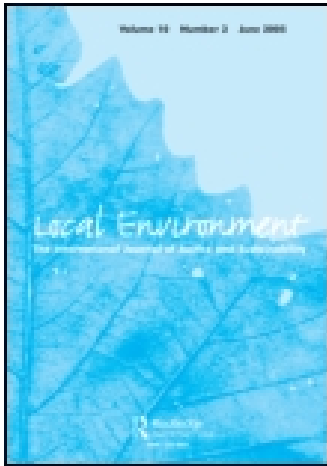


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### Energy in the locality: a case for local understanding and action

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## EDITORIAL

### Energy in the locality: a case for local understanding and action

#### Context for considering energy in the locality

We live in an urbanising world occurring on the background of rapid population growth. Both these phenomena contribute to an ever-expanding and changing built environment, which draws heavily on the existing energy and resources. Today's buildings use about 40% of the world's energy and are responsible for nearly the same amount of carbon emissions – more than that in the transportation or industrial sectors (WBCSD 2009). Buildings are also highly dependent on finite resources that will be depleted in the near future with most of their energy coming from fossil fuels, such as oil, coal and gas – over 80% of world's energy comes from fossil fuels and a fair share of this goes into our buildings (EIA 2012).

Furthermore, energy is used throughout the life cycle of buildings. First, the construction materials that are used embody energy, since energy is needed for the extraction, manufacture and transport of raw materials. The modern building and construction sector is very steel, cement and glass intensive. All of these materials embody a considerable amount of energy – for example, steel can have 24 times the embodied energy of wood, while aluminium 124 times more (UN Habitat 2012). Second, energy is used in the construction phase of the project, as all the drilling machines, pumps, tractors, etc. need energy for their operation. Third, energy is needed for the use and maintenance of the building (in lighting, air conditioning and cleaning); in fact, the single largest use of energy in buildings has been attributed to heating and cooling – in 2012, 67% of the domestic energy consumption in the EU was for heating purposes alone (OECD 2013). Finally, energy is needed for demolishing the building and removing the debris.

All these global trends show how “energy hungry” our built environment is and, as a result, less resilient to problems related to energy security and energy price increases. This has a significant impact on the way we live our lives given the existence of three energy challenges: carbon mitigation (energy must be safe for the environment), energy security (energy should be secure for nation-states) and combating fuel poverty (energy should be affordable for all). This so-called energy trilema (WEC and Wyman 2012) has become today's dominant energy paradigm. It involves complex intertwined links between public and private actors; governments and regulators; economic, political, social and technological factors; national and local resources; combined with wider environmental concerns and patterns of individual behaviours. “No country is an energy island” (HoL 2013), however, in the absence of a universally accepted framework for energy policy, the ways these links are understood and pursued have important implications for energy in the “locality”.

First, it has become evident that carbon emissions derived from human activity and, in particular, energy consumption challenges the environment and the long-term stability of the climate, becoming a threat to life in many parts of the world. Renewable energy is

on the agenda of many countries as a “clean” alternative to current energy production. However, renewable energy only accounted for 13% of world energy production in 2010 (OECD 2013) and its up-scaling and diffusion has proved challenging so far, especially starting from a local level up and across various spatial scales or “localities” (Rydin *et al.* 2012, Turcu and Rydin 2012, Devine-Wright and Wiersma 2013).

Second, it is evident that secure and sustainable energy is a requirement for the success of wider security and sustainability frameworks. And most developed countries, including the UK, have identified that such success relies on a multitude of technologies using both renewable and existing sources. This is often referred to as the “energy mix” or “energy diversity” which most countries see as a pre-condition for energy security. Achieving the desired energy mix is challenging in the “locality”, especially in terms of the mismatch between energy supply and energy demand and delivering the infrastructure needed for such mix, i.e. new power grids or plants. However, perhaps the biggest challenge of all in the local energy mix is mobilising the “energetic society” which demands substantial and continuous adjustments in the way governments think and act (Hajer 2011).

