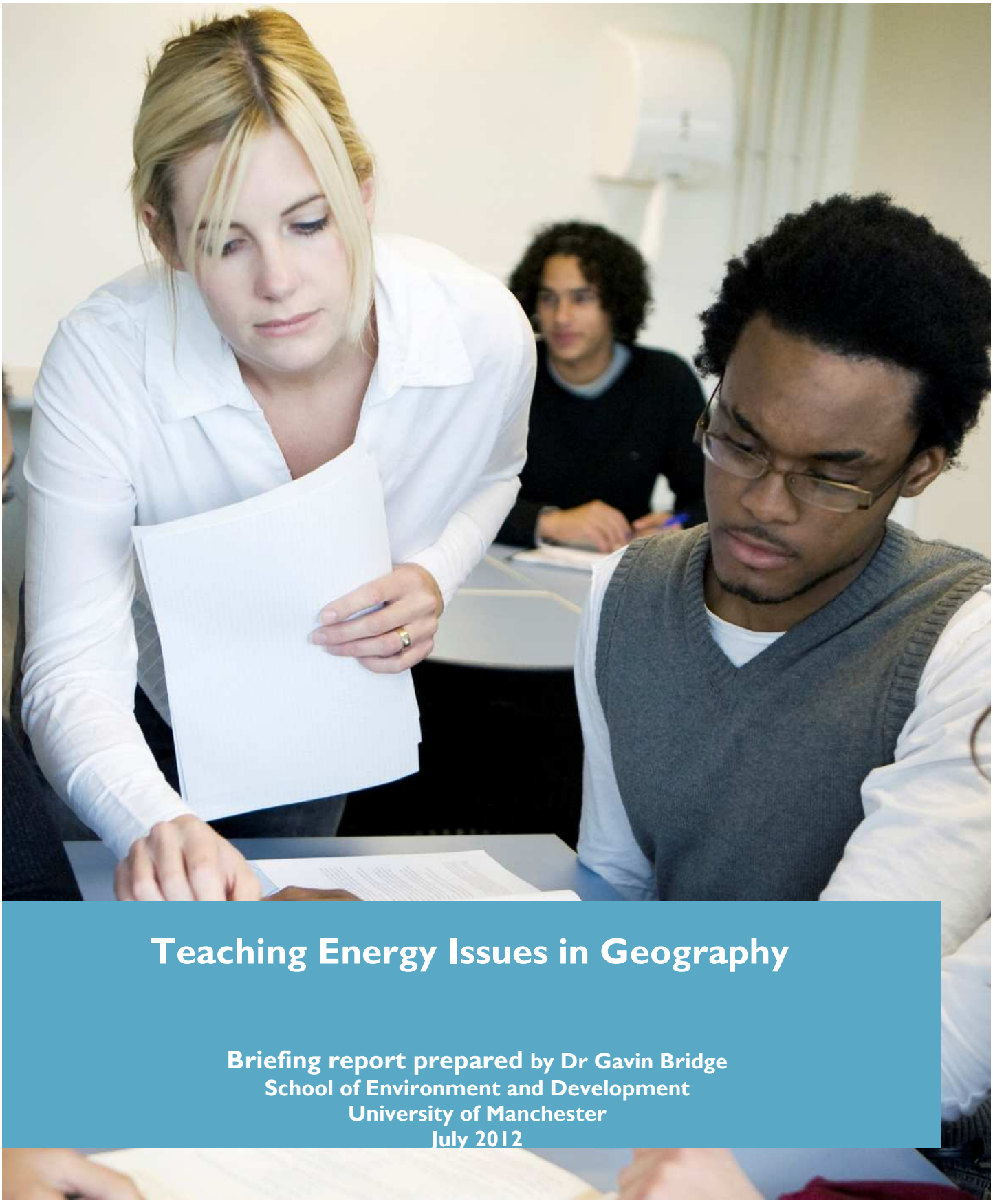
The Higher Education Academy
STEM



Teaching Energy Issues in Geography

Briefing report prepared by Dr Gavin Bridge
School of Environment and Development
University of Manchester
July 2012

Contents

1. Introduction

This briefing report summarises outcomes from three networking events that were convened during 2011-12 to discuss current practices and resources for teaching energy issues within Geography. The report

- characterises the ways in which energy issues are taught in Geography and provides examples of current practice; and
- highlights key issues for those seeking to develop new courses on energy, including gaps in available teaching resources and efforts to address them.

