Knowledge, agency and collective action as barriers to energy-saving behaviour

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Abstract

Energy saving is becoming a rising priority as a response to climate change and fossil-fuel depletion in recent years. However, despite energy-related behaviour change being an important part of many environmental education initiatives, 'energy literacy' among citizens remains patchy in both the US and the UK, with evidence of strong positive attitudes but less consistent knowledge. Whilst it is clear that increasing knowledge does not automatically produce behaviour changes, potential questions must be asked about the logic of focusing solely on behaviour without simultaneously exploring and enhancing understandings of energy issues. This research, undertaken at a higher education institution with a strong focus on sustainability, illustrates the potential risks of targeting behaviour change and individual action at the expense of increasing knowledge, or encouraging collaborative and democratic endeavours. Results from an online survey indicate widespread misconceptions about energy which may reduce the effectiveness of energy-saving behaviours, alongside variable levels of motivation and engagement with energy issues. Respondents report a strong belief in the efficacy of personal changes, yet uncertainty about their capacity to influence business and government alongside a persistent faith in science to provide solutions to energy issues. The paper concludes by reflecting on the challenges arising from these findings for understanding agency and effectiveness in energy relationships.

Key words: energy literacy, higher education, knowledge, trust, agency, behaviour

Introduction

Energy consumption pervades virtually every aspect of contemporary life; as such, energy-saving forms an important component of many national and international responses to

climate change and fossil-fuel depletion. Initiatives promoting behaviour-change at the individual and household levels form an important part of the wider suite of policies to improve energy efficiency and promote low-carbon energy sources (Geller *et al.* 2006; Brounen *et al.* 2012). Indeed, some research indicates that household energy consumption can be reduced by nearly 30 per cent without individuals making major economic or other 'quality-of-life' sacrifices (Gardner and Stern 2008). However, without a strong motivation for changing behaviours, this is unlikely to happen: According to a 2012 GlobeScan poll[1], environmental concerns among citizens in 22 countries are at a twenty-year low and climate change is rated as a 'very serious' problem by a relatively low 49% of respondents. This suggests a gap between the findings of the Intergovernmental Panel on Climate Change Fifth Assessment Report (IPCC 2013) and public acceptance of the need for action to curb greenhouse gas emissions. Other research suggests that even where people are motivated to change energy behaviours, many lack accurate, accessible and actionable information about beneficial energy-saving actions (Lorenzoni *et al.* 2007; Gardner and Stern 2008). Attari *et al.* (2010) further note that energy-saving behaviours tend towards curtailment activities (turning lights off) rather than efficiency improvements, and that many people engage in low-effort, low-impact actions rather than more far-reaching changes. They also suggest that more numerate individuals have more accurate perceptions of energy consumption and savings.

Such findings have contributed to a growing recognition of the need to enhance 'energy literacy' in both industrialised and developing countries. A variety of definitions have been attached to the term 'literacy' in the sustainability context, ranging from those that associate literacy chiefly with collections of knowledge and skills that enable effective participation by individuals in diverse areas of social life (Stibbe, 2009) to those that, in addition, emphasise

[1] http://www.globescan.com/commentary-and-analysis/press-releases/press-releases-2013/261-environmental-concerns-at-record-lows-global-poll.html l.a. 090713

its affective and behavioural dimensions, including individuals' willingness to act on ideas in relation to some aspect of sustainability (Jensen and Schnack 1997; Almers 2013). This somewhat broader formulation provides a particularly apposite lens for investigating individuals' understandings, attitudes and behaviours towards energy saving because of the connections it creates between cognitive literacy and notions of action competence and sustainability citizenship that might propel individuals to use knowledge in a functional way. Almers (2013: 117) describes action competence as:

'commitment; willingness and courage to act; knowledge about consequences of and root causes to problems; knowledge about and a capability to develop visions and possible solutions to a problem; knowledge about how to influence and change conditions; and, finally, to be able to put this knowledge into practice.'

The affective and behavioural dimensions of energy literacy are especially pertinent in the light of other research, which suggests that knowledge about sustainability issues (the more cognitive and skills focus proposed by Stibbe and others) may have less impact on subsequent lifestyle choices than attitudes and values (Blake 1999; Kollmuss and Agyeman 2002). Many universities worldwide have therefore developed approaches to education for sustainability that touch on all three aspects of sustainability literacy (Sterling *et al.* 2013) and view the development of values and attitudes as key complements to knowledge and skills within professional education (Carter 1985).

