

DISKUSSIONSFORUM

Research on Nuclear Energy in an International Context

Challenges for Empirical Research Design and Preliminary Findings

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Nuclear energy is a complex system with social, technical, economic, environmental, political, and cultural dimensions. It is also a globalized system involving international transfers of knowledge, materials, technologies, people, and products. Accordingly, it is important to examine nuclear energy as an international phenomenon using interdisciplinary analytical approaches. This paper describes a project by a U.S. researcher examining organizational, institutional, and public communication about nuclear energy in Germany as a first step toward a cross-national comparison. The approach taken differs from standard technology assessment methods, relying more on qualitative fieldwork and interpretive analysis. Preliminary results are presented comparing public and political discourses of nuclear energy, regulatory practices, and organizational and institutional strategies in the U.S. and Germany.

1 Introduction

Nuclear energy is more than a physical phenomenon, a set of technologies, and a source of power in a context of growing and changing societal demands. It is a complex sociotechnical system encompassing basic research, technology development and implementation, operations demanding high reliability and safety, regulation, policy, and financing. Taken together, these elements present broad social, economic, environmental, political, and cultural imbrications. Nuclear energy is also a globalized system involving international transfers of knowledge, materials, technologies, people, and products including electrical power, toxic wastes and other environmental hazards, and

materials and knowledge that must be carefully safeguarded. In this global context, it is necessary to examine nuclear energy as an international phenomenon using interdisciplinary analytical approaches. Although understanding the particulars of individual national programs remains important, those programs are now more interdependent than ever. Social scientific knowledge grounded in studies of particular national programs must be expanded and adapted accordingly.

This article reports on an interdisciplinary project examining the state of nuclear energy in Germany from organizational, institutional, political, and cultural perspectives. The analytical framework for the project is drawn primarily from U.S. approaches to communication studies and from the international, interdisciplinary field of Science and Technology Studies. The project's research methods are qualitative in approach, utilizing interpretive strategies grounded in phenomenology, critical theory, and rhetoric. In this way, the project diverges from more traditional approaches to technology assessment. As appropriate for the "Concepts and Methods" section of this journal, the primary purpose of this article is to characterize the project's analytical and methodological approaches for the technology assessment community. A second purpose is to briefly present some early research findings, primarily by highlighting comparisons between the nuclear energy system in Germany and the corresponding system in the U.S. As noted above, however, this national comparison is presented in the context of a broader, increasingly global system that transcends national and regional boundaries. As this article was in preparation the nuclear disaster at the Fukushima Dai-ichi facility in Japan has transformed the analytical context; although the long-term effects of the events at Fukushima cannot yet be assessed, the article responds to those events to the degree possible at this time.

2 Research Context and Focus

With support from the U.S. Fulbright Scholars Program and the German-American Fulbright Commission, the author spent four months in Germany during the Spring of 2010. Based at the Institut für Kernenergetik und Energiesysteme (IKE) at the

University of Stuttgart, the author also conducted interviews at other locations including Berlin, Darmstadt, Heidelberg, and Karlsruhe, visited two German nuclear power plants and the proposed underground nuclear waste repository site at Gorleben. Interviews were conducted with nuclear engineers, energy policy analysts, regulatory officials, sociologists, a historian, technology assessment specialists, independent scientists working in the areas of energy and environment, and the creator of a public art exhibit critical of nuclear energy. These interviews were combined with a review of publically-available documents in English drawn from German sources spanning federal and state agencies, regulatory organizations, university research programs, independent scientific research institutes, and journalistic reports on nuclear energy. These research materials have been interpreted in the context of the author's 17 years of social scientific research on nuclear energy in the U.S., which has spanned the fields of nuclear fusion, environmental remediation and public communication at former U.S. nuclear weapons production sites, and commercial nuclear power. Since 2009, the author has also collaborated with members of the Japanese nuclear energy community as an additional step toward developing a framework for a global analysis of nuclear organizations, institutions, and policies.

Building on this foundation, the present research project seeks to assemble a set of case studies of national nuclear programs. Each program is of interest in its own terms, as part of a cross-national comparative study, and as part of a broader study of the interconnected global nuclear energy system. At present, the U.S. and German cases provide an opportunity to test the principles for cross-national comparisons and integrative analysis.

3 Analytical Framework

As noted above, this project's approach differs from typical approaches to technology assessment. Rather than collecting and analyzing quantitative data, the project adopts an interpretive approach grounded in critical cultural analysis. The objects of analysis are communication processes and artifacts, rhetorical action in range of settings, textual materials including material and social

texts, and broad formations of discourse surrounding nuclear energy. Examples of this approach applied to U.S. contexts include work by Farrell and Goodnight (1981), Katz and Miller (1996), Kinsella (2001), Kinsella (2005), Taylor et al. (2005), and Taylor et al. (2007). Here the term "cultural" is applied broadly, encompassing questions of values, world-views, and practices as manifested in organizational, institutional, public, and political contexts. These, too, are necessary elements in the assessment of sociotechnical systems.

