Global Environmental Change 42 (2017) 1–12

Contents lists available at ScienceDirect

Global Environmental Change

journal homepage: www.elsevier.com/locate/gloenvcha

Seeing futures now: Emergent US and UK views on shale development, climate change and energy systems

Tristan Partridge[a], Merryn Thomas[b], Barbara Herr Harthorn[a,*], Nick Pidgeon[b], Ariel Hasell[c], Louise Stevenson[c], Catherine Enders[c]

[a] Center for Nanotechnology in Society and Department of Anthropology, University of California, Santa Barbara (UCSB), CA 93106, USA
[b] Understanding Risk Group and Tyndall Centre for Climate Change Research, School of Psychology, Cardiff University, Tower Building, 70 Park Place, Cardiff, CF10 3AT, UK
[c] Center for Nanotechnology in Society, University of California, Santa Barbara (UCSB), CA 93106, USA

ARTICLE INFO

Article history:
Received 4 May 2016
Received in revised form 28 October 2016
Accepted 6 November 2016
Available online xxx

Keywords:
Shale development
Fracking
Energy transitions
Risk perception
Energy futures
Climate change

ABSTRACT

Shale development – extraction of oil and gas from shale rock formations using hydraulic fracturing or 'fracking' – has become a critical focus for energy debates in the US and UK. In both countries, potential industry expansion into new areas for shale extraction is expected to produce a wide range of environmental and social impacts and to change the configuration of future energy systems. To engage with emergent views on these complex, multi-scale issues, we held a series of day-long deliberation workshops (two in the US and two in the UK) designed and facilitated for diverse groups of people to discuss a range of possible consequences and meanings of shale development. Amid nuanced differences between and within national contexts, notable similarities in views were tracked across all four workshops. Concerns in common were not limited to specific risks such as water contamination. Participants also questioned whether shale development was compatible with their visions for and concerns about the longer-term future – including views on impacts and causes of climate change, societal dependency on fossil fuels, development of alternative energy technologies, the perceived short-term objectives of government and industry agencies, and obligations to act responsibly toward future generations. Extending prior qualitative research on shale development and on energy systems change, this research brings open-ended and cross-national public deliberation inquiry to bear on broader issues of climate change, responsibility, and ideas about how shale development might undermine or reinforce the energy systems that people consider important for the future.

1. Introduction

Fossil fuel extraction from shale rock using processes of hydraulic fracturing (or 'fracking') has increased significantly in recent years. This has created a range of measurable impacts at local, regional, national and global levels (Willow, 2014). The US has become the world's largest producer of oil and gas (EIA, 2015), and governments elsewhere, including the UK, support shale development within their energy policies. Widespread changes that shale development introduces affect energy systems, defined as the material and social infrastructures involved in energy generation, distribution and consumption. Since energy systems interact with industrial processes such as manufacturing and agriculture as well as with ecosystems, shale development also has consequences for global climate change (Levi, 2013). Energy systems underpin many technological arrangements, forms of social organization, and environmental practices in industrial economies (Miller et al., 2013) and so the actual and potential changes introduced by shale development are wide-ranging, as are public responses to them.

Surveys have broadly gauged changing levels of public support for and opposition to shale development in both the US (Clarke et al., 2012) and UK (O'Hara et al., 2014). However, these studies have not yet fully explored the concerns, values and imagined futures that influence views on shale development and energy systems more broadly (Demski et al., 2015). Addressing such gaps, the research presented here is based on a series of public deliberation workshops held in the US and UK – designed and facilitated for diverse groups of people to learn about and explore

* Corresponding author.
E-mail addresses: barbara.harthorn@ucsb.edu, harthorn@anth.ucsb.edu (B.H. Harthorn).

http://dx.doi.org/10.1016/j.gloenvcha.2016.11.002

through open-ended group discussion a range of possible consequences and meanings of shale development that go beyond the tangible health, economic and environmental effects addressed in survey research. Much previous public participation research on environmental decision making has focused on local issues (Dietz, 2013), but climate change and energy system change operate across multiple temporal and geospatial scales and have similarly wide-ranging effects on social, economic and environmental relations (Ostrom, 2010; Jasanoff and Kim, 2013; Pidgeon et al., 2014). Through multi-sited, deliberative research we bring public deliberation techniques and inquiry with their special capacity to illuminate emergent views to bear on diverse views on these complex, multi-scale issues in locations with distinct histories, priorities and socioecological conditions.

The US and UK share important similarities and differences that contextualize this research. Miller et al. (2013) argue the broader social consequences of energy system change have been systematically underemphasized in US energy debates, including in reports from the Department of Energy (DOE, 2011) and the National Academies on *America's Energy Future* (e.g. NRC, 2008; NAS, 2009). Similar observations have been made of UK energy debates (Butler et al., 2013). Both countries have also historically shared comparable degrees of dependency on fossil fuels for electricity generation (DECC, 2016; EIA, 2016) and today face similar pressures to develop shale oil and gas reserves (Thomas et al., 2016). However, shale extraction in some US states is an established industry, while in the UK it is still at an exploratory stage (Hawkins, 2015). We suggest these variations make shale development a "liminal" case for deliberation and discuss the implications this has for deliberative research. Further critical differences between the two countries in science values (Gaskell et al., 2005), attitudes toward precaution about risks, climate change beliefs (Capstick et al., 2015), deliberative processes and risk controversy histories (Jasanoff, 2005; Pidgeon et al., 2009) provide a compelling basis for studying public deliberation across these different contexts.

