Energy Research & Social Science 6 (2015) 95–99

Contents lists available at ScienceDirect

Energy Research & Social Science

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

Short communication

Integrating social science in energy research

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ARTICLE INFO

Article history:
Received 5 December 2014
Received in revised form
15 December 2014
Accepted 15 December 2014

Keywords:
Energy studies
Interdisciplinarity
Transdisciplinary research

ABSTRACT

This article reflects on the state of the energy studies field, and it proposes recommendations for better integrating social science into energy research. Realizing a future energy system that is low-carbon, safe, and reliable will require fuller and more meaningful collaboration between the physical and social sciences.

1. Introduction

With the one year anniversary of this journal imminent, we wanted to take a moment to reflect on the state of the energy studies field, and to propose some suggestions for integrating social science into energy research. For it is all too common for energy researchers to generally undervalue social science discoveries, ignore possible interdisciplinary awareness, and marginalize diverse perspectives [1,2]. In this article, we argue that securing our energy future will require that this pattern changes. We must alter infrastructure and technology and support social change if we are to achieve a future energy system that enhances human well-being and is sustainable and just [3]. Such an energy future can be realized only by integrating insights from the physical and social sciences [4,5]. Energy advocates, the climate change community, and related policymakers need to recognize that energy production, consumption, and policy are both social and technical domains [6–8].

Belatedly, even the U.S. Department of Energy (DOE) acknowledges that energy demand is significantly shaped by individual, community, and organizational choice alongside technical performance [9]. The President's Council of Advisors on Science and Technology suggests that we need "a multidisciplinary social science research program that will provide critical information and support for policy development that advances diffusion of innovative energy technologies" [10]. Energy programs that integrate social science can enable us to comprehend better the sources and dynamics of energy problems and develop feasible and acceptable solutions to them.

Nonetheless, a series of biases continue to handicap energy studies [11]. Researchers often promote technological solutions to energy problems while ignoring the social processes that determine their acceptance and use, shape the risks they can present, and offer opportunities for achieving energy policy goals with existing technology [12]. The reliability of energy models is often low because they are overly sensitive to cost assumptions and ignore other major drivers of energy policy and behavior such as social equity, politics, and unforeseen technological advances [13–15]. Further, national and local energy institutions in many countries

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http://dx.doi.org/10.1016/j.erss.2014.12.005
2214-6296/

		Usefulness	
		No	Yes
Fundamental understanding	Yes	Pure basic research (high-energy physics, cognitive neuroscience)	Use-inspired basic research (atmospheric science on radiative forcing for utilization in climate models, behavioral understanding of energy efficiency adoption)
	No	Advocacy drawing inappropriately or selectively on science (campaigns to discredit climate change science, claims that fossil fuel consumption is essential for human well-being)	Purely applied research (improvements to the conversion efficiency of thin film solar photovoltaic panels, more effective advertising campaigns for energy efficient products)

Note: The shaded part of the matrix is sometimes referred to as Pasteur's Quadrant.

Fig. 1. Four types of energy and climate research.

lack significant social science expertise outside economics, and although they may assert that they understand what social science offers, they often act as if expertise in other fields is superior to, or obviates the need for social science [16]. Lastly, while some energy research has both usefulness and enhances fundamental understanding, being located in what has been called "Pasteur's quadrant," [17] much of it does not (Fig. 1).

2. Recapping three shortcomings of energy research

As the inaugural volume published one year ago in this journal noted, these shortcomings are clearly evident in the energy research literature [1]. To recap, a review of thousands of articles in leading energy journals—*Energy Policy*, *Electricity Journal*, and *The Energy Journal*—over a 15 year period confirmed three negative patterns.

The first is that *social dimensions are under-examined*. The human elements of energy systems and their consequences are frequently neglected. Instead, most articles investigate "state-of-the-art" innovations such as small modular reactors, hydrogen fuel cells, or offshore wind turbines. That is, more attention is paid to the hardware than to the human software behind it. Among the social phenomena that go under-researched are the factors underlying demand for energy services and the acquisition and use of technology; perceptions and judgments about energy risks; energy attitudes; persuasion and communication about energy choices; energy decision-making processes in individuals, organizations, and communities; and energy ethics.

The second pattern is a *disciplinary chauvinism* which treats most social science as secondary and peripheral. As Fig. 2 illustrates, physical science, engineering, economics (a special case that cuts across technical and social science), and statistics accounted for the disciplinary training of 67 percent of authors within the sample; by contrast, the rest of the social sciences, arts, and humanities as a whole accounted for less than 20 percent, with almost all of those affiliations in law, business, and public policy. Sociology, geography, history, psychology, communication, and philosophy, among others, constituted less than 0.7 percent, together, of disciplinary training. References to non-economic social sciences and humanities journals, containing articles on topics such as consumer behavior and social impediments to policies, comprised less than 4.3 percent of the more than 90,000 citations across the sample. This technical focus of the literature blunts our ability to understand the energy consumer's side of energy issues [18]. Moreover, it can create blind spots about the distribution of potential risks and rewards, and lessen our ability to determine the effectiveness of various policies, programs, and technological innovations [19]. Another result is a preponderance of quantitative perspectives, mapping a general tendency to propose technical solutions to social problems.

The third pattern is one of *homogenous perspectives*. Fig. 2 indicates that published researchers are overwhelmingly male and tend to hale from Western, affluent institutions and countries. This imbalance is reflected in a preponderance of studies of problems facing the industrialized world and relative neglect of such problems as energy poverty, inequitable access to energy services [20], and the gendered aspects of energy use such as the health impacts arising from the indoor air pollution associated with biomass cookstoves [21].

3. Revealing the value of social science

These three trends are unfortunate, to say the least, given that social scientists can help solve one of the perennial challenges of applied energy research: the disconnect between technological solutions and consumer adoption of new technologies. For decades, studies of consumer choice have demonstrated barriers to adoption of more efficient, cost-saving household appliances, for instance. In 1983, Meier and Whittier reported that more than half of refrigerator purchasers, in a large national sample, refused to pay $60 more for a model that would reduce their energy usage by greater than 25% annually; instead, most bought a model identical in all respects except its energy usage [22]. The simple mathematics required to calculate the long-term cost savings of the $60 investment is not only within the capacity of the average consumer, it is a baseline assumption of most rational choice models. Further, while $60 was not a trifling amount three decades ago, it likely added less than 10 percent to the cost of the refrigerator and fell short of cost prohibitive for all but a few of the purchasers. This scenario begs two questions: What non-economic barriers thwarted early adoption of economically and environmentally efficient technologies? Furthermore, what interventions could help to remove those barriers?

Since then, a raft of social science studies has explained why consumers rationally decline to adopt a diverse array of more efficient technologies. These reasons range from a lack of terminological clarity (i.e., the "bargain" was not clear because the