Third, affordable energy is well recognised as a condition for social well-being and prosperity, and an important prerequisite for economic development. On the one hand, in developed parts of the world, current obstacles to affordable energy lie within financial and infrastructure frameworks, whereas other parts of the world are fighting energy availability and/or stability in order to get out of energy poverty. On the other hand, most efforts have been put into measuring and understanding energy poverty at the national or regional level (Pachauri and Spreng 2011) – see for example the Hills Review on fuel poverty in the UK (Hills 2012) or Buzar’s work on geographies of energy deprivation in Eastern Europe (Buzar 2007a, 2007b) – while gaps in understanding still remain, especially in the area of local frameworks and determinants of energy poverty.

Over the last decade or so, the scientific community has increasingly reflected upon and discussed the issues we highlighted above. As such, energy studies have become a fast moving and complex research area. In the UK alone some \$407 million<sup>1</sup> were invested in funding such research, in 2009, via a number of organisations: Research Councils UK (RCUK) for academic research, Technology Strategy Board, Energy Technologies Institute for applied research and demonstration, and Carbon Trust and others at the pre-industrial demonstration level (RCUK 2010). Much research has been done around technological, economic, social and institutional aspects of energy production and consumption, through the lens of different disciplines and under an all-encompassing concern for the environment. Many of these studies draw on high-level trends and depict a “view from the top”, which, no doubt, is a powerful tool at the hands of politicians and policy-makers. However, less is understood about how these “views from the top” become “localised” in order to fit local energy contexts.

This special issue aims to fill this gap to some extent. It brings together the themes of energy, the built environment, local activism and social practices. We argue that at this interface significant action can be taken to achieve carbon reductions associated with the urban energy system. It is increasingly recognised that the configuration and use of the built environment plays an important role in determining the carbon emissions from urban energy production, distribution and consumption. The design, construction, innovation and ongoing engagement through occupation of the built environment are all implicated in the ongoing energy flows through cities and the associated carbon burden. They reflect the way that the built environment and urban energy systems are co-produced and how the details of the built environment impact on the whole chain of energy production, distribution and consumption within urban areas.

Our understanding of “locality”/“local” is twofold. First, we firmly position and understand energy within the context of the built environment; we attach to it a spatial understanding. This means that considering the inter-relationship of the built environment and energy systems offers up the potential for a variety of ways of reducing carbon emissions. There is the potential for demand management through smart metering and energy efficiency measures, such as insulation to reduce energy consumption. Greater efficiency can be achieved in energy supply and distribution, say through combined heat and power plants at a neighbourhood scale. Second, we refer to a “case-by-case” understanding of energy, which advocates for the “smaller scale” approach (as opposed to the high-level approach) as involved in decentralised energy (DE), community energy, local networks, practices, agency, etc. This also means that a shift towards embedding more renewable energy sources within the national energy system can be promoted through greater deployment of decentralised technologies, such as solar thermal panels, photo voltaic panels (PVs) or micro-hydro, which produce energy closer to the place where it is consumed. At the same time, much can be learnt from the way daily routines evolve around energy issues, local organisations and communities are involved in the co-production of energy action and buildings could be “energy proofed”.

### Background to the special issue

The Challenging Lock-in through Urban Energy Systems (CLUES) Project (2010–2012) set out to critically assess the development of DE systems in urban areas in the light of the UK’s decarbonisation and urban sustainability goals. Based upon national and international reviews, it explored the range and types of urban energy systems that have been and could be installed. The project worked from a co-evolution perspective, which considered change in energy systems to be not only driven by technological and economic factors, but also by social and governance aspects of society (Guy and Shove 2000, Shove 2003, Geels 2005, Rydin *et al.* 2013) – see CLUES website for further details at <http://www.ucl.ac.uk/clues/>.

The CLUES Project was undertaken by a consortium of six UK universities and led by the Bartlett School of Planning at University College London (UCL). Its work was disseminated via a number of journals, including the paper by Chmutina, Sherriff and Goodier, and Sherriff, published in this special issue. However, the CLUES Project also provided seed corn funding for organising a conference in May 2012 held at UCL. The special issue came out of this conference. The theme of the conference, “Energy in the Locality”, aimed to bring together a variety of studies that looked at energy systems in urban and rural locations and employed a range of techniques. What all these studies had in common was an interest to understand how “energy cases” can be employed to understand dynamics in energy systems and to reflect on the broader theoretical and methodological implications of using “case studies” to comprehend change in such systems. Sixteen papers were presented at the conference, which was attended by over one hundred participants.