The report is not a comprehensive review of the provision of energy teaching in Geography, and is not supported by a systematic survey methodology of either institutions or instructors. It is a snapshot of current provision in 2011-12, informed by an extended dialogue with teaching staff from a range of higher education institutions. It focuses on energy teaching within Geography programmes, rather than the wider question of where and how energy education is provided across campus.

2. Sources of information for this report

The primary source material for this report is drawn from three networking events convened by the Energy Geographies Working Group of the Royal Geographical Society-Institute of British Geographers (RGS-IBG). These events were organised specifically to explore how energy issues are currently taught at undergraduate and post-graduate levels within Geography, and with wider reference to Geography, Earth and Environmental Sciences (GEES). The events were

- a panel discussion 'Energy Geographies: what, how and where do we teach energy issues?' at the Annual Conference of the Royal Geographical Society in London in September 2011;

- a panel discussion 'Energy Geographies: what, how and where do we teach energy issues?' at the Annual Meeting of the Association of American Geographers (AAG) in New York in February 2012 (co-convened with the Energy and Environment Specialty Group of the AAG); and

- a one-day HEA Workshop on 'Teaching Energy Issues in GEES Disciplines' at the University of Manchester in May 2012.

Each event sought to identify the range of current practice, and consider ways to enhance teaching and learning on energy. Panellists for the RGS-IBG and AAG sessions were invited to speak for 10-15 minutes and to participate in general discussion (see Appendix One). Each panellist provided an overview of course offerings on energy available to geography students in their institution, and reflected on their own approaches to teaching energy issues, resources used (texts, materials, cases), opportunities for engaging students in learning, and support needs. Participants in the HEA Workshop responded to an open call to participate (see Appendix Two). The over-arching objective of all three network events was to develop

a richer sense of current teaching practice around energy within Geography and to identify through discussion the needs and opportunities for enriching the 'energy offer' to students. A small amount of additional material has been drawn from on-line sources, including the newly established Wiki 'Energy Teaching in GEES' (see Section 4.6).

3. Context for a growing interest in teaching energy issues in Geography

'Energy' is broad concept that spans a range of conventional disciplines, from ecology, physics and engineering, to economics, politics and other social sciences. As a consequence, Geography – and the GEES disciplines in general – have no natural monopoly over the teaching of energy, which traditionally has fallen to the engineering and physical sciences. Yet the manner in which energy is captured and transformed lies at the heart of society's relationship with the natural world; and, at the same time, the availability and accessibility of energy strongly influence the relationships among different societies, and between different places.

Particular events have thrust society's relationship to energy into the spotlight, such as the explosion of the Deepwater Horizon oil rig in the Gulf of Mexico, the failure of the Fukushima nuclear reactor in Japan, or dramatic new evidence (such as surface melting of the Greenland ice sheet) of the connection between anthropogenic carbon dioxide emissions and climate change. More generally, the persistence of deep inequalities in human development - along with significant shifts in economic and political power at the global scale – emphasise that the ways in which societies secure energy and transform it to do useful work exert a powerful influence on their economic prosperity, geographical structure and international relations. In short, it has become increasingly clear that the way we use energy and organise our energy systems are as much questions for the social sciences as they are ones for engineering and technology. Indeed, re-defining society's relationship to energy is one of the 'grand challenges' of the twenty-first century.

The character of this grand challenge, however, is not the same everywhere: in short, geography matters. The 'global energy dilemma' is in fact a series of distinctive and inter-related problems (Bradshaw 2010). For those societies where energy is now abundantly available by historical standards, the primary challenge is to develop more sustainable energy systems that are characterised by security and affordability of supply and efficient, low-carbon sources – what some are calling a 'new energy paradigm'. The International Energy Agency, for example, summarises the significance of the energy transition facing many countries of the OECD: nothing less than "the future of human prosperity," they argue, "depends on how successfully we tackle two central energy challenges… securing supply of reliable and affordable energy; and effecting a rapid transformation to a low-carbon, efficient and environmentally benign system of energy supply" (IEA 2008).