Like sustainability itself, sustainability literacy encompasses a potentially enormous agenda and perhaps gains greater utility when operationalised into specific issue areas, in this instance *energy* literacy. It is again noteworthy that definitions and goals for energy literacy articulated in the literature extend beyond purely knowledge and skills-based interpretations. DeWaters and Powers (2011: 1699) describe energy literacy as something which:

'… encompasses broad content knowledge as well as affective and behavioural characteristics, will empower people to make appropriate energy-related choices and embrace changes in the way we harness and consume energy.'

The interpretation of energy literacy used in this paper is based on the DeWaters and Powers definition above, and incorporates an exploration of understandings, attitudes and reported behaviours of undergraduate students with respect to energy issues. Overlaps clearly exist between the various domains; however, all are considered to play an important role in a holistic understanding of energy literacy.

To date, relatively few studies have focused explicitly on developing integrated understandings of energy literacy, though many focus on its components. For example, a national survey of UK university students found that 72% of respondents claimed they took energy-saving actions but only 25% reduced their personal air travel (Drayson *et al*. 2012). Another UK study, using video-diaries, suggested that university students are highly aware of energy issues yet lack accurate information about energy use on campus and are uncertain about energy-efficient behavioural choices (Winter and Cotton, 2012). Similarly, Shephard *et al.* (2009), in New Zealand, found significant confusion among students about appropriate energy saving behaviours. However, improving information about energy-use may not be sufficient to influence behaviour: Research on undergraduate students in the US found no relationship between levels of knowledge and energy-saving behaviours (Ajzen *et al.* 2011). Financial and cultural barriers to energy-saving behaviours have also been identified among student populations (Dahle and Neumayer, 2011), and a study involving Asian university students revealed a link between rural background and greater energy-conservation behaviours (Asmuni *et al.* 2012).

The aim of the current research was to develop a more integrated understanding of energy literacy and to draw out connections between knowledge, attitudes and behaviours. The findings are used to explore the extent and impacts of misconceptions about energy, as well as to theorise about the impact of differing concepts of personal agency with respect to energy-saving behaviours. The research was conducted at Plymouth University, a UK university that has been widely recognised for integrating sustainability into teaching and campus activities. Plymouth University is the sixth largest in England and has been recognised through a number of awards for its achievements in sustainability (it is the overall front-runner since 2007 in the UK People and Planet Green League, and has won several 'Green Gown' awards). It has also been a recipient of Revolving Green Fund monies from HEFCE (Higher Education Funding Council for England) to embed energy saving measures, and was of the first two HEIs to gain Silver Accreditation in the LIFE (Learning in Future Environments) programme. Thus, it provides a context in which curriculum and campus greening issues have been taken seriously.

Methodology

The research employed an instrumental case study approach (Stake 1995) in order to develop a deeper understanding of energy literacy. An instrumental case study uses a single institution to explore and exemplify a wider issue. The case-study approach was chosen on the basis of its strong grounding in reality and ability to generate rich, detailed accounts of issues, in this case, students' levels and areas of energy literacy, and their explanations for this. Generalization, in this study, takes the form of 'theoretical inference' (Hammersley 1998), in which the conclusions move beyond the claims made about the individual case to a more general theoretical level that is potentially of wider interest. Any theoretical understanding thus produced should be considered as tentative and would benefit from further investigation. The selected institution provides a rich context for exploring energy

literacy: Whilst Plymouth University is not necessarily representative of the wider HE sector, or the general UK population (gaps in energy literacy might be expected to be lower than many other contexts); conversely, any issues of concern identified with these respondents might be expected to be magnified in wider research.

