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Energy Policy 36 (2008) 1344–1354

ENERGY POLICY

www.elsevier.com/locate/enpol

# An international comparison of regulatory organizations and licensing procedures for new nuclear power plants

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Received 13 May 2007; accepted 22 October 2007
Available online 30 January 2008

**Abstract**

This paper considers measures needed to license new nuclear power plants efficiently. We base our analysis on international standards and a comparison of the national regulatory and licensing framework in seven countries (Canada, France, Germany, Japan, Switzerland, the UK and the USA). We split the review into the organization of regulatory responsibilities and the licensing process. We propose a set of considerations that should be incorporated into national solutions. While conscious of the different cultural fundamentals of each region, we hope this paper will help fuel an emerging debate on this highly topical issue.
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*Keywords:* Nuclear power; Safety regulation; Licensing

## 1. Introduction

After some decades of stagnation, a revival of interest in nuclear power is underway in several western countries. This is mainly due to four factors: increasing political instabilities in fossil-fuel exporting countries; declining domestic natural energy resources; growing concerns about greenhouse gas emissions; and increasing demand for electricity. Each country faces its own balance of factors and approaches these questions differently based mainly on the level of their national nuclear–industrial capacity. One aspect is common to all countries, if nuclear power plants are to be built again, then fresh attention must be paid to their licensing.

This paper aims at giving an overview of the national regulatory and legislative systems of Canada, France, Germany, Japan, Switzerland, the UK and the USA together with their common international legal basis. Based on this material, we have synthesized a hybrid solution that may be more efficient for the approval of nuclear new-build.

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0301-4215/$ - see front matter © 2008 Published by Elsevier Ltd.
doi:10.1016/j.enpol.2007.10.035

## 2. Context and methodology

### 2.1. Main issues for the nuclear renaissance

A project to develop a new nuclear power plant generally follows a common path: selection of a site, construction, testing of the facility and finally operation within prescribed limits. The design will be reviewed in most cases during the site review but a generic review may be undertaken beforehand. The four main stakeholders are the public, investors, environmentalists and regulators/governments. We note that the public and investors are two broad groups with rather unclear limits. Investors, who may pay attention to regulatory efficiency or public acceptance, include operators, financial institutions or vendors, in case they take part in the investment (e.g. by accepting some of the financial risks arising from regulatory delays or further costs). The "public" includes electricity consumers, but we posit that public come to licensing consultations more as citizens in general rather than as electricity consumers concerned primarily with energy prices.

At the heart of the process, public acceptance is a prerequisite, which is mostly required during the siting

step. If one accepts a site for a new nuclear plant, then one must also have already embraced the overall idea of building a nuclear plant. Western public anxiety towards nuclear power emerged strongly after the accidents of Three-Mile Island, PA, USA, in 1979 and Chernobyl, Ukraine, in 1986. Arguably, the modern public fundamentally mistrusts political elites and large companies. Furthermore, the link between nuclear innovation and the military results in a widespread perception, and arguably a reality, of top-down nuclear strategy surrounded by a climate of secrecy (Flam et al., 1994). Publics and other stakeholders are therefore likely to be highly sensitized to the democratic features of any siting policy.

During the 1980s environmental groups greatly improved the effectiveness of their actions (Rudig, 1990; Joppke, 1993). Processes for democratic public participation must be receptive to the remarks of all stakeholders while being robust enough to attenuate shrill voices and to resist forces that seek to undermine proper policy processes.

The licensing system must give attention to investors' economic concerns, as no project is likely to receive investments as long as costs remain uncertain, especially the project costs incurred by long public inquiries.

Nuclear power planning is highly cross-disciplinary and relates to numerous technical and social issues. The technology is highly complex, it requires an especially skilled workforce, it requires access to significant quantities of cooling water, and it yields radioactive spent fuel (waste) and leaves a decommissioning legacy. During licensing, the regulator must therefore have a thorough and informed appreciation of each aspect of the project.

### 2.2. National backgrounds

The seven countries that we decided to analyse are each unique. On the cultural side, we have three *laissez-faire* countries, all sharing a long-standing belief in the benefits of competitive markets (Canada, the UK and USA) and we have four countries with traditionally a more *dirigiste* approach (France, Germany, Japan and Switzerland).

All of them—except Switzerland—have developed large indigenous nuclear industries. Switzerland acquired full nuclear design capacity temporarily, from the fusion of Asea and Brown, Bovery and Co. until ABB's sale of its nuclear business to BNFL in 2000. The UK made an equivalent move with the 2006 sale by BNFL of Westinghouse to a consortium led by Toshiba.

Historically, three of the countries considered here developed military nuclear research programmes, which drove progress in civil nuclear applications (France, the UK and USA). The other countries mentioned here have no current nuclear weapons programmes and are parties to the non-proliferation treaty (Canada, Germany, Japan and Switzerland).

Concerning public acceptance, the British, German and US public are widely perceived to be strongly opposed to nuclear power. By contrast, it is widely assumed that French and Swiss populations are supportive of, or at least not opposed to, nuclear power (the Swiss have rejected six different referenda to withdraw from nuclear power generation over the last 20 years). In reality, however, public opinion is less clear-cut.

Mainly as a consequence of public opposition, most of the countries considered here have not built any nuclear power plant for more than 10 years: Germany, Switzerland, the UK and USA. Germany has implemented a slow nuclear phase-out since 1998.

### 2.3. Methodology

A comparison of different national regulatory and legislative systems has the potential to be very constructive in a context of an increasingly internationalized nuclear industry and utilities; active international environmental groups; and national publics sharing worldwide common references points. Advocates and opponents of nuclear new-build face common global issues, but must undertake their activities in national or sub-national regulatory and legal landscapes. Comparing countries' procedures, while keeping in mind their cultural fundamentals, is the basis of the work reported here.

In addition, an international cross-comparison may help benchmark the current efficiency of the national licensing procedures, especially those of countries where no new nuclear plants have been built for 15–20 years. These questions are all the more interesting because little academic work has been done on these questions. Some studies compared national regulatory and legislative regimes in the late 1960s (ENEA, 1969; Puget, 1967) but the subject has been relatively neglected since then. Only the Nuclear Energy Agency reports now on the different national systems (NEA, 2000, 2001, 2003) but it does not analyse its data comparatively. One international comparative review of technical issues related to nuclear safety has been published very recently, but it does not investigate policy issues and does not propose any efficient ways of licensing new plants quickly (Raetzke and Micklinghoff, 2006).

The analysis presented here is restricted to civil nuclear power plant licensing. Defence and other nuclear installations are not covered; neither are the economic and security issues of nuclear regulation. The whole licensing procedure for the plant creation is reviewed, apart from decommissioning. This is because, in part, the issues of end-of-life decommissioning, when examined from a perspective prior to initial construction, are predominantly economic rather than legal or technical. In addition, decommissioning wastes differ from fuel cycle wastes raising issues beyond those that can properly be considered here.

The factors that we consider are the regulator's independence from the government, especially the nature of the licensing authority; its consultation of external bodies; the licensing process (steps, public participation,

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