For communities without abundant high quality energy services and where access to energy is currently very limited (in much of the global South, for example, but also in poor communities within the OECD), the challenge is to enhance access to energy in ways that reduce poverty and improve livelihood chances, both now and into the future. The UN's *Sustainable Energy for All Initiative* (2012), for example, links improving energy access to achievement of the Millennium Development Goals, and seeks to "provide universal access to modern energy services; double the global rate of improvement in energy efficiency; and double the share of renewable energy in the global energy mix".

Ensuring energy access and energy security in a carbon-constrained world, then, has become one of the 'big issues' of our time. Consequently there is a growing expectation – from students, employers, and society at large - that an undergraduate education will include exposure to and critical analysis of energy systems, and will develop an understanding of the key questions surrounding future energy provision. Some higher education institutions are responding to these broad drivers by identifying opportunities at an institutional level to enhance the teaching offer around energy. Examples include the development of specialised Masters programmes (for example, on *Energy Policy* and *Environment, Energy and Resilience* at the University of Exeter, and on *Energy Demand Studies* at University College London), or the adoption of energy as a theme within institutional initiatives that are designed primarily to create an inter-disciplinary experience for undergraduates (e.g. The 'Big Dilemmas Project' at the University of Exeter, for which the Severn Barrage was the focus of a 2010/11 project on the future of renewable energy).

At the moment, however, the interest in developing energy-related courses and content in Geography comes mainly from individual lecturers and instructors, and focuses on the design of specific course units. This reflects both the growing salience of energy issues and student interest (as outlined above) but also the recent entry into teaching of a cohort of newly-trained PhDs whose research and teaching interests centre on the intersection of social science and energy, and who think about energy outside of its traditional disciplinary silos (e.g. the links between architecture and energy, between consumption and energy practices, or the governance of large technical systems). This particular driver of change in the provision of energy-related teaching in Geography can be expected to continue in the medium-term, given the investment by the UK Research Councils in interdisciplinary, energy-related PhD training (for example, the network of 13 Energy Centres for Doctoral Training established by UKERC in 2011). As Section 4 shows, the ways in which individual instructors are responding to the broad drivers for more energy-related course content are diverse, often creative, and for the most part reflect the research interests and experience of those developing the courses. Typically, however, they are neither comprehensive in their coverage nor co-ordinated in their development and it appears that to date there are no curriculum-wide initiatives for integrating energy into undergraduate programmes in Geography. Nonetheless, with its focus on spatial differentiation, socio-natural relations, uneven development and the scaling of socio-political organisation, Geography – and GEES more broadly - has something distinctive to contribute to the challenging questions posed by contemporary global energy dilemmas (Bridge et al. 2012).

4. Key observations

4. 1 Low visibility: energy issues marginal in current curricula

Stand-alone courses built around the theme of 'energy' are currently not the norm within Geography undergraduate programmes. In one sense this is to be expected: energy is not an established sub-disciplinary field of Geography in the manner of 'urban geography', 'political geography' or 'environmental geography,' and often it is through these sub-disciplinary building blocks that curricula are constructed. What is more surprising, however, is the very limited way in which energy features in the curriculum in comparison to other 'big issues' such as climate change or international development, for example. While these themes are well-established as part of undergraduate teaching and learning in Geography – and, although

multidisciplinary in nature, are 'owned' by Geography in some institutions - the same cannot be said for energy. Where energy-themed courses exist within Geography programmes they typically reflect the interest/research specialty of the instructor. Most are offered as an 'option' at second or third year level, or form part of a specialised Masters programme. Examples include third year courses on *Geographies of Energy and Capitalism* at the University of Birmingham, *Energy, Space and Power* at the University of Manchester, *Energy Policies for a Low Carbon Economy* at the University of Exeter, and *Global Energy Dilemmas: Energy Security, Globalisation and Climate Change* at the University of Leicester.

The lack of visibility within the curriculum does not mean, however, that energy issues are not being taught. Components of energy teaching (e.g. on energy systems, energy transitions, planning for renewable energy) are sometimes dispersed across conventional course categories. The most common case is where energy is covered as a sub-theme or section within courses that are headlined as 'environment' or 'sustainability'. Examples of this include Masters courses on *Energy and Climate Change* at the University of East Anglia, and *Planning for Sustainability* at Cardiff University; a third year course on *Climate Change and Politics* at the University of Exeter; and a first year course on *Living in the Material World* at Clark University, Massachusetts. Occasionally energy features as a sub-theme or 'case' within thematic courses such as political geography (e.g. on the geopolitics of energy) or urban geography (e.g. in reference to the evolution of urban morphology), or via traditional course offerings in regional geography (more common in the US than in the UK). In general, however, the significance of energy for processes such as globalisation, urbanisation and development – processes which typically have courses dedicated to them – is rarely acknowledged in the way these topics are taught.