The primary data collection tool was a detailed questionnaire containing a mixture of open- and closed-ended questions and distributed to all on-campus students in the Spring term of 2013. The questionnaire consisted of 40 questions, building on prior research to explore knowledge, attitudes and behaviour with respect to energy issues. It included questions from previous surveys on energy targeted at the education sector or the wider population (Holden and Barrow 1984; Holmes 1987; Curry *et al.* 2005; Poortinga *et al*. 2006; DeWaters 2009; Brewer *et al.* 2011; Dwyer 2011; Bodzin 2012; Du Plessis *et al.* 2012). The revised New Ecological Paradigm (NEP) scale was also included as a means of exploring respondents' wider environmental values and to enable comparisons with other surveys that have employed this scale (Dunlap *et al.* 2000; see also Lundmark (2007) for critical discussion of the NEP).

The survey was administered online via 'Survey Monkey', and received 1136 responses, a 6.3% response rate from the on-campus population[2]. The respondents were broadly representative of the university as a whole – although some discipline differences were visible with somewhat greater response rates in Geography, Marine and Environmental Sciences as might be expected. It should be assumed therefore that the students who responded are more likely to have an interest or expertise in energy issues than those who did not respond. The age group of respondents (78% under 25 years old) was broadly in line with overall university demographics, although it clearly differs from the wider population, so attempts to generalise beyond the university sector should be treated with caution. 60% of

[2] Although this appears to be a relatively low overall response rate, the size of the data set significantly exceeds that required for generalisation. Newman and McNeil (1998: 49) calculate the sample size needed to generalise at the 95% confidence level for a population of 30,000 as 370.

respondents were female and 40% were male, compared with an institutional gender balance of 54% female and 46% male, perhaps reflecting a greater concern for energy issues among females (Zelezny 1999). Data were analysed using SPSS, using frequencies, cross-tabulations and chi-square tests to investigate relationships between demographic variables and elements of energy literacy. Significance tests cited are at the $p<0.001$ level unless otherwise stated. Illustrative quotes are from the open-ended options on the questionnaire.

Results

a) *Cognitive elements: Knowledge and understanding*

Respondents were first asked to self-assess their knowledge on energy issues. Self-reported knowledge was generally high, perhaps reflecting the nature of the sample and those who chose to respond. Gender differentials were significant, with females expressing greater uncertainty about how much they knew and males more likely to select the top two points on the scale (Figure 1).

Figure 1 about here

Whilst this echoes wider research on gender differences in self-confidence (Syzmanowicz and Furnham 2011), there was also some evidence of gender differences in levels of technical knowledge. For example, male students were more likely than females to respond correctly to the question about which type of light bulb used the least energy (65% of males answered correctly compared with 32% of females,).

The level of energy-related knowledge across the sample is summarised in Table 1, and demonstrates clearly the 'patchy' nature of responses, with the percentage of correct answers to these multiple-choice questions ranging from 26% to 87%.

Table 1 about here.

Although high levels of understanding were evident for some more straightforward issues, answers were split on others, and those with high self-reported knowledge were in fact more likely to answer certain questions correctly. The validity of self-reported knowledge is also perhaps underlined by the fact that those with low self-reported levels of knowledge were less likely to identify effective behavioural changes (see Section c).

b) Affective elements: Attitudes, values and locus of control

Previous research strongly indicates that attitudes and values form an important intermediary in the translation of energy knowledge into behaviours (DeWaters and Powers 2011). To test respondents' attitudes towards environment, energy and climate change, a question was included on the importance of issues facing the UK (Figure 2).

Figure 2 about here.

The predominant concern among both genders was strengthening the economy, and this was echoed in some open-ended comments:

I know climate change is a concern but I think there are more pressing issues i.e. economic crisis. [ID 456]

Although answers were fairly evenly split on most issues, gender differentials were significant with respect to preventing wars and nuclear threats (more females thought this was most important) and secure energy supplies (more males thought this was most important). Some disciplinary differences were also significant. For example, more respondents from Social Science and Social Work thought reducing inequality was the most important issue, whilst more Management and Tourism students selected strengthening the economy.

However, despite an apparently over-riding focus on economic issues, responses on the New Ecological Paradigm (NEP) scale indicated that our respondents tended towards ecocentric worldviews. The overall mean score on the NEP was 2.34, where 1 equals highly ecocentric and 5 highly technocentric (see O'Riordan, 1981 for further discussion of these positions). Respondents thus exhibit slightly more ecocentric mean worldviews than other surveys which have shown mean values of between 2.42 and 2.8 (Shephard *et al.* 2009; Hawcroft and Milfont 2010; Harraway *et al.* 2012; Amburgey and Thoman 2012)[3]. In addition, respondents expressed significant concern about a range of energy issues (Table 2).