The decision to organise the conference and subsequently to convene this special issue was rooted in two observations. First, we noted that there seemed to be a substantial body of studies that undertook the more localised or smaller scale approach of “energy case studies”, much of this research not only overlapping or complementing each other, but also tapping into a range of innovative methodological strategies – see for example studies under the People, Energy and Buildings (PEB) programme,<sup>2</sup> Sustainable Urban Environments (SUE) programme<sup>3</sup> and the Rural Economy and Land Use

(RELU)<sup>4</sup> programme in the UK. Second, despite the prolific nature of this type of studies, it seemed that the energy literature remains strongly grounded in large-scale or quantitative exercises which over-rely on a modelling or technical perspective, notwithstanding the more recent departure from this traditional approach, reflected in the socio-technical transitions and system innovation literature – see for example some of Frank Geels’ work (Verbong and Geels 2007, 2010, Geels 2012). As such, we thought that these emerging studies were not brought together in a coherent and meaningful way in the literature, and so they tend to be overlooked. The main purpose of this special issue is to showcase some of these studies and “mark” their contribution to the existing energy literature.

From the papers discussed at this conference, four have been developed for publication here. They present different specific cases of local action to reduce carbon emission through changes in urban energy systems. They range from a comparative analysis of four non-UK cases: promoting energy efficiency in Berlin; installing PVs at schools in New Jersey; using seawater for district heating in the Hague and low-carbon commercial office development in Stockholm (Chmutina *et al.* 2014); through understanding drivers and barriers to urban energy initiatives in the UK (Sherriff 2014); to research on individual household energy practices in the UK (Higginson *et al.* 2014) and resident feedback and energy saving interventions at a major housing estate in London (Behar 2014). These four papers are set into the wider context by a viewpoint that undertakes a 20-year review of key trends in policy for low-energy built environments in the UK (Rydin and Turcu 2014).

### **Theoretical and methodological context**

The four papers seek theoretical grounding in two main families of literatures: evaluation studies (Chmutina *et al.* 2014, Sherriff 2014, Behar 2014) and social practice studies (Higginson *et al.* 2014). They are all at the intersection between these literatures and a concern with energy and the built environment.

Chmutina *et al.*’s (2014) paper proposes an outcome vs. process framework to evaluate success in deploying DE projects. The authors contend that the DE outcomes and processes tend to “collapse over time: over a sufficiently long timescale the outcomes of individual projects become part of a wider process contributing toward higher goals or targets” (in this issue). This means that, as opposed to traditional perspectives that measure DE “success” in terms of “hard” outcomes, a more “fluid” or “softer” understanding of “success” should be pursued, where it can be seen as an ongoing process between various actors and networks, their understanding and positioning.

In turn, Sherriff (2014) draws on the drivers and barriers discourse in energy studies from a socio-technical perspective. Drivers are “reasons for engagement in local energy projects” (in this issue) while barriers are not only seen as mere economic and technical limitations but also as social and institutional restrictions to achieving one’s full potential. By employing a Delphi approach carried out in three stages and surveying 140 people the author argues that the public, private and third sectors have similar drivers and barriers but prioritise them differently and, in addition to carbon reductions, they also contribute towards other important goals in our society, such as energy poverty, social inclusion, community capacity building and local economic development.

The paper by Higginson *et al.* (2014) is solidly grounded in practice theory, which looks at energy consumption as a set of social practices, and so understands these practices as “the place where agency is understood to lie” (in this issue). Elizabeth Shove’s work foregrounds practice theory in discourses of social theory and climate change in

the area of energy demand – she distinguished between energy practice as “performance”, one moment of doing, and energy practice as “entity” that exists over time and space, is a recognised “doing” and undergoes ongoing reproduction (Shove *et al.* 2012). Following a similar line of enquiry, Higginson *et al.* (2014) question the relationship between practice and the household time-shifting of energy demand in order to understand demand flexibility better.