Geography students often have access – via provision for options and electives in their programme - to energy-related courses offered outside the discipline. Examples include a second year undergraduate course on *Energy: Science and Policy* at Leeds University; the post-graduate course on *Energy Issues in Developing Countries* at Yale's School of Forestry and Environmental Studies; and the programme of undergraduate courses that comprise the University of Delaware's BSc in *Energy and Environmental Policy*. In some institutional settings – particularly where formal Geography programmes do not exist – geographically trained instructors teach on energy issues while based in other disciplines. Examples include teaching on the water-energy nexus as part of a course in the School of Public Policy at Georgia Tech on *Negotiating Sustainability*; upper-level courses on *Energy and Environment* at Salem State University offered via Interdisciplinary Studies, and on *Energy and Environment* and *Sustainable Energy Strategies* delivered via Environmental Studies at San Jose State University; and a Masters course on *Global Politics of Energy* at the University of Westminster.

4. 2 Squeezed out? Making the case for energy as a distinctive theme

The themes of climate change and sustainability have a relatively secure place within geography teaching. While these themes can - and do (see above) - provide a range of opportunities for teaching on energy, the incumbency of these themes potentially 'crowds out' energy from the curriculum. There is also a risk that addressing energy via climate (rather than on its own terms) unnecessarily constrains discussion of energy issues to the management of carbon. Discussion during the networking events confirmed both the breadth of energy issues – how they extend beyond carbon management to questions of social justice, public participation and energy access, for example - and the value of considering them together within a common thematic framework. Indeed, the emergence of energy as a

pressing social and political issue in the last few years is precisely because it demands its own institutional frameworks for governance, regulation and analysis and is not reducible to other categories: the debate over energy security makes clear, for example, how energy policy issues are not the same as those for climate policy. The range of contemporary energy dilemmas - such as determining whether, how and for whom particular landscapes should be valued for their (low-carbon) energy generating potential, or deciding on the geographical scale (urban, regional, national, international) at which trade-offs between energy security and environmental impact should be made – highlight the value of a dedicated perspective that is able to capture the complex combination of factors associated with energy issues.

4. 3 Diverse forms: existing energy courses adopt a variety of perspectives

Although there are relatively few being offered within Geography at present, a number of dedicated courses on energy are currently on offer that express geographical themes or which have geographical issues embedded within them. These provide potentially useful reference points for anyone seeking to develop new courses on the theme of energy geographies. Although the number of courses is small (in comparison to core modules on economic geography or urban geography, for example) it is possible to identify four general perspectives. These are the geopolitics of energy; energy economics; energy, society and sustainability; and resources, technologies and transition. Figure 1 indicates the core themes that characterise each of these perspectives and provides a few examples.

The Geopolitics of Energy • energy as a means of national power • resource curse, resource nationalism • energy security • geopolitical consequences of low-carbon transition Illustrative examples: *Geopolitics of Energy*, via Harvard's Kennedy School; *Global Politics of Energy,* in International Relations at the University of Westminster.	*Energy Economics* • demand, supply, income elasticity • oil, gas, electricity markets • prices, deregulation, efficiency • energy and climate change, cap and trade • ethical critiques of economic analysis Illustrative examples: *Energy Markets*, via the Business School at the University of Abertay; *Issues in Energy Economics* via Geography at the University of Exeter.
Energy, Society and Sustainability • climate change, energy and development • historic evolution of practices of energy consumption and production • energy access and energy poverty • planning, land use, social justice Illustrative examples: *Global Energy Dilemmas: Energy Security, Globalisation and Climate Change,* Geography at Leicester and the Oslo Summer School in Comparative Social Science; *Energy and Natural Resources for Sustainability*, via Geology at University of North Carolina, Wilmington.	*Resources, Technologies and Transition* • energy history, key transitions • technologies of conversion and transmission • environmental risks of energy systems • coal, oil, gas, wind, solar, water, geothermal, biomass Illustrative examples: *Energy Resources and Technologies,* via the Geography Programme at Central Connecticut State University; *Energy and Society,* Geography at the University of Toronto-Mississauga; *Energy Resources in a Sustainable World*, Geography at the University of Utah; *Energy and Environment,* Environmental Studies/Chemistry at University of Washington.

