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Policymakers and stakeholders' perceptions of science-driven nuclear energy policy

Nan Li ^{a, *}, Dominique Brossard ^{b, c}, Dietram A. Scheufele ^{b, c}, Paul P.H. Wilson ^d^a Department of Agricultural Education and Communications, Texas Tech University, 2500 Broadway, Lubbock, TX 79409, United States^b Department of Life Sciences Communication, University of Wisconsin-Madison, 1545 Observatory Drive, Madison, WI 53706, United States^c Morgridge Institute for Research, 330 N. Orchard Street, Madison, WI 53706, United States^d Department of Engineering Physics, University of Wisconsin-Madison, 1500 Engineering Drive, Madison, WI 53706, United States

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ABSTRACT

This study surveyed 137 policymakers and key stakeholders (e.g., employees of government agencies, academic institutions, nonprofit organizations, industry, and advocacy groups) involved in making decisions on nuclear energy policy, investigating how they differentially perceived the importance of scientific evidence in driving nuclear policy. We also identified the policy areas that each group of decision-makers are mostly concerned about and showed how such concerns might contextualize and ultimately shape their perceptions of science-driven policy.

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1. Introduction

Scientific evidence is commonly required to underpin the US Energy and Environmental Policy [1]. Government agencies such as the US Department of Energy (DOE) and the Environmental Protection Agency (EPA) offer scientists routine venues to help policymakers manage the uncertainty and risks associated with energy systems [2]. The EPA Science Advisory Board, for example, reviews the quality of the scientific information that serves as the basis for agency regulations. They also advise the agency on broad scientific matters and recommend policy options [1]. In recent decades, scientific evidence has played an essential role in shaping the US nuclear energy policy. For example, university and national laboratory scientists oversee the performance of federal programs and offer informational inputs to legislation [3]. Recently, the Blue Ribbon Commission on America's Nuclear Future involved scientists worldwide to reassess the nuclear waste management program in the United States [4].

Although scientific evidence is needed to reduce uncertainty and risk in energy policy decisions, there is little evidence that shows technical arguments have much of a direct impact on most

policy outcomes [1]. Previous literature has documented an epistemological and cultural gap between scientists and those involved in making policy decisions in various contexts [5,6]. While offering informational input to nuclear energy policymaking, scientists often have to address a group of audience with varied understanding of scientific concepts [7]. This group of audience is typically composed of policymakers and key stakeholders, such as the regulated industry or professionals, nonprofit organizations, the media, and the public (individuals, community groups, and interest groups) [8]. The disconnect between scientists and their audiences' conceptual frames, as Knopman, a former member of the U.S. Nuclear Waste Technical Review Board pointed out, “is one of the several factors that contributed to the present stalemate [surrounding the Yucca Mountain program and nuclear waste management policies]” [7].

Scientists have provided a significant share of the knowledge base for nuclear policy decisions. However, the effectiveness of science–policy interface is constrained by scientists and policy decision-makers' divergent views on the normative and pragmatic value of scientific evidence [1]. Whereas the US federal government is generally supportive of the development of nuclear energy, no new commercial nuclear power plan has gone online since the 1990s [4]. Policymaking on nuclear waste management has reached a stalemate since the DOE terminated the Yucca Mountain project

* Corresponding author.

E-mail address: nan.li@ttu.edu (N. Li).<https://doi.org/10.1016/j.net.2018.03.012>1738-5733/© 2018 Korean Nuclear Society, Published by Elsevier Korea LLC. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

in 2011 [9]. While some argued that science should have dominated the site selection for a permanent nuclear waste repository, such decisions were made primarily for “policy reasons and not for technical or safety reasons” [10]. Given the tension between science and politics, it is critical to understand how policy decision-makers, including policymakers and key stakeholders involved in policy decision-making, perceive the role of science in driving nuclear policy.

In this study, policymakers are defined as a group of employees from government department and legislature who is responsible for making new rules and laws pertaining nuclear energy development. The term “stakeholders,” in contrast, refers to individuals, communities, and organizations involved in making high-level policy decisions on nuclear energy, which include but are not limited to academics, industry, nonprofit organizations, and interest groups. In particular, we focused on the attitudes of policymakers (i.e., regulatory and administrative agencies) and the attitudes of stakeholders (i.e., nonprofit/nonadvocacy organizations and industry/advocacy groups) toward evidence-based policymaking.

We surveyed 137 policymakers and stakeholders and examined how their attitudes toward science-driven policy vary as a function of institutional affiliation. We identified the policy areas of respondents' most salient concerns (defined as issue concerns) and investigated how each issue concern may have contextualized and ultimately shaped their perception of science-driven policy. Such understanding would help explain the reluctance of certain groups to adopt scientific evidence in their decision-making and reveal the source of documented miscommunication among policymakers, scientists, and other stakeholders [6]. Being aware of the specific concerns that prevent policy decision-makers from committing to science-driven policy, scientists will be able to develop effective communication strategies tackling such concerns.

