large-scale low carbon energy projects. However, siting new transmission lines is often controversial, leading to opposition by local communities and environmental groups. We argue that efforts to develop new electricity networks will thus be extremely difficult unless public perceptions about power lines are better understood and integrated in that process.

High voltage power lines are potentially controversial in and of themselves, beyond their connection to electricity generation technologies

Research in Norway and the UK has shown that one of the main reasons for public opposition to transmission lines is the visual impact they are perceived to have upon the scenic qualities of rural landscapes [30] [31]. In the UK, rural landscapes have cultural significance, fostered by planning procedures that since the 1920’s have been essentially restrictive in order to preserve the countryside [32]. Landscapes have therefore become “inseparable from English culture and sense of identity” [33], shaping public attitudes towards countryside conservation.

To deal with some of these challenges, in 2011 the UK government launched a competition and selected the ‘T-shape pylon’ as a new design that could be used in future transmission networks to replace the traditional A-shaped steel lattice pylon design. Devine-Wright and Batel [31] used a nationally representative survey to examine public preferences for different pylon designs, their perception of the fit between the designs and rural landscapes, and also their preferences for different mitigation measures of the impact of pylons on rural landscapes.

Results revealed that the ‘T-shape’ design was the most preferred – ranked number one by 77 per cent of participants, with another new pylon design ranked number two (13 per cent) and the traditional pylon design ranked number three (10 per cent). The T-shape design was also perceived to be a better ‘fit’ in a rural landscape.

We then examined which socio-psychological factors best explained perceptions of ‘fit’, and identified three key factors, regardless of the specific design. These were general attitude towards transmission lines; trust in the National Grid plc. (the transmission system operator in England and Wales); and educational attainment. Specifically, the more positive the general attitude towards transmission lines and the more trust placed in National Grid, the better perception of fit, regardless of the specific design. We also found that the more educated a participant was, the less likely they were to regard the pylons as fitting well into the landscape.

Key factors underlying perceptions of pylon ‘fit’ into rural landscapes

Attitudes towards power lines in general and trust in National Grid were key factors underlying perceptions of ‘fit’ into rural landscapes, independently of the pylon designs considered. If trust in network operators and more positive attitudes towards power lines are to be enhanced, it is crucial to engage with stakeholders, citizens and communities about why new power lines are needed, and try to understand their concerns about them and integrate those into decision-making processes (see also Case Study 3).

Network operators try to mitigate the visual impact of new power lines in several ways. We asked our respondents what mitigating actions could make them more willing to accept a new transmission line near to where they live. We found that using new pylon designs was one of the less supported measures – the top ranked measures were to bury the power line underground and to route it away from homes and schools.

T-shape Pylon Design.



Involving local residents in the decision-making process from an early stage was also strongly backed, supporting recent calls for earlier engagement with communities directly affected by power line proposals [34]. Finally, when asked about their willingness to pay for undergrounding power lines, around 40 per cent of the participants said they would be willing to pay something through their electricity bills, and that local residents should not have to bear the burden of the extra cost of placing a new line underground.

Updating pylon designs does not guarantee public acceptance

The fact that the most preferred mitigation measures were undergrounding and re-routing of the lines indicates that updating the pylon design will not, by itself, be sufficient to gain public acceptance. Additionally, involving local residents in the decision-making process from an early stage was also strongly supported as a mitigation measure, suggesting the need for genuine, early engagement with affected communities.

Findings from the research summarised here highlight the importance of taking a contextual, place-based approach to decision-making that takes into account the characteristics, concerns, needs and expectations of the specific

communities to be affected. The research was conducted with representative samples from four settlements (three towns and one village) that were to be affected by two new transmission lines: the Hinkley Point C connection in Somerset, and the Mid Wales connection.

Different responses towards the power line proposals (i.e. attitudes towards the projects and expected local impacts) were found in the different places. To understand the different responses, we need to take into consideration the different characteristics of each place and how energy infrastructures are seen to threaten or enhance place-related attachments and identities [15].

The importance of local context

Public responses are locally variable, indicating the importance of adopting a place-based approach. To understand local responses to new power lines, it is necessary to identify discrete settlements or places and to examine local perceptions of how new energy proposals impact on these places.

Results show that members of the public do not need to be 'directly' affected by a particular energy project (i.e. one that is to be sited near to where they live) to be concerned with their deployment. This defies the often-adopted NIMBY representation of the public that presumes a parochial attitude to energy technologies (see Case Study 2). Our research shows that it is as important to study what people think about energy infrastructures at a national level (see Case Study 4), as it is to study what they think about them at a local level when energy infrastructures will be affecting them in their own 'backyards'.