Figure 1: Four general perspectives on teaching energy

4.4 Different objectives: a range of educational goals for teaching energy

Instructors who have developed courses on energy for delivery within GEES and related disciplines are, collectively, seeking to achieve a range of different educational objectives. While some are focussed primarily on delivering content and the particular challenge of building 'energy literacy' (see below), others view teaching and learning on energy as an opportunity for students to develop transferable skills (analysis, team-work etc). Others, however, highlight the particular attraction of energy issues for channelling the aspirations of some students not only to understand the world around them, but also to effect change within in it. These three objectives are illustrated in Figure 2. They should be considered ideal types (and each can be linked to a distinctive philosophies of education) as individual instructors often held some combination of these objectives in mind for their courses.

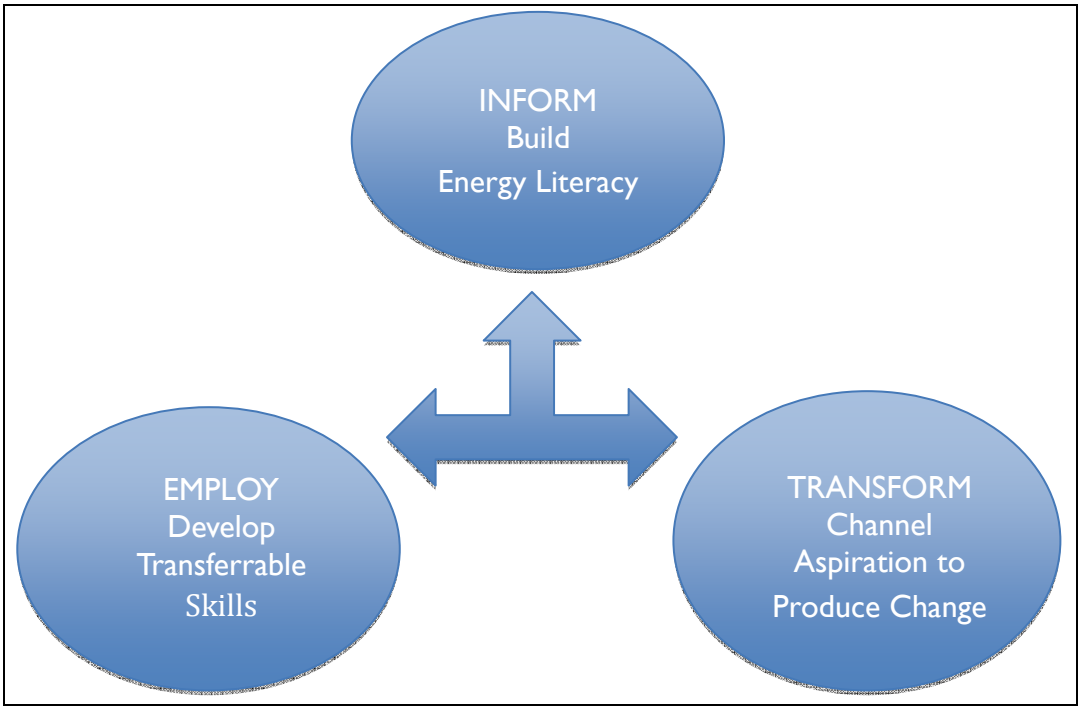


Figure 2: Three student-focussed objectives for teaching energy issues within geography

4.5 Engaging students: energy as an opportunity for experimental and innovative pedagogy

A number of people who have put together courses on the theme of energy within GEES disciplines identified the scope which energy provides for developing innovative approaches to teaching and learning, including the deployment of new learning technologies. On the consumption side, the direct experience of energy consumption at the household level – through daily practices such as driving, cooking and heating – creates opportunities for engaging students in monitoring and measuring their own energy consumption, and for critical reflection on the factors that may constrain efforts to use less energy. Approaches here take a variety of forms: from traditional diary/journal keeping and metering (e.g. to calculate carbon footprints); through the use of inter-active technology in the classroom to aggregate personal data on consumption (e.g. polling clickers); to technologically-mediated monitoring such as the use of thermal imaging cameras to investigate energy efficiency in the built environment. An example of creative, technologically-mediated experimentation around energy teaching is the HEA-funded INTREACT project (INvesTigating REsidential and business energy consumption via student-led ACTion research) undertaken by the *Energy, Society and Place Research Unit* at the University of Birmingham.

