



Cross-country survey on the decommissioning of commercial nuclear reactors: status, insights, and knowledge gaps

Rebekka Bärenbold¹, Muhammad Maladoh Bah¹, Rebecca Lordan-Perret¹, Björn Steigerwald², Christian von Hirschhausen^{2,3}, Ben Wealer², Hannes Weigt¹, and Alexander Wimmers^{2,3}

¹Faculty of Business and Economics, University of Basel, Peter Merian-Weg 6, 4002 Basel, Switzerland

²Workgroup for Economic and Infrastructure Policy, TU Berlin, Straße des 17. Juni 135, 10623 Berlin, Germany

³DIW Berlin, Mohrenstraße 58, 10117 Berlin, Germany

Correspondence: Christian von Hirschhausen (cvh@wip.tu-berlin.de)

Received: 31 March 2023 – Accepted: 19 May 2023 – Published: 6 September 2023

Abstract. In the past, nuclear decommissioning has often been overlooked in the literature but will gain increasing relevance amongst researchers and industry alike as more and more nuclear power plants reach the end of their respective operational lifetimes (Laraia, 2018; Schneider et al., 2022). Existing research has up until recently focused mostly on technical challenges and liability issues of nuclear decommissioning, while analyses of the organization, regulation, and financing across various countries remain limited. In this cross-country survey paper, we compare the differing approaches for nuclear decommissioning organization in France, Germany, Sweden, Switzerland, the United Kingdom (UK), and the United States based on detailed country reports (Wimmers et al., 2023). We find that while, in theory, the countries follow the same standards, the implementation of responsibilities for nuclear decommissioning, financial liability, and oversight can differ quite significantly. For example, France is the only country in our survey to have implemented a centralized ownership of its nuclear reactor fleet, while all other countries have multiple operators that necessitate a different regulatory approach. In terms of financing, we observe that most countries follow a single approach, while Germany and the UK have different financing schemes depending on the nuclear reactors to be decommissioned (e.g., the former GDR reactors in East Germany and the UK's non-PWR (pressurized water reactor) legacy fleet). Based on our analysis, we derive several insights that merit further research on the topic of nuclear decommissioning. For example, the interlinkage between ownership and nuclear decommissioning production should be of particular interest, as we determine potential organizational models (following the system approach coined by Beckers et al., 2012) emerging through corporate actors aiming at the monetization of swift decommissioning – a trend that cannot be observed where the state is in full control. We further find that only limited information on decommissioning costs exists. Reducing knowledge gaps in this regard would help further understand and potentially identify potential challenges in nuclear decommissioning in advance before more nuclear reactors are shut down. Further insight into nuclear decommissioning fund adequacy and liability issues might be required to avoid the transfer of financial liabilities from private operators to taxpayers. Other research gaps include an analysis of market-based decommissioning approaches and possible supply chain bottlenecks and the subsequent investigation of efficiency through economies of scale, the limitation of nuclear decommissioning production from limited access to nuclear waste management facilities, and the influence of regulation, e.g., the number of overseeing regulators, on the production.

The paper is based on a joint DFG project between TU Berlin and the University of Basel, entitled “Best practices for decommissioning nuclear power plants”.

Financial support. This research has been supported by the Deutsche Forschungsgemeinschaft (grant no. 423336886) and the Schweizerischer Nationalfonds zur Förderung der Wissenschaftlichen Forschung (grant no. 100018L 185154).

References

- Beckers, T., Gizzi, F., and Jäkel, K.: An Approach to Analyze ‘System Goods’ – Classification, Presentation, and Application, 2021–02, WIP-Working Paper, Berlin: Workgroup for Infrastructure Policy (WIP), Technische Universität Berlin, 2012.
- Laraia, M.: Nuclear Decommissioning, Vol. 66, Lecture Notes in Energy, Cham: Springer International Publishing, <https://doi.org/10.1007/978-3-319-75916-6>, 2018.
- Schneider, M., Froggatt, A., Hazemann, J., von Hirschhausen, C., Ramana, M. V., Wimmers, A. J., Sailer, M., Schneider, N., Suzuki, T., Stienne, A., Meinass, F., and Verbruggen, A.: World Nuclear Industry Status Report 2022, Paris: Mycle Schneider Consulting, <https://www.worldnuclearreport.org/IMG/pdf/wnisr2022-hr.pdf> (last access: 6 October 2022), 2022.
- Wimmers, A., Bärenbold, R., Bah, M. M., Lordan-Perret, R., Steigerwald, B., von Hirschhausen, C., Weigt, H., and Wealer, B.: Decommissioning of Nuclear Power Plants: Regulation, Financing, and Production, DIW Data Documentation 104, Berlin: DIW Berlin, German Institute for Economic Research, https://www.diw.de/documents/publikationen/73/diw_01.c.864222.de/diw_datadoc_2023-104.pdf (last access: 17 March 2023), 2023.