Along with this focus on communication, rhetoric, and discourse the project utilizes analytical concepts drawn from the sociology of science and technology, science and technology studies, and research on public understandings of science and technology. Actor network theory, for example, provides a set of resources for examining how complex sociotechnical systems assemble knowledge, people, policies, apparatus, organizations, and institutional elements into dynamic wholes (e. g. Latour 2005). This interdisciplinary perspective contributes to the field of technology assessment by providing "big picture" insights into how specific technologies are embedded in larger systems that enable and constrain their effectiveness, impacts, social and political implications, and overall viability.

Such an approach entails a multitude of questions at the "micro" level of local practices, as for example in the training of engineering students at a university nuclear energy research institute. At the same time, other questions involve "macro" level phenomena such as public opinion trends, government policies, and economic and political environments. This project's approach emphasizes that the micro and macro levels, as well as the dual principles of social action and social structure, are interdependent and mutually constitutive (cf. Giddens 1984).

4 Research Methods

Questions of validity, reliability, and generalizability are not absent within interpretive approaches such as the one employed in this project, but they must be assessed differently (Denzin, Lincoln 2005; Giddens 1993). The researcher should seek a close and detailed familiarity with the settings

studied; demonstrate coherency, fidelity, and plausibility in narrative analyses of the phenomena studied (Fisher 1987); and test those narratives in consultation with members of the community under study. “Etic” understandings brought to the project by the researcher, products of pre-existing conceptual frameworks and established research literatures, intersect with “emic” understandings that circulate within the community studied, as observed and recorded in the field (Pike 1967). The knowledge produced in such research is a product of the interaction of these etic and emic elements as they are reconciled, reevaluated, and brought together to ground productive insights.

For this project, fieldwork at the micro level in Germany included unobtrusive observation and participant observation over a four-month period as a visiting researcher at a university nuclear energy institute. Assigned an office within one of the institute’s departments, the researcher interacted with faculty and doctoral students informally on a daily basis, conducted eleven formal interviews with faculty and doctoral students, participated in seminars and colloquia, presented four colloquia, observed one student dissertation presentation and practice presentations for a number of conference papers, toured the laboratory facilities, and participated in one instructional laboratory exercise. This fieldwork had two purposes: to gather factual information about nuclear energy technologies, policies, programs, and issues in Germany; and to become familiar with the practices, values, attitudes, and world-views of nuclear professionals and professionals in training.

Beyond the host institution, the researcher travelled to a number of sites in Germany to conduct fourteen interviews with technology assessment specialists, sociologists, energy policy analysts, independent scientists, regulatory officials, and the designer of an art exhibit critical of nuclear energy. Participation in a two-day conference on risk governance afforded an opportunity to meet informally with a number of policy specialists, social scientists, and others working on energy technology issues. An additional interview with two French nuclear officials, following up on a brief initial meeting at that conference, was conducted by telephone shortly after the conclusion of fieldwork in Germany.

Visits to two German nuclear power plants operated by different companies, one utilizing boiling water reactors and one using pressurized water reactors, provided direct access to the technological apparatus at the heart of the nuclear energy system. These visits also served as extended opportunities for informal interviews with engineering and public relations staff at the two sites. Similarly, a tour of the controversial, proposed nuclear waste repository site at Gorleben, arranged for a group from the researcher’s host institute, became the occasion for a two-day conversation with nuclear professionals about the state of Germany’s nuclear energy programs. Another informative and illuminating experience was a visit to an art and photography exhibit critical of nuclear energy, including conversations with a number of the exhibit’s staff and followed by an interview with the exhibit’s designer.

Throughout the four months of fieldwork, the researcher acquired and read numerous documents suggested by the host institute’s members and other interviewees. These included technical reports, policy papers, topical documents intended for more general audiences, and news reports on energy and nuclear energy issues. Because the researcher has no German language skills, all interviews and documents were in English. This is clearly a significant research constraint and a source of selectivity, but was not an impediment to productive data collection because of the high degree of English language competency within the community studied. The constraint posed by the four-month fieldwork schedule probably exceeds the constraint posed by the language difference.

A broader range of experiences, including observations of environmental and land-use protests, conversations about energy and environmental issues with people beyond the community studied, and visits to German history and technology museums, helped to provide a more general interpretive context for the questions studied.

5 Preliminary Findings

From these materials, focal themes emerged recursively over time. Applying an informal constant comparative method (Glaser 1965; Glaser 1992), the researcher began with a set of broad

questions and moved toward more specific questions guided by the data collected. Prominence, emphasis, and frequency of appearance of themes in interviews, observations, and textual materials led to a set of preliminary findings as summarized below. These are presented in part as specific to the nuclear energy domain in Germany, and in part as comparisons between the German and U.S. contexts. The themes are organized within three broad categories.