Energy questions often present themselves as 'hot button' issues, and these can provide entry points or 'teachable moments' through which to examine the social and spatial relations created via energy. Typical examples include planning controversies over facility siting (such as applications for wind farms, PV installations or pipeline routes), significant changes in government policy (on renewables or nuclear power, for example), or high-profile actions by non-governmental organisations challenging corporate or government practices (over coal-fired electricity production or shale-gas 'fracking'). The complex nature of these controversies can also provide scope for enquiry-based learning via fieldwork and extended projects, involving students in the design and execution of research to investigate a problem.

Undergraduate students in Worcester Polytechnic Institute's Interdisciplinary and Global Studies Division, for example - where teaching and learning take place via projects rather than a traditional curriculum – carry out research on energy technologies and community development in Capetown, South Africa as part of their degree. Project work around the geographical dimensions of energy can be particularly effective where controversies have a 'local' element to them, enabling students to consider the way energy problems are scaled by competing interests, and to interact with locally-based actors and institutions to develop an understanding of different – and often contending - perspectives. The immediate environment of the University can also provide a 'learning laboratory': several people indicated how University Estates and/or Physical Plant may be able to provide students with opportunities to undertake engaging, hands-on project work.

4.6 Needs and challenges

Many of the institutional challenges associated with developing courses that enable students to explore geographies of energy are unique neither to energy as a theme nor to Geography as a discipline: they are the generic issues associated with administrative processes, curricula requirements, and the management of workloads. At the level of course design, however, energy presents several distinctive challenges. Five are briefly discussed.

First, there is the problem of how to introduce geography students to the technical language in which many discussions of energy take place, while ensuring a course maintains focus on the geographical dimensions of energy issues and does not become subsumed to the need for 'language training'. A familiarity with the numerical language of units, metrics and associated conversions constitutes the basics of 'energy literacy.' Yet this language can be difficult to convey to a non-technical audience in an engaging and effective manner. Some people also observed that, while familiarity with this technical register is important, it can be difficult to reconcile with the sort of critical enquiry into the organisation of energy systems that many instructors wanted to develop with their students. The challenge here extends beyond the particular issue of numeracy and familiarity with the units in which energy and power are measured, to the need for students to understand - in a non-technical way - specific technologies for energy capture and conversion. In this regard, Vaclav Smil's extensive repertoire – see, for example, *Energies: An Illustrated Guide to the Biosphere* (2000) – and David McKay's *Sustainable Energy Without the Hot Air* (2009, available online) – were noted as useful resources.

Second, there are many sources of energy data freely available, covering production, transport, consumption and emissions by country, region and sector. The challenge here is how to harness some of these data as teachable resources. General sources include annual reviews such a BP's Statistical Review of World Energy, the International Energy Agency's World Energy Outlook, and a wealth of country and state-level statistics, such as the Digest of UK Energy Statistics (DUKES). They also include sectoral, country and state-level reports, such as those compiled by the US Energy Information Administration and the United Nations, as well as many other more specialised sources relating to particular fuels or energy conversion technologies. A number of participants commented on the potential educational value of these sources of data, but also identified the difficulty of using them 'raw'. The broad range of data types, together with the quality of the available data present significant opportunities to develop creative and engaging exercises to illuminate course themes. An example is the comparative energy analysis exercises which form part of the 3rd year course on *Energy and Environment* at Salem State University in Massachusetts. These require students

to engage with state-level data from the US Energy Information Administration on total energy use, energy intensity, and energy use per capita in order to evaluate where, and on whom, spending on energy efficiency should be targeted.