Transmission power lines are both national and local issues

More sustainable deployment of energy infrastructures must be supported by both national populations and local communities. We should move away from defining those affected by energy infrastructures (particularly 'nationally significant' projects) as only being the surrounding local communities, to defining them as potentially all publics when conceived as 'energy citizens' [35].

4. Key research findings

The case studies in this report offer a taste of the growing body of research into public engagement with energy technologies; they show that while the issues are diverse and complex there are also a number of common themes that emerge.

Most of the time the problem won't be a lack of information

With suitable support, ordinary members of the public are perfectly capable of understanding and debating the complex issues involved in energy system change. When faced with opposition, try to understand the underlying concerns which may not directly relate to the proposed change and try to engage with the silent majority.

Avoid over-simplistic assumptions

It is vital to understand the consumers' underlying requirements; decisions are not always driven by logic so understanding the 'softer' drivers may be more productive [36].

By understanding the daily reality of people's lives we can begin to appreciate and understand their underlying issues. With this understanding any barriers can then be 'designed out' to help people smoothly integrate with the changing system.

Be transparent and fair

Patience and openness are central to public engagement, trust is slowly won and quickly lost. Ensure that participants' expectations are carefully managed and activities have clearly explained objectives.



5. A common vocabulary

Due to the interdisciplinary nature of this report the definition of a common vocabulary and language is useful to determine from the outset. Part of the value of this report is to provide the energy sector with a common working definition of key terms to increase levels of understanding of the field.

General Terms: Definitions

Perception

The American Psychological Association (APA) defines this in a way that emphasises the physical aspects of perception: “processes that organize information in the sensory image and interpret it as having been produced by properties of objects or events in the external, three-dimensional world.”

To this we can add that there are also broader socio-cultural and psychological (i.e. cognitive and affective) interpretative processes at work when we perceive and make sense of our environment.

Values

Definitions of ‘values’ are contested across spheres and disciplinary domains but most share an understanding of them as being guiding principles that people use in formulating their views and actions.

Rokeach [37] offers one broad definition: “Values transcend specific objects and specific situations: to say that a person ‘has a value’ is to say that they have an enduring belief that a particular mode of conduct, or that a particular end-state of existence, is personally and socially preferable to alternative modes of conduct or end-states of existence”. Values in essence, then, refer to beliefs about how the world should be.

Values can be viewed as individually held or as shared cultural resources that people draw on in forming their perceptions and actions. They are linked to perceptions but where perceptions are malleable due to changing contexts or different frames of reference, values are much less so.

Protest against nuclear power in May 2011. Berlin, Germany.



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The receptiveness of public perceptions to change is particularly important when considering topics that may be of low salience to the public, are new and emergent or where views are not yet fully formed.

Attitude

‘Attitudes’ are hypothetical constructs representing an individual’s evaluation or judgement of an object. Attitudes are typically considered to have three main dimensions: a cognitive dimension, relating to beliefs; an affective dimension, relating to feelings; and a behavioural intention component, relating to how an individual states that they would behave in relation to an object.

Behaviour

‘Behaviour’ is defined in a number of different ways within academic literature. At a broad level, behaviour can be defined as the range of actions made by entities in conjunction with their environment, which includes the other systems or organisms around it, as well as the physical environment.

One example in the area of energy and sustainability comes from Stern [38] who defines behaviour as “an interactive product of personal sphere attitudinal variables and contextual factors”. The term behaviour relates to particular ways of understanding social action and is often discussed in opposition to concepts of practice – see below.

Persuasion

‘Persuasion’ is defined as the “process in which communicators try to convince other people to change their attitudes or behaviours regarding an issue through the transfer of a message in an atmosphere of free choice” [39]. Thus, persuasion is a deliberate attempt to influence the attitudes and/or behaviour of other people but, unlike coercion

– which forces people to act in a particular way – persuasion operates in a context where people are ultimately still free to choose what to think and how to act.

Acceptance

The concept of ‘public (or social) acceptance’ has been extensively used as an umbrella for research aimed at better understanding the factors associated with public responses to energy technologies, and is also often used in policy and decision-making contexts.

New research by Batel *et al.* [40] has highlighted that ‘acceptance’ can also be seen as a particular type of response to energy infrastructures, distinct from others types such as ‘support’ or ‘ambivalence’. Specifically, research found that ‘acceptance’ was more related to passivity and tolerance, with the implication that use of the concept can suggest a more top-down perspective on the deployment of energy infrastructures.

In consequence, Batel *et al.* [40] suggest that it is important to be cautious with concepts used in this area, both by researchers and decision-makers, and that it might be more important to focus on understanding public support for energy technologies than public acceptance.