5.1 Public and Political Discourses of Nuclear Energy

The first theme was prompted by early conversations with some of the researcher's hosts, but was sustained and developed further throughout the course of fieldwork. Issues surrounding nuclear energy appear to be far more contentious in Germany, relative to the U.S., in terms of both the strength of attitudes held and the degree to which members of the population pay attention to those issues. In the U.S., at least prior to the events at Fukushima, nuclear energy controversies have been background topics rather than salient ones for most of the population. Increased (but still-controversial) concerns regarding the problem of global climate change, concerns regarding energy costs and energy security, and opportunities provided by the Energy Policy Act of 2005 have led to a vigorous campaign by the nuclear industry to support the construction of new reactors and to extend the lifetimes for existing ones. Opponents and critics of nuclear energy have responded, but for most Americans the proposed nuclear expansion has not been a prominent issue. The greatest impediment to a nuclear expansion has not been public controversy, but instead has been the problem of financing costly, lengthy, and risky new construction projects.

In Germany, a far greater fraction of the population appears to take a strong and direct interest in nuclear energy issues. Nuclear controversies predate the accidents at Three Mile Island (more typically known to the researcher's German hosts as "Harrisburg") and Chernobyl. These controversies are grounded in part by environmental politics as they have evolved since the 1970s and in part by conflicts during the

1980s over the basing of U.S. nuclear weapons in Germany. Existing concerns were magnified and expanded by the Chernobyl catastrophe, which had direct and dramatic effects on the consciousness of many people throughout Germany.

In addition to these historical roots, attention to nuclear energy in Germany is informed by a political and institutional context quite different from that of the U.S. Nuclear energy appears to circulate as a form of political currency within the multi-party national government, playing an important role in the formation and maintenance of party coalitions and challenges to those coalitions. Similar patterns appear in the complex relations between states (Länder) and the national government. The essential tensions do not appear to be as much between government and industry, as in the U.S., but across lines of dispute within the federal and state governments. In the U.S., industry and interest group lobbying in support of federal government policy choices is the locus of political action; in Germany, political action appears to operate more in the public domain.

A related theme that emerged early and persisted throughout the fieldwork period is the central role of nuclear waste as both a material and a symbolic site of controversy. The researcher was told repeatedly that no aspect of nuclear policy generates as much controversy as waste transportation and disposal. In the U.S., cost issues dominate nuclear debates, probably followed next in prominence by issues related to reactor safety and incremental environmental contamination. Nuclear critics and opponents do make arguments about waste storage, disposal, and transportation, but these are not prominent concerns for most Americans. The prominence of nuclear waste issues in Germany was highlighted during the researcher's visit to the proposed repository site at Gorleben, where the facility's operators have left in place office windows damaged by protestors. The kinds of violent protests and police actions that have taken place in Germany around nuclear issues are far less common in the U.S.

5.2 Regulatory Policies and Practices

A theme that emerged later, but that appears to have significant potential for further development,

is the contrast between nuclear regulation policies and practices in Germany and the U.S. Citing a study by the Center for Strategic and International Studies (CSIS), Perin (2006) remarks that most nuclear regulation in the U.S. is self-regulation by plant operators and industry organizations such as the Institute of Nuclear Power Operations (INPO). According to Perrin, inspections by the U.S. Nuclear Regulatory Commission “customarily cover only about 5 percent of all equipment and programs at an ‘average’ plant and about 10 percent at plants with problematic records” (p. 8). Lacking comparable statistics for German plants, the researcher has inferred from interviews that the degree of regulatory penetration is probably significantly higher in Germany. Moreover, nuclear regulation in Germany is accomplished through an interlocking system of Länder-level and federal-level authorities, with a key role played by non-governmental technical service organizations (TSOs). Interviews with regulatory officials, nuclear engineers, and policy analysts indicate that this system may be more robust and resistant to problems of regulatory “capture” or “recreancy” (Freudenburg 1993) relative to the U.S. system.

5.3 Organizational and Institutional Strategies

The themes discussed above intersect with another set of questions surrounding organizational and institutional strategies in the German and U.S. contexts. At the time of this project’s fieldwork, Germany was tentatively and controversially committed to a gradual phase-out of nuclear power plants, but later in 2010 the phase out plan was interrupted by a decision to extend the lifetimes of some reactors. Shortly after the disaster at Fukushima, the reactor lifetime extension was reversed. The ultimate fate of this long-standing policy controversy is not yet clear. What Germany and the U.S. have shared for some time, however, is a situation in which nuclear institutions have had to sustain themselves by a combination of exportation of knowledge and technologies, diversification of activities, and continued efforts to maintain viable bases of expert personnel and technical knowledge. How the two nations’ nuclear institutions

continue to manage these challenges promises to be another area for further investigation.

6 Conclusion: Interpretive Research as Technology Assessment

The future of nuclear energy technologies in Germany, the U.S., and elsewhere depends not only on strictly “technological” factors such as reactor designs, safety systems, and methods for waste disposal. None of those elements can be fully understood outside a broader context of public opinion, government policy, and organizational and institutional practice. This article presents an example of how such elements can be evaluated using approaches grounded in interpretive concepts, data, and methods, contributing to a broader vision of technology assessment.

Note

- 1) The author wishes to thank the U.S. and German Fulbright Commissions and his hosts at the Institut für Kernenergetik und Energiesysteme (IKE) at the University of Stuttgart.

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