Shale development has become an important case in which critical US and UK energy debates are played out, and scholars in both countries have identified the need for analyses of the social context and impacts of energy system change (Hess, 2013; Laird, 2013; Parkhill et al., 2013a; Pidgeon et al., 2014). Such analyses require research that considers shale development in national and global contexts without restricting focus to specific locations and localized impacts – as has been the focus of much qualitative work in the US (Thomas et al., 2016). In this paper, we ask how people in small public deliberation groups across multiple US and UK locations form or refine views on shale development and associated near- and long-term impacts when considered as part of larger energy systems. We examine these emergent views in the context of broader discussions on: tensions between immediate interests versus longer-term concerns (Groves, 2014); dependency on fossil fuels (Demski et al., 2015); and questions about individual, collective, industry, and governmental responsibilities for changing energy systems to address long-term societal needs (Leiss and Powell, 2004; Lorenzoni and Hulme, 2009). Our analysis thus extends the focus of qualitative research on shale development from specific perceived risks and benefits to broader issues of responsibility, climate change, and energy-society relations.

2. Background

2.1. Shale development

Shale oil and gas are referred to as *unconventional* fossil fuels because they are located in low-permeability source rock and thus cannot be extracted using methods that drill directly into conventional subsurface resource reservoirs (Stern et al., 2014). Instead, extraction from shale requires a combination of additional technologies, some new and some repurposed. These include high-volume, high-pressure hydraulic fracturing in which fluid and fine-grain sand are injected to open fissures in the shale in order to access the oil and gas it contains (CCST, 2015). Other technological advancements that have facilitated the expansion of shale development, particularly in the US, include the ability to drill horizontally for distances of up to two miles and seismic imaging of deeper subsurface areas (Maugeri, 2013). Government investment and fluctuations in global resource markets have played key roles in enabling these developments (Trembath et al., 2012). At the same time, concerns are emerging regarding the social and environmental consequences of extracting these previously inaccessible and relatively abundant fossil fuels (Hughes, 2013; Davis and Fisk, 2014), raising critical issues related to economic growth (including job creation), environmental impacts (such as water contamination), climate change and energy systems (Boudet et al., 2013; Demski et al., 2015).

The processes and technologies associated with shale gas and oil extraction by hydraulic fracturing which here we refer to as "shale development" are more commonly identified in public and political spheres as "fracking." We note that no single term is sufficient to capture all associated phenomena (Evensen et al., 2014) and that in US survey research "fracking" has been linked more to negative associations than "shale gas development" (Clarke et al., 2015). In contrast to such survey research, however, our deliberative conversations principally addressed in detail many aspects of "shale oil and gas extraction," from the formation of unconventional shale resources and some of the technical procedures involved in their extraction, to the range of associated social and environmental impacts. During these conversations, "fracking" would sometimes emerge as a shorthand term used by both participants and researchers. In the workshop protocol, however, we explicitly used "shale gas and oil extraction" as the primary focus for our discussions and informational materials, and our pre- and post-survey questions consistently used the phrase "hydraulic fracturing ('fracking')," partly in response to our expert reviewers' expressed pReferences

2.2. Public views on shale development

Research to date demonstrates that public views on shale development vary significantly both within the US and elsewhere (Graham et al., 2015; Thomas et al., 2016). Nationally, US surveys have found widespread unfamiliarity and uncertainty about whether to support or oppose it (Clarke et al., 2012; Boudet et al., 2013; Borick and Clarke, 2016), changing to greater awareness and more emphatic views, both for and against, in areas where shale development is underway (Lachapelle and Montpetit, 2014; Kromer, 2015). In states such as Pennsylvania that have seen significant shale extraction operations, studies have found social conflict amid polarized views on local drilling (Schafft et al., 2013; Jerolmack and Berman, 2016). In other areas, often those marked by prolonged rural poverty (Simonelli, 2014), 'pro natural gas' activism linked to the economic benefits of shale extraction has emerged in direct conflict with proposed state-wide bans in New York (Colosi, 2015). In addition to factors such as proximity, familiarity, and socio-economic status, studies have identified views on shale development are also influenced by political ideology, environmental values, gender, worldviews and media use (Boudet et al., 2013). Meanwhile, UK polls have found fluctuating levels of support and opposition, influenced both by US experiences (Mazur, 2014) and high-profile protest events (O'Hara et al., 2013, 2014). The best summary appears to be that social and ecological impacts of shale development are contested, and public