Behar’s (2014) paper mainly draws on the building evaluation literature, more specifically building use studies (BUS) and post occupation evaluation (POE) studies which look at building (energy) use and performance. In order to respond to the main limitation of this literature – i.e. focusing on buildings rather than people – Behar also draws on the theory of planned behaviour that acknowledges that behaviour is driven by attitudes toward behaviour, social norms and perceived behavioural control (Ajzen 1985, Ajzen and Madden 1986). This combined framework proves especially valuable in the case of the historic and hard-to-treat residential buildings she looks at.

The four papers published here also employ a range of qualitative – including in-depth or semi-structured interviews (Chmutina *et al.* 2014, Higginson *et al.* 2014), stakeholder round tables and observation (Chmutina *et al.* 2014), 24-hr household diaries/ observation (Higginson *et al.* 2014) – and quantitative methods – such as Delphi surveying (Sherriff 2014), energy monitoring (Higginson *et al.* 2014), POE and BUS methodology (Behar 2014). Apart from Chmutina *et al.*’s (2014) paper which takes a qualitative line of inquiry, the other papers draw on a mix of qualitative and quantitative methodological tools.

However, what the four papers have in common is the use of a case study methodology ranging from a single case study approach in Behar’s case, through a comparative analysis of a small number of case studies (4 and 2) in Chmutina *et al.*’s (2014) paper, to Higginson *et al.*’s (2014) in-depth investigation of energy practice in 11 household cases and Sherriff’s (2014) insights from the wider “case” of “local energy approaches” in the UK. This is not new. The case study approach has been employed as a main research method by a considerable number of studies in the energy literature – see for example (Bulkeley *et al.* 2010, Devine-Wright and Heath 2010, Chmutina *et al.* 2012, Devine-Wright and Wiersma 2013, Goodier *et al.* 2013, Hargreaves *et al.* 2013). Case study analysis helps to understand complex social phenomena and improves theory building (Yin 2003, Bryman 2004) and at its best employs the analysis of each “case” to inform the understanding of the others, resulting in a greater combined analysis than the sum of individual cases.

Although case studies cannot prove or disprove theory, they can be used to reveal patterns, generate hypotheses and suggest questions for further research. However, the main limitation of case study research is in the small number of cases usually studied requiring researchers to be cautious when generalisations are made. Case studies also provide only a snapshot of the phenomenon rather than a view of developments over time and information obtained is limited by access to people and documents. Moreover, they mainly focus on the description of what works and what does not, sometimes lacking explanations for why it works or does not, especially when explanations lie beyond the scale of the case study area (Clasen 1999). These limitations can partially be offset by stratified sampling and information-oriented selection (i.e. selection based on maximum variation cases, critical cases, deviant cases or paradigmatic cases); by making systematic comparisons – with the help of qualitative comparative analysis or Boolean logic; and by using various types of evidence when comparing, including comparisons with national or regional level data, data from local area surveys, research performed by other researchers, etc. The papers published here employ a number of the above strategies in order to generate knowledge.

**Papers outlined**

In their paper, “Success in international decentralised urban energy initiatives: A matter of understanding?”, Chmutina, Sherriff and Goodier use interviews with key stakeholders in four international case studies to look closely at success in DE systems. While there are examples of recent papers that take a descriptive approach to effective case studies, in this paper the very notion of what makes a successful project is questioned. The authors argue that success is not simply a measure of three frequently cited outcomes: financial profit, energy reduction and/or implementation within schedule (in fact in some instances financial deficit or over-running timescale is not a determination of an unsuccessful project). Rather it is a subjective notion that is derived from a range of process factors, from design through to implementation. What makes Chmutina *et al.*'s (2014) contribution significant is their reliance not on quantitative business metrics but on qualitative data which draws attention to some unexpected and broader points at which to investigate successful urban energy projects, including establishing or reinforcing partnerships, enhancing reputation, building on interest from media and other organisations, as well as taking the chance for education and further development. Unpacking success and understanding what it is that makes DE systems successful is a tactic that allows the authors to highlight nuanced processes and overlooked factors from widely cited international projects. Not only does this make a case for reconsidering larger contextualising issues of existing energy reduction projects that might be initially considered failures, but, more importantly, it could inspire further schemes locally which will assist in meeting carbon reduction targets here in the UK and elsewhere.