Third, there is the issue of how to balance – within a single course – the development of a *distinctive* geographical perspective on energy, with material that could equally be taught via courses in environmental science (e.g. principles of thermodynamics, ecological energy conversions) or environmental management (e.g. pollution and the environmental risks associated with different energy conversion technologies). Addressing this question is important for intellectual reasons, as ultimately it concerns the perceived utility of Geography as a discipline and the analytical value of its core concepts (scale, place, and territory, for example). It is also important for more practical reasons: 'energy' is already being taught in one way or another elsewhere on campus (in the engineering and environmental sciences, for example) and, without a distinctive geographical perspective, there is the risk that new courses on energy offered via Geography duplicate large portions of what may be available to students outside the discipline.

A fourth challenge is related to the way recent efforts within GEES to develop energy-related courses, and identify teaching resources and materials, have often been carried out in relative isolation. The three networking events described in Section 2 were designed in part to address this process of 'independent invention,' creating an opportunity to share current practice and experience. One of the outputs of the HEA Workshop on Teaching Energy Issues in GEES Disciplines, organised by the Energy Geographies Working Group of the RGS-IBG, has been development of a Wiki 'Teaching Energy in GEES', see http://energygees.wikispot.org/. Initiated in June 2012, the Wiki includes links to energy-related undergraduate and taught post-graduate programmes in the UK and beyond, and to a number of course syllabi. The Wiki is hosted by the Energy, Society and Place Research Unit at the University of Birmingham.

Fifth – and related to challenges three and four – is the lack of a text on energy suitable for undergraduates written from a geographical perspective. To address this, a new text is currently being created that develops a distinctively geographical approach to energy issues. It is being co-ordinated by the Energy Geographies Working Group of the RGS-IBG and co-written by several members of the Group.

5. Summary

This report has described the context for an increased interest in teaching energy issues within Geography. It has outlined an extended process of dialogue, convened by the Energy Geographies Working Group of the RGS-IBG and undertaken in collaboration with other partners including the HEA, to explore current practices around the teaching of energy within Geography, and with reference to GEES more generally. The report has also summarised a number of significant observations made by participants during the course of these discussions. Many higher education institutions (in the UK) began a process of 'mapping' energy research capacity a number of years ago. Within these institutions the process of mapping *energy teaching*, however, is far less advanced. This exploratory report has provided a snapshot of current practice on teaching energy issues within Geography, drawing on a series of discussions held during 2011 and 2012. Although not based on a systematic survey of institutional or individual practice and impressionistic in character, the

report has highlighted some of the opportunities and challenges associated with enhancing the ‘energy offer’ to students in Geography and related programmes.

About the RGS-IBG Energy Geographies Working Group

The Energy Geographies Working Group (EGWG) of the Royal Geographical Society-Institute of British Geographers was established in 2011 to facilitate more research and teaching on energy within UK Geography and, by doing so, to enhance the contribution of the discipline to an issue of broad social significance and future concern. The formation of the EGWG reflects the social 'challenge' that energy issues now present in both the global North and South, the centrality of these issues for a discipline committed to understanding society-environment relations, and the distinctiveness of the contemporary energy agenda. Energy transition, security, infrastructure, and governance are fundamentally spatial and scalar concerns.

Under the rules of the RGS-IBG, the EGWG is time-limited to 2 years, in its initial phase. In that time, the EGWG is organising and convening a series of activities designed to take stock of capacity on energy research and teaching in the discipline, bring together sub-disciplinary expertise on energy, and foster new research that applies geographical perspectives, concepts and methodologies to energy questions. By creating a space within the discipline for dialogue and debate on 'energy geographies', the EGWG aims to develop an agenda to guide future geographical research on energy. More details can be found at http://energygeographiesworkinggroup.wordpress.com/

About the Author

Gavin Bridge is Reader in Economic Geography in the School of Environment and Development at the University of Manchester. He is Chair of the Energy Geographies Working Group of the Royal Geographical Society-Institute of British Geographers, and an Editor of *Geoforum* and *New Political Economy.* His research on the geographical political economy of mining, oil and gas has been funded by the U.S. National Science Foundation, European Commission, British Academy, and the National Geographic Society. Core themes in this work are the relationships between resource scarcity, global reach, corporate restructuring and territorial development. He is currently involved in a UKERC-funded project on The Geopolitical Economy of Global Gas Security and Governance: implications for the UK. His new book *'Oil',* co-authored with Philippe LeBillon, is published by Polity Press. Email: gavin.bridge@manchester.ac.uk

References

Bradshaw, M. J. (2010) Global Energy Dilemmas: a geographical perspective. The *Geographical Journal* 176: 275-290.