Table 2 about here.

The highest levels of concern were about depleting supplies of fossil fuels or the potential for war over energy, though the survey was conducted before media reports of the discovery of new UK oil reserves.[4]

[3] Some caution is needed when interpreting NEP scores, partly because of the subjectivity in determining 'mean' environmental worldviews and partly because the aggregation required to produce overall NEP scores can be variable between different authors (such that the meaning of a low NEP score differs).
[4] 'The receding threat from 'peak oil'', 15 July 2013, BBC News, http://www.bbc.co.uk/news/science-environment-23280894 I.a.18jul13

The questionnaire also explored respondents' sense of responsibility and locus of control (the extent to which respondents felt that they could influence events around them) with regard to energy use and climate change (Table 3).

Table 3 about here.

78% of respondents believed that climate change was caused by human activities and 75% felt that their own energy use made a difference to the national energy situation. Strong emphasis was also placed on government regulation, yet only 19% trusted the government to act on energy issues.

The government is short-sighted in that it would rather get another term in office than make unpopular changes that would preserve biodiversity and a habitable environment for the future. [ID221]

In addition, only around a quarter of respondents felt that they had the capacity to influence government or business actions on energy:

Politicians focus too much on money as it is at the heart of every home and life but energy seems far too top-down. People at the grass roots feel they have no say or can't impact it so we just leave it to the politicians but it should be at the forefront of any politician's campaign. [ID419]

In contrast to the generally ecocentric leaning in the NEP findings, responses in this section exhibited a rather technocentric belief in scientific solutions to energy problems:

I believe that scientists can develop technologies that are much less of an impact than the methods of producing energy now. [ID637]

When asked whether energy prices should include the environmental costs of energy, 68% agreed or strongly agreed. Similarly, 67% disagreed or strongly disagreed that keeping energy costs low is more important than environmental protection. However, while this may reflect ecocentric leanings, these trends may be related to the fact that many respondents do not yet pay full energy bills (where costs are communal or included in student accommodation charges). The implications of these attitudinal findings for understandings of energy literacy are explored further in the discussion.

c) Energy-saving behaviours

The translation of understanding, attitudes and values into energy-saving behaviours was explored through a series of questions. When rating personal energy use, 60% of respondents stated that they were medium energy users, 18% were low users and 17% were moderately high users. At the extremes, 2% and 3% rated themselves as very low and high energy users respectively, though it was unclear whether their understanding of energy usage was strong enough to make accurate judgements. For example, although 57% of respondents correctly stated that transport and space heating have the greatest energy-saving potential among domestic uses, around 40% thought that turning off lights or appliances at the plug produced the highest energy-saving impact (Figure 3).

Figure 3 about here.

There were also indications that levels of knowledge influenced behaviours. Those with self-reported low energy knowledge were more likely inaccurately to identify turning off lights as the most significant action and less likely to identify turning down heat. Those with self-reported high knowledge levels were significantly more likely to report undertaking energy-

saving behaviours. However, these links were not linear: more respondents carried out effective energy-saving practices than correctly identified them (see Table 4). For instance, 88% of respondents reported walking or cycling short distances (presumably in part because they did not own cars and walking and cycling was more economical than taking public transport), thus illustrating the impact of the economic context on energy-related behaviours.

Table 4 about here.

Many respondents also used the open-ended questions to express confusion about some of the behavioural choices:

I cannot understand that an electric powered revolving door saves energy when compared to these push button doors. [ID502]

In general, less popular choices included those with a financial element, unsurprisingly, in the light of students' limited financial means. The potential benefit of not charging phones overnight seems to have been frequently misunderstood: Several respondents commented that they had not previously considered this option or commented on the lower energy prices at night. Cost-benefit trade-offs appeared regularly in open-ended comments:

A large sway over my behaviour … is what I have to pay for bills. When living in a house where bills are included in the rent, I am much more liberal in my consumption, but when I see the cost directly I am much more cautious… [ID510]

Several comments also illustrated peer and domestic living constraints:

My attempts to save energy are futile in my house. My housemates have a complete disregard for the environment. [ID1260]

Although 54% of respondents claimed that they always or frequently tried to convince friends to alter their energy behaviour on environmental grounds and a similar proportion claimed to learn as much as possible about environmental issues, very few reported being active in events organised by environmental organisations. There was a significant relationship between this activity and respondents who claimed to have a stronger locus of control over energy issues (as described in Table 3). This suggests that engaging with environmental groups may be empowering in terms of individual behavioural change as well as in terms of social movements for change often associated with environmental non-government organisations (Kenis and Mathijs 2012). The low overall participation in such activities might be explained by the time commitment required, as well as some stereotypical views about environmental groups. Alternatively, it may provide a further indication of the gap between reported commitment to sustainability and actual engagement (Butt, More and Avery, 2014).

The findings suggest something of an attitude-behaviour gap between opinions on global issues and individual purchasing behaviours. For example, 69% of respondents agreed or strongly agreed that 'energy costs should include the price of environmental damage', yet only 50% stated that they always or frequently bought things that involve less energy. In other areas, however, there was evidence of a positive link between attitudes and behaviour. Respondents who believed that climate change is a serious problem were also more likely to report purchasing resource efficient goods. When respondents were asked about the factors that prevented them from being more energy efficient, money and time were the most commonly cited (listed as most important by 38% and 21% of respondents respectively).

I would like information related to being more energy efficient but combined with saving money. If it costs me money I probably won't do it! [ID568]

Knowledge (15%) and comfort (14%) were also considered most important by some respondents, while lack of personal control was cited by only 12%. These responses broadly

reflect the character of student populations, though financial constraints may become even more significant in an era of rising student fees in the UK and elsewhere.

Discussion: Knowledge, agency and collective action as barriers to energy-saving behaviour

This survey has revealed findings that provide important clues about the nature and drivers of energy literacy. Key among these are:

(i) a general picture of reasonable but uneven knowledge of energy issues, particularly practical understandings about energy-saving behaviours;

(ii) considerable faith among respondents in low-effort personal behaviour changes, but some frustration at the perceived unwillingness of others (e.g. other members of households) to take action; and

(iii) a lack of trust in larger-scale actors to act on energy issues, but an accompanying faith in the ability of scientific innovation to provide solutions to energy-related problems.

The final section of this paper considers the implications of these findings for understandings of energy literacy and efforts to promote responsible use of energy. Within the discussion, particular emphasis is placed on the broader lessons gained about knowledge, agency and collective action as (perhaps under-emphasised) barriers to energy-saving behaviour.

Turning first to the *cognitive* aspects, the survey revealed reasonable knowledge of the basic parameters of energy debates but also frequent misconceptions about more technical issues and the efficacy of different energy-saving behaviours, as well as some evidence of gender-based differences in cognitive energy literacy. Knowledge-deficit models have been heavily critiqued in recent decades for offering a simplistic and linear outlook on the complex 'sense-making' processes that individuals undergo when deciding whether and how to respond to

environmental issues (e.g. Barth *et al.* 2012; Blake 1999; Whitmarsh *et al*. 2011). However, despite the validity of arguments that nurturing behaviour change involves more than just knowledge provision and acquisition, it is important not to over-extend this critique in ways that encourage attention deficit to knowledge issues in sustainability scholarship and practice. This is particularly true for energy literacy, not least because few respondents expressed indifference to energy issues but a greater proportion were unable to identify effective energy-saving behaviours, and because clear associations were found between levels of cognitive understanding and more effective behaviours.

The case for sustained attention to the cognitive aspects of energy literacy is further bolstered by the fast-changing character of individuals' relationships with energy as new energy-consuming and energy-saving technologies become available and the fact that much 'in-the-moment' energy consumption is invisible to the individual. As Chetty *et al.* (2008) suggest, utility systems tend to fade into the background, so new approaches are needed to encourage individuals to understand and reflect on the energy implications of their everyday behaviour. There is an argument here that students (and probably most people) respond to energy issues on a daily basis at a level of 'unconscious competence' (Geller, 2002): turning off lights without being aware of the extent to which this saves energy, simply because they have been taught to do so. This is generally considered beneficial in behaviour-change models, but may have unintended consequences in terms of limiting individuals' ability to evaluate other potential behaviours. The challenge for campaigners and educators is to encourage *informed* behaviour change, such that students have the capacity to respond to *new* developments in energy conservation throughout their lives. Social marketing approaches that include a strongly audience-targeted information-provision dimension might help at least partly to address this issue, as may more general approaches that encourage individuals to engage to a greater degree with the fluid nature of energy technologies and routines (Marcell *et al.*, 2004)