Following this, Sherriff (2014) employs similar yet distinct qualitative methodologies in a paper highlighting the results of a 2012 energy activity survey in urban areas in the UK; both the research and his contribution to this special issue aim to inform a move towards more decentralised approaches. “Barriers to and Drivers of Urban Energy in the UK: A Delphi Survey” makes use of a two-stage web-based interview process, which draws together data from key players from the public, private and third (voluntary and professional non-profit) sectors with an interest in urban energy initiatives. The extensive transcript quotes from across the three sectors, which are appropriately labelled throughout, allow Sherriff (2014) to show the diversity of drivers *for* and barriers *against* implementation that those working in the field face. Some of the drivers that show the potential contribution local energy can make include carbon reduction, social and economic regeneration, the reduction of fuel poverty, economic competitiveness, resilience in the face of rising energy costs and energy security. Not surprisingly, these drivers are prioritised differently across the various sectors. Sherriff (2014) draws out key themes of barriers prohibiting localised energy, including economic barriers, lack of government leadership and technical barriers, such as the quality of buildings to work with. With the diversity of drivers and challenges in mind Sherriff argues for flexible policy approaches while understanding the motivations of each of the sectors and targeting incentives accordingly. In short, “a better understanding of varied motivations for urban energy . . . could therefore inform better-targeted policy” (Sherriff 2014, p. 20). Moreover, as the paper shows to focus solely on carbon reduction targets risks overlooking diverse local energy approaches. And finally, relatedly, in the light of the barriers highlighted, further policy could attempt to overturn such challenges diverse sectors face in implementing localised approaches to urban energy.

Moving from the UK context to the household scale, a practice theory approach in which householders are understood to have agency in helping reach 2050 carbon reduction



targets informs Higginson, Thomson and Bhamra's paper. In "For the times they are a-changin': The impact of shifting energy use practices in time and space", the authors begin from the premise that in a renewable energy-based future, for example wind, supply cannot be easily turned off to match demand and energy storing systems remain expensive. While tiered pricing structures and advanced technology are two commonly favoured approaches, the fact is that they only go so far in terms of reducing energy consumption. Rather than focus on these methods to try to shift behaviour, the paper attempts to better understand behaviour itself. The authors offer more sustained thought to everyday domestic agency, which, they feel, needs to take a central focus in further research; not simply reducing appliance use at the individual level, but also looking at shifting practices more generally which we all take part in, namely laundry or cooking dinner. Looking to a range of methodologies, including interviews with 29 people, 24-hr observations in 11 homes, and time-shifting energy challenges, the argument put forward sees disruption and flexible demand as a manageable part of running a home, which is intimately related to using less energy. Further, as the authors posit, time-shifting energy demand can fit in with and complement the complexities of everyday life: practices are not only flexible and dynamic but they are also temporally and spatially dispersed. Understanding the diversity of domestic practices is the key to enacting localised sustained change. When many individuals in a society implement changing energy-use practices a balanced grid and carbon reductions will be the outcome.

Keeping with the theme of the domestic, Behar (2014) looks to at a larger case study, the Barbican Centre – a housing complex with more than 2000 apartments, located in the City of London – in order to investigate how occupant feedback surveys can inform a culturally significant and unique site. In "Utilising resident feedback to inform energy saving interventions at the Barbican", Behar argues that methodologies which allow the voice of occupants to speak are particularly useful in the context of this well-known Grade II example of British post-war Brutalist architecture. Heat loss through the building envelope is one of the main means by which the built form contributes to a city's carbon footprint. And in the light of the fact that the Barbican's concrete façade – which is not only un-insulated but also comprised a material that easily transfers heat – is integral to its heritage status, the project faces a challenge. Behar realises that without significant funding in millions of pounds, it is unlikely, at least in the short term, that the case study will see grand renovations to improve its energy performance. Therefore, focusing on post-occupancy evaluation surveys which look at occupant comfort and satisfaction, the author finds that there are small-scale changes, which occupants can make, that will contribute to a relatively significant carbon reduction while not detracting from the iconic architecture. Among other interesting findings, the research shows that many residents are not aware that there are some means in place to allow individual adjustments to what is for the most part a centrally controlled heating system, which leads to an alarming rate of residents admitting that windows are opened to regulate heat in winter. Since this problematic statistic can be easily decreased, it is clear that localised individual actions can make a significant contribution towards meeting the UK's carbon reduction targets.

