



Public preferences for investments in renewable energy production and energy efficiency



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HIGHLIGHTS

- Support for energy policies depends on the type of renewable energy included.
- Citizens chose to allocate more funds to energy efficiency than renewable energies.
- Promotion or prevention focus impacts support for policy and allocation decisions.
- Social and fiscal leanings impact support and allocation, in different ways.

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ABSTRACT

In this paper we investigate the choices citizens make when asked to express willingness to support a proposed energy policy and are then compelled to allocate the program funds to either renewable energy or energy efficiency. In a survey study based on a random sample of residents of the state of Maine, USA, we find that citizens have preferences for specific types of renewable energy but these preferences do not yield significantly different allocation of investment funds between renewable energy and energy efficiency. We find that preferences are generally consistent regardless of presentation of options (i.e. limited ordering effects). Our results also indicate that personal characteristics that are understudied in the energy literature, including promotion/prevention focus and social/fiscal leanings, influence both willingness to support energy policies and also their allocation of fund choices, but in different ways. This suggests the importance of including multiple options in energy policy proposals, and that targeted messages regarding the components of such policies is key for optimal communication.

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1. Introduction

For over forty years energy policy research has addressed the question of potential alternatives to fossil fuels currently used to energize global economies (Landsberg, 1974). Yet fossil fuels continue to dominate among all primary energy resources despite expressed support by citizens worldwide for alternative energy sources, e.g. in the United States, (Farhar, 1994; Roe et al., 2001; Greenberg, 2009) Italy (Cicia et al., 2012), Turkey (Ertör-Akyazi

et al., 2012), and Portugal (Ribeiro et al., 2014). This persistence of conventional energy reliance despite public support for alternatives reflects both the challenges inherent in shifting from one primary energy source to another (Smil, 2003) but also the potential trade-offs associated with energy demand reduction. What is missing in many of the studies of energy policy is recognition that the public is not just concerned with energy supply issues but also with demand, where both are 'affected as much by individual choice, preference and behavior, as by technical performance' (US Department of Energy, as quoted by Sovacool (2014)).

Alternative sources of primary energy supply exhibit a mix of costs and benefits such that none is unambiguously optimal from all perspectives. Alternatives to fossil and nuclear based power are renewable (products of the hydrologic cycle or of net primary productivity of photosynthesis), reduce reliance on imported

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hydrocarbons (improving balance of trade metrics and national security), and may lower global climate change effects. Alternatives may also create locally undesirable land uses (LULUs), threaten surface or ground water quality, and exhibit lower power densities than conventional primary energy sources (Smil, 2003). Public perceptions of alternative energy policy in the US and elsewhere often reflect an understanding of the tradeoffs among primary energy sources.

Energy choices facing the individual consumer or society as a whole include not only conventional and alternative primary energy supplies, but also efficiency in energy use and changes in lifestyle (Deitz et al., 2013). Of the 97 quads of estimated primary energy supply for the US economy in 2013, only about 40% delivered energy services while the remainder was 'rejected energy' reflecting inefficiencies in the conversions from primary to secondary forms, losses in distribution, and inefficiencies in use of secondary energy in end-use technologies (Lawrence Livermore National Laboratory, 2014). Moreover, the energy intensity of global economies (measured as units of energy per dollar of GDP) has been declining since the middle of the 1970s in most parts of the world reflecting the importance of investments in energy efficiency (BP, 2013, p. 18). Thus, when policy makers and the public consider energy futures there must be an understanding that the future will include a mix of conventional energy sources, development and expansion of alternatives because of their renewability or other 'green' characteristics, and investments in energy efficiency.