Important though they are, however, cognitive aspects provide only a partial explanation of respondents' engagement with energy issues. Further attention is needed to the *affective* and *behavioural* dimensions of energy literacy, where interesting disjunctures emerged between respondents' expressed faith in the efficacy of personal actions and scientific solutions to energy issues, alongside the projection of responsibility for energy issues onto governments and industry despite limited trust in these actors. This might simply reflect a lack of consideration of potential inconsistency between these standpoints. However, it may also be evidence of a cognitive dissonance device that enables students to avoid feeling overburdened at the scale of energy challenges (Thøgersen 2004). Students first attribute accountability and agency to major institutions and science, then reconcile their mistrust of government and industry, together with their lack of detailed knowledge of scientific advances in energy technologies, by stressing a relatively unreflexive faith in science and the efficacy of personal action. The latter argument might have two possible motivations: (i) self-validation (I've done my bit); or (ii) a genuine belief in the possibility of individuals acting in sufficient numbers to produce structural energy transformations. The second possibility is inviting; however, there is considerable evidence from other environmental issues (and respondents' reported personal experiences of attempts to change their peers' behaviours) that large-scale autonomous action on environmental issues is rare (Lorenzoni *et al.* 2007). For instance, recycling has increased substantially in many countries (in Europe in particular) but in most cases this has required policy intervention and major infrastructure investment to encourage and enable behavioural shifts (Barr and Gilg 2005).

It is important to stress that further work is needed to explore the ways in which individuals negotiate issues of personal efficacy and their (mis)trust of scientific solutions and government and industry actions. It may be that these responses are specific to students rather than applying to the wider population: Although the respondents felt individual actions could make a difference, the overriding story is one of limited agency, exacerbated by respondents' low incomes and perceived powerlessness. This is reflected by the low level of

participation in events run by environmental organisations on energy issues (Table 4). Lack of engagement with energy activism may, in turn, reflect and create feedback loops for students' affective energy literacy, for example, by reinforcing existing feelings of powerlessness.

The possibility that 'every little bit *doesn't* help' is nevertheless emotionally unattractive because it leaves solutions to energy issues reliant on distrusted institutional actors or scientific breakthroughs (Faiers *et al.* 2007). However, technical knowledge was self-identified *and* proven via questioning to be a weak area in cognitive energy understandings. Faith in science may thus assist individuals to avoid the hopelessness that might otherwise accompany full acknowledgement of the implications of their lack of agency and mistrust of institutions in the face of large-scale energy challenges. Not least, it offers the prospect of solutions that can trigger action by government and business actors *and* enable personal action to make a genuine difference.

Ongoing challenges

At least two major challenges can be identified from these findings. The first is how to find a suitable balance and connections between the cognitive and affective dimensions of energy literacy. Although there are no easy answers to this issue, both clearly are required for effective behaviour change and this research particularly emphasises the importance of not overlooking knowledge as a means of improving the prospects for informed decision-making in both existing and new contexts. The fact that the respondents surveyed for this research were a highly educated group studying in an institution with strong commitments to sustainability but still exhibited significant gaps in their knowledge of energy issues suggests that this area is not being effectively communicated through formal educational channels. This in turn suggests that greater efforts are needed to link formal learning with daily life to enhance awareness of how individuals use energy in everyday practices and illustrate how changing behaviours affect energy use (Hards 2013). One example of how this might be

promoted is through combining educational initiatives with more lifestyle-related interventions, such as the provision of household appliances or the creation of social media platforms which encourage recognition and reflection on energy-consumption behaviours (Bouzarovski 2014) and discourage particular choices or habits (such as over-filling kettles).