The viewpoint by Rydin and Turcu (2014) offers a setting for the four papers outlined above. "Trends in Policy for Low-Energy Built Environments: a 20-year Review" re-examines energy policy developments related to the low-carbon built environment in the UK and sets this within the wider context of European policy. The authors reflect on how today's energy problems and interest in developing a UK and European response have their precursors, most notably in the early 1970s when an earlier oil crisis prompted a debate about energy within Europe. The results were limited at the time: ambitious proposals from the

European Commission received a mixed response from member states, which led to a partially developed European energy policy framework. More recently, the last three decades of UK energy policy have been characterised by changing priorities and objectives. In the early days, competition in the energy market and security of supply were a key objective, whereas environmental protection grew in importance from the early 1990s. Their paper discusses the last 20 years and examines in greater detail developments since the turn of the century.

### **Common themes and future directions**

A number of themes can be discerned across these four papers. First, local agency through local authorities, local companies or local non-governmental organisations is important. This fits well with the focus of the journal but it is useful to have it confirmed again that such local agency can be effective and important within the overall energy sustainability and carbon reduction agenda. Second, there is recognition of the interface between individual practice and the efficacy of these local-based initiatives. These papers show that how such individual agency operates is important. It matters if the company takes a pro-sustainability perspective in developing a local heat distribution system. It matters if people within an estate feel empowered to manage their own energy consumption. It matters how inflexible people are in their daily routines. Third, that said, there is a need for a policy framework that supports such local initiatives and shapes individual practices through funding measures, appropriate regulation and clear policy guidance for the range of stakeholders involved. This can partly be a local policy framework, at the local authority scale, but – in recognition of the importance of multi-level governance – there is also a need for complementary national government policy framework. The final viewpoint reviewing the evolving policy framework for energy and the built environment in England illustrates the importance of such national as well as local government support.

The excellence of energy research undertaken in the UK is well acknowledged internationally, (RCUK 2010). However, the papers in this special issue suggest some future directions in the field. On the one hand, further work could build on Chmutina *et al.*'s (2014) research on outcome vs. process aspects of success, for a better understanding of DE initiatives. Alongside conceptual framing, research could critically assess the co-production of outcomes and processes in DE deployment, as well as their inter-changeable nature across “cases” and countries. On the other hand, Sherriff (2014) argues that a better understanding of drivers and barriers to local urban energy within and across the public, private and third sectors can inform better policy-making and include in energy policy frameworks a wider range of less traditional energy policy foci, such as social inclusion, capacity building and job creation. At the same time, Higginson *et al.* (2014) remind us that domestic energy demand and response is not only a matter of understanding appliances and individuals, but also practices and agency; further research could benefit from a better understanding of the latter and also focus on how energy can be “materialised” in order to deliver additional flexibility in energy demand. Another direction for further research comes from Behar's work who argues that the historic and hard-to-treat building stock needs a more systemic exploration on how to deliver the much needed energy saving targets. How energy relates to its “locality” and is “determined” by local manifestations of both structural and agency “cases” is already seen by policy-makers as a prerequisite for more sustainable energy systems, and so will develop into important areas of research in years to come.

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### Notes

1. This compares with \$738 million in Germany, \$1293 million in France and \$11,960 million in the US (RCUK 2010).
2. The PEB programme was launched in 2009 and is jointly funded by the UK's Engineering and Physical Sciences Research Council (EPSRC) and Electricite de France Energy (EDF Energy), one of the UK's energy utilities.
3. The SUE programme run between 2003 and 2010 and was funded by the EPSRC.
4. The RELU programme run between 2004 and 2013 and funded by RCUK.

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