Bridge, G., Le Billon, P. 2012. *Oil.* Cambridge, Polity Press.

Bridge, G., M. Bradshaw, S. Bouzarovski, and N. Eyre. 2012. Geographies of Energy Transition: space, place and the low-carbon economy. Submitted to *Energy Policy*.

International Energy Agency 2008. World Energy Outlook. Available online at http://www.worldenergyoutlook.org/

United Nations (2012) *Sustainable Energy for All Initiative*. *http://www.sustainableenergyforall.org/*

Further information

BP Statistical Review of World Energy
http://www.bp.com/sectionbodycopy.do?categoryId=7500&contentId=7068481

Digest of UK Energy Statistics (DUKES)
http://www.decc.gov.uk/en/content/cms/statistics/publications/dukes/dukes.aspx

International Energy Agency, World Energy Outlook
http://www.worldenergyoutlook.org/

McKay, D. 2009. *Sustainable Energy without the Hot Air.* UIT Cambridge.
http://www.withouthotair.com/

RGS-IBG Energy Geographies Working Group
http://energygeographiesworkinggroup.wordpress.com/

Smil, V. 2000. *Energies: An illustrated guide to the biosphere*. Cambridge, Mass: MIT Press.

UN Sustainable Energy for All
http://www.sustainableenergyforall.org/

US Energy Information Administration
http://www.eia.gov/

Appendix One
Participants in the RGS and AAG Panel Sessions

'Energy Geographies: what, how and where do we teach energy issues?'

Panel Session at the Royal Geographical Society Annual Conference 2011
1st September 2011

Dr Stewart Barr, Exeter University
Dr Stefan Bouzarovski, Birmingham University
Dr Ed Brown, Loughborough University
Dr Gavin Bridge, University of Manchester
Dr Patrick Devine-Wright, Exeter University
Dr Dan van der Horst, Birmingham University

'Energy Geographies: what, how and where do we teach energy issues?'

Panel Session at the Association of American Geographers Annual Meeting
27th February 2012

Dr Gavin Bridge, University of Manchester
Dr Jacque (Jody) Emel, Clark University
Dr Michael Heiman, Dickinson College
Dr Matthew Huber, Syracuse University
Dr Scott Jiusto – Worcester Polytechnic Institute
Dr Janelle Knox-Hayes – Georgia Institute of Technology
Dr Marcos Luna, Salem State University

Appendix Two
Participants at HEA Workshop on Teaching Energy Issues in GEES Disciplines
Manchester, May 21st 2012

NAME	ORGANISATION
1. Stefan BOUZAROVSKI	School of Geography, Earth and Environmental Sciences University of Birmingham s.bouzarovski@bham.ac.uk
2. Gavin BRIDGE	School of Environment and Development University of Manchester Gavin.bridge@manchester.ac.uk
3. Ed BROWN	Department of Geography Loughborough University E.D.Brown@lboro.ac.uk
4. Alejandra CORTES	Bartlett School of Planning UCL acortesfuentes@gmail.com
5. Simon CUTHBERT	University of the West of Scotland Simon.cuthbert@uws.ac.uk
6. Ralitsa HITEVA	School of Environment and Development University of Manchester ralitsa.hiteva@manchester.ac.uk
7. Philip JOHNSTONE	School of Life and Environmental Sciences University of Exeter Pcjj201@exeter.ac.uk
8. Andrew KARVONEN	School of Environment and Development University of Manchester andrew.karvonen@manchester.ac.uk
9. Guy LEUNG	School of Environment and Development University of Manchester guyleung@gmail.com
10. Andres LUQUE	Geography Department University of Durham a.e.luque@durham.ac.uk
11. Anne-Marie NUTTALL	School of Natural Sciences and Psychology Liverpool John Moores University a.nuttall@ljmu.ac.uk
12. Wojciech OSTROWSKI	University of Westminster W.Ostrowski1@westminster.ac.uk
13. Saska PETROVA	School of Geography, Earth and Environmental Sciences University of Birmingham s.petrova@bham.ac.uk
14. Helen WALKINGTON	Discipline Lead for Geography, Earth and Environmental Sciences The Higher Education Academy Helen.walkington@heacademy.ac.uk
15. Jennifer WATTS	School of Environment and Development University of Manchester jennifer.watts@postgrad.manchester.ac.uk