The second challenge concerns the apparent difficulty of moving beyond individualistic responses to energy issues. Students are almost certainly not alone in their lack of faith in politicians or businesses to deliver significant change, and it is hard not to sympathise with their feelings of powerlessness in the face of multi-national corporations (see Klein, 2014 for a popularist exposition of this view). But what also seems evident from our findings are indications of limited faith in collective action by individuals around energy (or other sustainability) issues. Collective action is frequently identified as playing a key role in adaptation to environmental change (Adger, 2003), yet our findings offer depressing reading on this front. In line with the reduction in participation in many political arenas (Power, 2006), our research suggests an increasing focus on individualism. As Barr (2014) notes, this emphasis on the individual stifles debate about the ways in which environmentally-related social practices develop in association with social norms and economic practices, and may contribute to incrementalist and narrowly defined views – among researchers, policy-makers and, crucially, individuals themselves – of what ecological citizenship might look like and implies. Again, there is an argument for trying to embed collective action in everyday experience as well as through formal groups and official bodies. Informal group activities, such as participation in online social networks, can provide relaxed fora for debate and discussion, allowing participants to resolve conflicting information, identify imperatives and possibilities from this evidence, and choose how to act on it (Robelia et al., 2011). Navigating the complex relationship between individual and collective action nevertheless remains a major challenge for energy scholars and practitioners.

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Tables:

Table 1: Percentage of correct responses to different questions

	% correct answer
Which resource provides about 85% of the energy used in countries like the UK and Europe?	87
What does it mean if an energy power plant is 35% energy efficient?	85
The term 'renewable energy resources' means …	84
Which kind of lighting uses the least amount of energy	44
Which of the following actions, if everyone did this all the time, would save the most energy in the UK?	39
Which of the following forms of transport uses the least amount of fuel to transport one tonne of goods per mile?	26

Table 2. Concern over energy issues

[In response to the question: How concerned, if at all, are you that in the future …]

Energy Issue	**Average level of concern (on 4 point scale where 4 is very concerned)**
Supplies of fossil fuels (e.g. coal and gas) will run out	3.34
There will be war over energy	3.24
UK will become dependent on energy from other countries	3.17
Electricity will become unaffordable	3.16
Electricity will be rationed	2.95
Our standard of living will fall	2.95
There will be power cuts	2.84
Terrorist attacks will cause interruptions to electricity supplies	2.60

Table 3. Locus of control and sense of responsibility of respondents

[In answer to the question: Please indicate how much you agree with the following statements. (The remaining respondents indicated ' neither agree or disagree)]

	% Agree/ strongly agree	% Disagree/ strongly disagree
The way I personally use energy does not make a difference to the energy situation	10	75
I can influence what the government does about energy problems	26	45
I can influence what companies do about energy problems	25	48
I trust the government to do something about any energy problems	19	58
Scientists will find ways to solve energy problems	60	8
The government should have stronger standards on fuel efficiency of cars	66	5
Climate change is caused by human activities related to using energy	78	8

Table 4: Reported energy-saving behaviours (%)

[In answer to the question: Do you do any of these things with the aim of saving energy?]

Behaviour	Always	Frequently	Infrequently	Never
Turning off lights when not in use	65	32	3	0
Walking or cycling short distances instead of using the car	52	35	11	2
Turn off stand-by button on TV set or switch appliances off at the plug	40	28	23	9
Turn down the heat	35	45	18	3
Tried to convince friends to act responsibly towards the environment	15	39	34	12
Try to learn what I can do to help solve environmental issues	14	39	41	6
Buy things which involve less energy or resource use	14	36	43	7
Pay a bit more for environmentally-friendly products	13	34	43	9
Avoiding charging mobile phones overnight	13	77	33	37
Participate in events run by environmental organisations	4	10	42	44

Figures:

Figure 1: Gender differentials on self-assessment of energy knowledge

[In answer to the question: How much do you feel you know about energy?]

