

Decommissioning of Nuclear Power Plants and Storage of Nuclear Waste in Europe - Comparison of Organization Models and Policy Perspectives

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Overview

The decommissioning of nuclear power plants (NPP) and the long-term storage of nuclear waste are major challenges to energy policy. A large number of European reactors have reached the end of their lifetime and with Germany shutting down its nuclear fleet in the years to come, some countries are already confronted with the organisation of the decommissioning process and the subsequent management of nuclear wastes. The decommissioning process is technologically challenging and the ongoing search for storage sites is a long and challenging process. The financing is complex, it is not always clear whether the operator or the government is in charge. Additionally, the relationship between the oligopolistic nuclear industry with only a few suppliers for special nuclear services and the national regulators is characterized by an asymmetric information distribution between the two parties, a classical principal-agent problem.

This paper analyses and compares different strategies of organising the process of decommissioning NPPs, and storing the nuclear waste. The paper is based on a recent research project by the authors in the case of five major nuclear countries (Wealer, Seidel and von Hirschhausen, 2017), and in-depth case studies on the technical, economic, and institutional developments for these countries.

Methods

We deploy a comparative institutional approach to describe the strategic choices of plant operators and national and international governmental bodies, the “regulators”. We distinguish the two main elements of the strategy: the process needs to be financed, and someone has to manage the production process of the decommissioning and the waste storage. The case studies are based on a detailed scheme of analysis (Wealer, et al., 2015). Figure 1 shows the essence of the matrix, that provides for different “organizational models” for the sector: the y-axis specifies different ways of financing the process, such as the federal budget, a dedicated fund (private or public), in-house financing by the companies, and yet others. The x-axis shows different actors that could carry out the decommissioning and the storing. These actors can be private or public companies, generally regulated under incentive- or cost-plus regulation.

Production / Financing	A) Public enterprise	B) Public tender (centralized or decentralized)	C) Further alternatives	D) Private enterprise (decentral or status quo)
1) Public budget				
2) Unitary public funds				
3) Separate Funds				
4) Further alternatives				
5) Decentral provisions (status quo)				

Figure 1: Options for organizing decommissioning of nuclear power plants and storing nuclear waste – A matrix of financing and production

The empirical part of the paper includes five case studies, that have been developed by the authors for five countries with a strong nuclear sector: the Germany, the U.K., France, Switzerland and Sweden. The case studies are based on in-depth desk research, but on-site case studies are planned.

Preliminary Results

The financing of both processes is a long-term challenge and cost estimations are underlying uncertainties due to the long time-scales, and estimated interest and inflation rates. This could lead to an underestimation of future costs in all of the observed countries. In Germany, the financing and liability system was reformed in 2016 and the liabilities for the storage are going to be transferred to a public fund. In the UK, the lessons learned from the shortfall of former provisions for the older Magnox fleet led to the establishment of a public fund for the operational fleet. In France, the financial resources are secured in internal segregated funds with administrative control and oversight by national authorities, but there are concerns that costs are underestimated and the impending bankruptcy of EDF and Areva aggravates the situation. In Sweden, the financial resources are secured in the public Nuclear Waste fund, which is characterized by a high degree of authority control, transparency and public participation. Switzerland is characterized by a high level of transparency in the field of cost estimations and investment policy and is the only country with two segregated public funds: one for decommissioning and one for high level waste storage.

The production of both processes is technologically challenging and both processes were in most cases neglected, hence decommissioning experiences are scarce and an operational high level waste disposal facility is still missing. While the siting and future operation of such a facility is the scope of a public company, the decommissioning of the power plants - except for the British and German legacy fleets - is more or less done by private companies. Overall, it can be concluded that both processes are highly interconnected and need an integrated planning approach, e.g. missing waste disposal routes hinder the decommissioning process and interim storage facilities had to be built. The only observed country, where a more or less integrated planning approach could be observed is Sweden. Here no decommissioning experiences could be gained but the overall transparent planning of the decommissioning projects is linked to the realization of the different waste disposal routes and seems rather farsightedly. The findings for Switzerland are comparable to Sweden, with low to zero decommissioning experiences but a well-defined site selection process for a high level waste repository.

Conclusion

Decommissioning of NPPs as well as the search for a final storage site are complex challenges. This paper identifies lessons from the specific national European approaches to decommissioning and storage, in particular at the interaction between financing, service provision and regulation. In general, the approach with a public fund seems to be the most suitable to finance the future costs, to adhere to the "polluter-pays principle", and to mitigate the financial risks of the society even if it also could not overcome the problem of too low cost estimations. The payments to the fund should be spread over time in order to help the companies to adapt. The interdependencies between financing and production are too strong to be treated separately, therefore a joint approach for both will probably be the most efficient solution for the wicked problems of nuclear phase-out.

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