1.1. Science and nuclear energy policy

Nuclear energy policy concerns many issues, such as reactor safety, nuclear weapon proliferation, economics, and environmental sustainability [11]. The earthquake and tsunami that damaged Japan's Fukushima Daiichi Nuclear Power Plant in 2011 raised questions in the US Congress about the disaster's implications for plant safety regulation, on-site waste management, and US nuclear energy expansion [12]. Since the 1970s, the nuclear policymaking community has been concerned about potential proliferation resulting from reprocessing of spent fuel [13]. More recently, the dispersion of centrifuge enrichment technology has increased concerns about proliferation resulting from uranium enrichment. In 1977, the Jimmy Carter administration permanently banned the reprocessing of commercial reactor spent fuel. More recently, policymakers have contested the economic competitiveness of nuclear energy [14,15]. While some believe that nuclear energy can be economically attractive, others raise concerns about the high capital costs of building new reactors [16]. In addition, the long-term availability of fresh water may constrain the environmental sustainability of nuclear energy [16].

Owing to the technical complexities involved in managing nuclear fuel cycles, scientists have played a critical role in making most nuclear policy decisions [3]. Nonetheless, policies on nuclear waste management present an arena where science and politics collide. As Samuel Walker, former historian of the Nuclear Regulatory Commission, highlighted, the Atomic Energy Commission disregarded precautionary science and failed to obtain local and state agreement during its first attempt to site a waste repository in 1970s [17]. In 1982, the US Congress passed the Nuclear Waste Policy Act, mandating the geological disposal of spent fuel and high-level

wastes. While multiple sites were under consideration, the Congress ultimately designated the Yucca Mountain, Nevada, site to be the only one for permanent disposal.

Since then, technical and political disputes surrounding the choice of Yucca Mountain have never ceased. Supporters believe that Yucca Mountain is optimal only because of its location and rock type; opponents, however, argue that “politics not science” determines the decision on site selection [18]. In 2002, the US DOE, with the backing of the President George W. Bush and Congress, overrode the State of Nevada's objections and approved the Yucca Mountain site for a nuclear waste repository. His successor President Obama, however, proposed budget cuts for the project, stating that Yucca Mountain is “not workable” [9]. This decision has been widely criticized for its lack of scientific justification [9]. Considering these long-term disputes and policy contradictions, we investigated how competing policymakers and stakeholders perceive the role of scientific evidence in determining nuclear energy policies.

1.2. Policy decision-makers' perception of science-driven policy

Prior research has examined policy decision-makers' perception and the use of scientific evidence in various policy contexts [6]. Research in this field has used different methods—qualitative, analytical, and quantitative—and works at different levels of analysis, ranging from behavioral decision theory to systems theory [19]. One common conclusion emerging from these lines of literature is that policy decision-makers' attitudes toward the use of scientific evidence varies depending on the responsibilities, needs, and goal-oriented interests. Following the Two-Communities Theory [20], each member of scientific and policymaking communities has distinct “cultural baggage” that entails unique sets of communication styles, targets of interest, cognitive frameworks (e.g., perception, motivation, decision-making, and goal setting), and focal interests to policy discussions. As a result, policy decision-makers' perception and use of scientific evidence is largely influenced by a combination of such cultural and psychological factors.

Specifically, employees of governmental bodies, such as the DOE and the EPA, that have played an active role in funding and disseminating scientific research might perceive a positive role of science in driving policy. Their positive attitudes can be explained by the availability of their on-site research resources and a strong motivation to promote research supportive of policy change [6]. In a similar vein, people working for nonprofit or for-profit organizations (e.g., think tanks, consulting firms, and private research institutions) that seek to provide expertise and knowledge-based advice to the government might also value the use of scientific evidence in policy debates [19]. Members of such groups have also frequently testified in Congress and served as information and commentary sources for mass media [21]. They would therefore need scientific evidence to back up their positions and establish intellectual legitimacy within society [22].

In addition, members of organizations that enter the policy process through organized interests (e.g., industry and advocacy groups) are willing to uptake scientific evidences that support their favored policies. However, they often “ignore, downplay, distort, or vociferously contest scientific knowledge that fails to support a group's desired policies” and tend to prioritize economic and political considerations over scientific evidence when initiating a new policy [19].

There have been various institutions, organizations, and interest groups involved in making nuclear policy decisions in the United States, ranging from state governments, nuclear industry, and nongovernmental bodies to concerned public [8]. Given their distinct institutional responsibilities and interests, policymakers

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