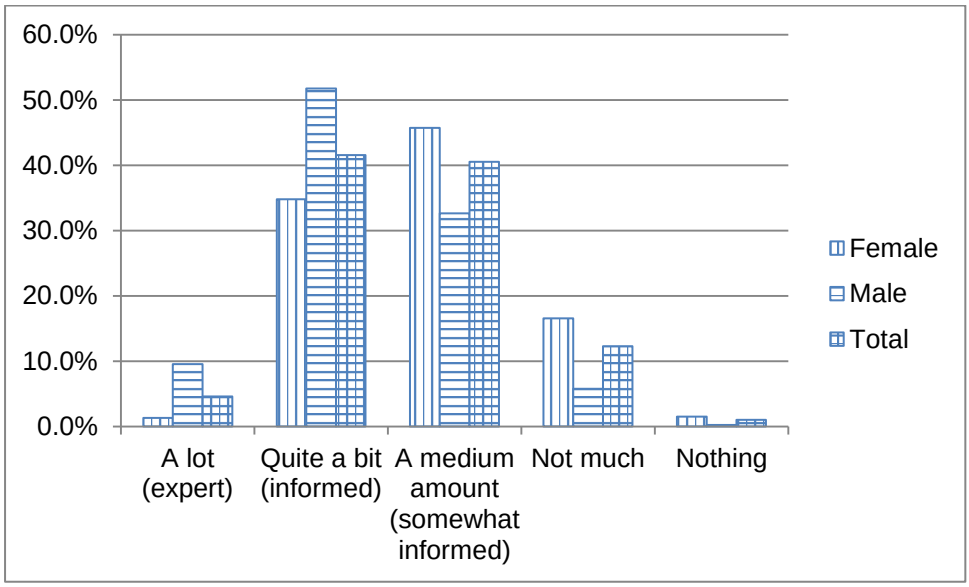

Figure 2. The most important issue facing the UK (% of respondents)

[In answer to the question: Please indicate what YOU think is the most important issue in the UK (please select one)]

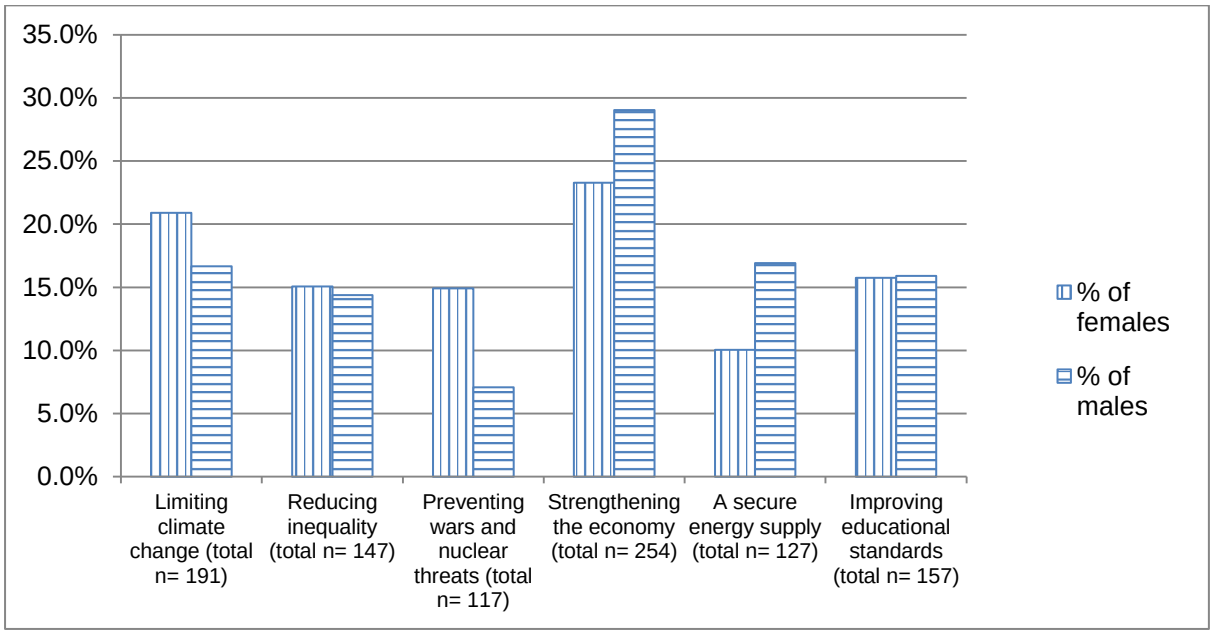

Figure 3. Respondents' knowledge about energy-saving behaviours