Participation

‘Participation’ has come to mean the act of sharing in the activities of a civil society organisation, political party, or political process. Particularly exercises that give people an opportunity to be more actively involved in the development or amendment of policies and proposals.

Public support implies a more favourable position towards, and active engagement with, energy infrastructures; therefore arguably contributing to their deployment in a more sustainable way (see Batel *et al.*, [40]). Can be distinguished from a more passive response of ‘acceptance’.

Information deficit

'Information deficit' is a term used to describe a lack of knowledge and/or understanding, often on the part of the public. However, it is important not to assume that information provision will suffice to induce a change in attitude.

Value-action gap

The 'value-action gap' denotes an observation that people often do not act in ways congruent with their values. A significant amount of research has been dedicated to understanding both the reasons for the value-action gap and how it might be addressed.

Practice [41][42]

'Practice' is a term used to describe a broad theory of social action, which is sometimes posed in opposition to behavioural models and theories that view social action as rationally motivated and highly conscious.

Theories of practice suggest that individual actions are shaped by a framework of social structures (e.g. the family) and physical structures (e.g. road infrastructure), but this framework is itself created and modified by those actions; this is the theory of social action that is referenced when using the term practice.

Practices involve shared understandings of what it means to carry out a particular activity. They are durable social structures made up of a configuration of elements, including: ideas, emotions and meanings associated with the activity; mental and physical skills required to perform it; and materials and equipment needed.

This approach recognises the contextual, relational nature of thought and action, while simultaneously viewing individuals as active and creative, constantly re-interpreting social structures and norms within the changing contexts of their lives.

Prosumer

The term 'prosumer' was first mentioned in 1980 by Alvin Toffler in his book "The Third Wave" [43], describing the phenomena that consumers are not just merely consumers but becoming producers, too. Within the energy domain the term refers to individuals and communities that are becoming self-sufficient (e.g. micro-generation, community projects). These early adopting prosumer groups are increasingly well informed and proactive in seeking their own independent solutions.

Types of Engagement: Definitions

Stakeholder engagement

'Stakeholder engagement' is the process by which an organisation involves people who may be affected by the decisions it makes, or can influence the implementation of its decisions. They may support or oppose the decisions an organisation takes, be affected by those decisions in the long-term, be influential in the organisation or within the community in which it operates, or they may hold relevant positions in industry or government.

Public engagement

'Public engagement' is an umbrella term for any activity that engages in public dialogue. To be most effective public engagement activity should involve two-way aspects of listening and interaction.

Community engagement

'Community engagement' is the term for processes which help to build active and empowered communities; this includes public bodies involving citizens in influencing and carrying out public services. It can also involve enabling people to understand and exercise their powers and responsibilities as citizens; empowering them to organise groups which work for their common good.

Upstream engagement

‘Upstream engagement’ refers to the dialogue and deliberation amongst affected parties about a potentially controversial technological issue, at an early stage of the Research & Development process, and in advance of significant applications or social controversy.

Strategies for Engagement: Definitions

Dialogue

‘Dialogue’ is a conversation – or other form of discourse – between two or more individuals. In the context of public engagement, it often represents a two-way exchange of information in contrast with processes that are one-way, such as public education campaigns or those that are aimed at gathering social intelligence, such as focus groups.

Consultation

‘Consultation’ is a process of dialogue or the gathering of information that contributes to a decision or change.

Incentives

An ‘incentive’ is something that motivates an individual to perform an action. The study of incentive structures is central to the study of all economic activities (both in terms of individual decision-making and in terms of co-operation and competition within a larger institutional structure).

Nudges [44]

Nudges are ways of influencing choice without limiting the choice set or making alternatives appreciably more costly in terms of time, trouble, social sanctions, and so forth. They are called for because of flaws in individual decision-making, and they work by making use of those flaws.

Mavens

Maven is originally a Hebrew word for ‘one who understands’. In marketing, mavens are considered to be influential individuals with specialist knowledge of a product area, whose opinion is trusted. A Brook Lyndhurst study for DEFRA [45] concluded that these individuals also exist in the context of green marketing and that engaging with these individuals can assist in uptake.

Citizen jury

A citizens’ jury is intended to supplement existing processes of representative democracy. The Jefferson Centre defines a citizens’ jury as ‘a randomly selected and demographically representative panel of citizens that meets for four or five days to carefully examine an issue of public significance’.

Citizen assembly

As with the citizens’ jury, a citizens’ assembly has a similar democratic motivation but usually refers to a larger, standing assembly of the public that may be self-organised or selected by government. As a standing body, it may consider a range of issues on an on-going basis.

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