This paper identifies factors contributing to consumers' 'preferred mix' by evaluating tradeoffs between investments in different types of renewable energy and energy efficiency, and importantly identifying different factors which may influence these distinct decisions. Consistent with Sovacool (2014) call for researchers to include twelve under-represented components in future energy work, we incorporate both the role of an individual's political perspectives and social psychology metrics in evaluating consumer preferences. The objective of this study is to measure public preferences for investment in alternative sources of renewable energy supply and in energy efficiency that would affect energy demand. Importantly, we extend prior work by examining facets of public choice: support for policy, preferences for allocation of policy dollars and the economic and personal factors that explain these distinct energy choices. The design of this research was adopted in recognition that energy futures will include multiple interventions to affect both supply and demand, and that these futures are highly dependent upon public preferences and support. Consistent with Menegaki (2008) definitions of valuation and evaluation, we offer insight into consumer evaluation of renewable energy sources and energy efficiency using data collected from residents of Maine, USA Maine, a state located in the northeastern corner of the United States, is an apt study site for testing public preferences regarding energy efficiency and renewable energy in part because of strong investments in both of these facets of an energy portfolio.

2. Previous research and current hypotheses

Paul Stern recently reminded the research community that when it comes to energy issues 'We need all hands on deck' (Stern, 2014). He urged multi- and interdisciplinary teams to focus their efforts on the pressing energy issue. Similarly, Sovacool (2014) and Sovacool et al. (2015) noted a disturbing trend of undervaluation of the influence of social dimensions on energy. We respond to these calls with inclusion of factors and techniques employed across both the fields of economics and psychology in the current work.

2.1. Energy choices

The growing literature on individual-level energy decision making offered fertile fields for the development of this current work. Willingness to fund changes in energy policy may be viewed as a pro-environmental behavior intention (Ajzen, 1991; Stern, 1992). While pro-environmental behavior has often been described as a single behavior, rather than distinct sets, this assumes that different types of environmental behavior are determined by similar factors (von Borgstede et al., 2013). We operate under the assumptions that different antecedents affect different types of environmental behaviors and recognize the gap between stated behavioral intentions and behavior. The literature repeatedly demonstrates a willingness-to-pay (WTP) for green electricity, however the low participation rate in green power programs indicates an intention to behavior gap that must be addressed by researchers (Tabi et al., 2014; Borchers et al., 2007).

Research methods are one potential explanation for the incongruence between research findings in the energy literature and consumer behavior in the market. When studying consumer preferences for energy options, researchers may provide participants vague options to support such as 'renewable energy' that are generic and lack specification (von Borgstede et al., 2013). These presentations are thus more distant to the consumer and more positively evaluated than concrete renewable energy options may be in the marketplace (von Borgstede et al., 2013). Borchers et al. (2007) investigated the impact of asking consumers to evaluate 'generic' green energy in relation to specific green energy types and found that consumers did not perceive all green energy sources as equivalent. Rather people had source-specific demand attributes that go undisclosed when renewable energy is packed as a generic unit. Other work has focused on providing specific energy types for consumers to select from in order to investigate whether consumers reveal demand for specific green energy sources (Grösche and Schröder, 2011; Roe et al., 2001). Findings indicate that consumers do not perceive green energy sources as equivalent (Tabi et al., 2014; Kontogianni et al., 2013; Sardinou and Genoudi, 2013; Grösche and Schröder, 2011; Borchers et al., 2007; Roe et al., 2001) and may have some confusion over the generic term 'renewable energy' (Zarnikau, 2003). The above literature leads us to:

H1. : We hypothesize that consumers will reveal different levels of willingness to support an energy policy scenario dependent upon the type of renewable energy and order of options presented within the scenario.

Importantly, participants in polls and studies are often not asked to select or balance their priorities (i.e. engage in cardinal ranking), rather they are merely called upon to indicate support or not (Manley et al., 2013). For example, Pew Research Center for the People and the Press (2010) polls, indicate that 87% of respondents favored renewable energy legislation, while 78% supported higher efficiency standards. These numbers suggest that citizens may support seemingly competing goals given limited financial and other resources to support energy initiatives. In an effort to address this prioritization gap, von Borgstede et al. (2013) find that the top two energy-related policies supported by Swedish citizens were increased financial investment in renewable energy and energy-saving measures. In asking consumers to prioritize, Zarnikau (2003) found that energy efficiency became a priority energy option at the expense of renewable energy support. Further, a key feature of the rational choice model is that preferences or ranking are consistent regardless of the order in which alternatives are presented and the label they carry. Economic theory indicates that these contexts should not affect an individuals' decision.

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