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Transaction Costs and Organizational Models in Nuclear Decommissioning

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Introducing Transaction Costs to Nuclear Decommissioning

Transaction costs: Transaction costs are real resources that are required to create and operate an institution. They are not directly linked to value creation but occur when goods and services are transferred across separable interfaces. (Williamson, 1979, 1985)

Dimensions of Transactions in Nuclear Decommissioning

Uncertainty

- Unknown degree of on-site radiological contamination of buildings and components
- Structural integrity of ageing concrete structures
- ...

Frequency

- Achievability of economies of scale through repetition of tasks and standardization uncertain
- Economies of scope limited due to complexity of radiation management
- ...

Asset Specificity

- Diverse nuclear power plant fleet structures limit standardization possibilities
- Historical neglect of decommissioning necessity during construction
- Specialized tools necessary
-

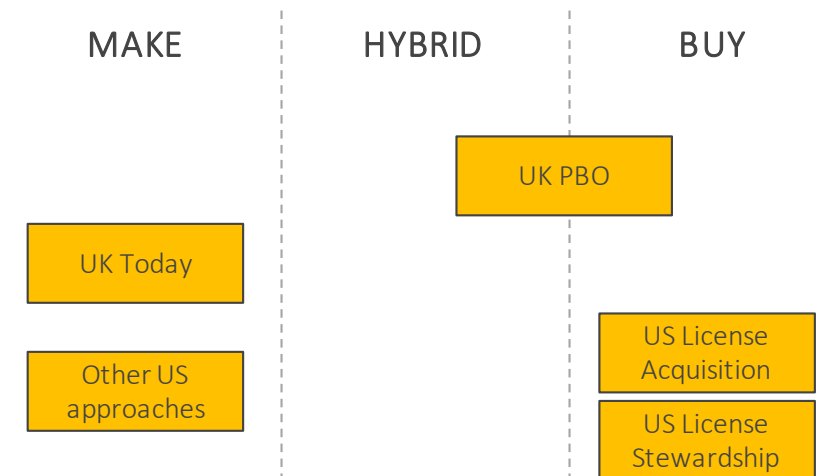
Theoretical Organizational Approaches to Decommissioning

Make or Buy?

“a firm [has] [...] a role to play in the economic system if it [is] possible for a transaction to be organized within the firm at less cost than would be incurred if the same transaction were carried out through the market” – Coase (1988, 19)

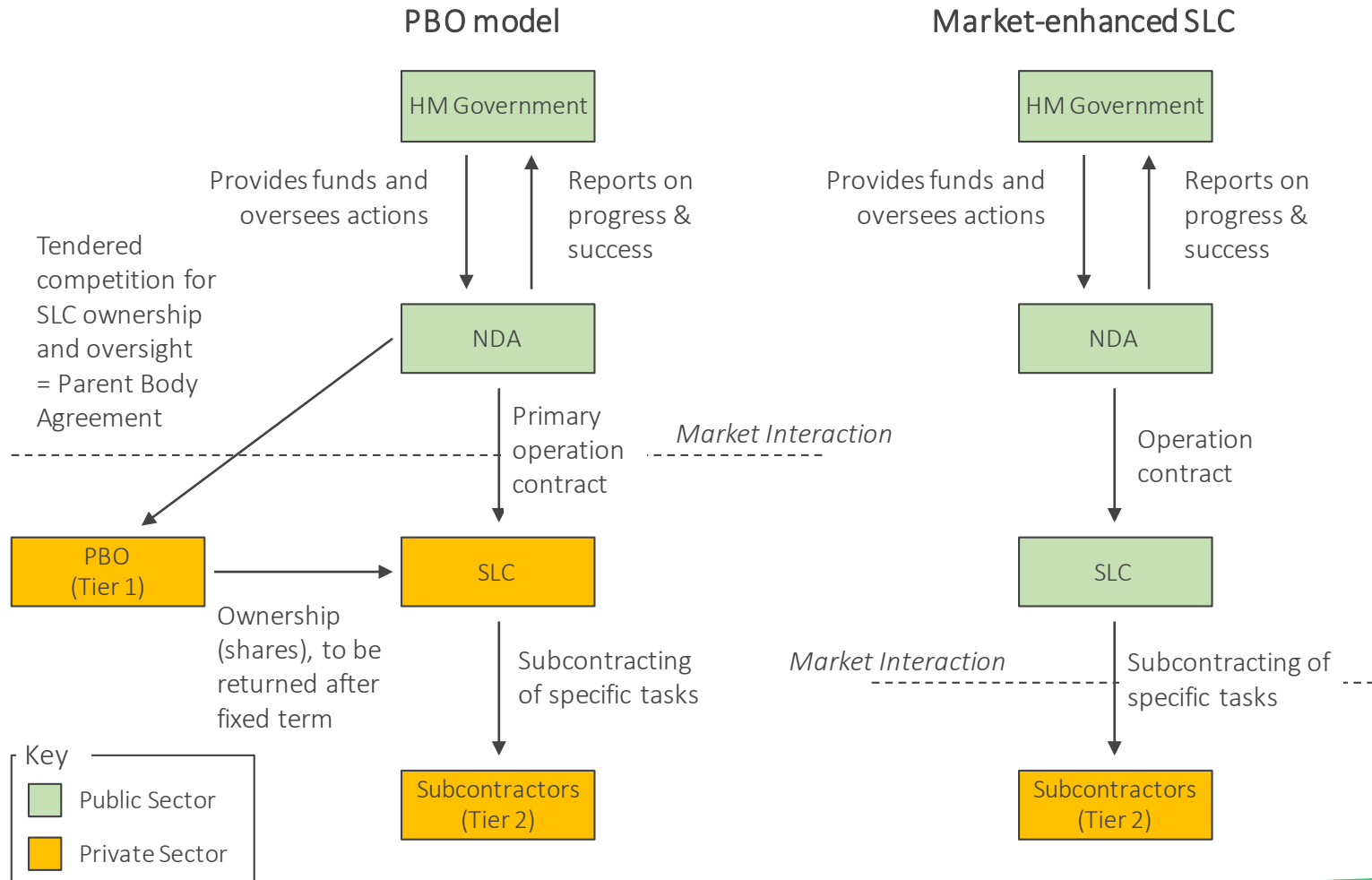
-> degree of vertical integration also known as “MAKE or BUY”

- Nuclear (decommissioning) industries in deregulated US markets and the United Kingdom both experience introduction of private, third-party, contractors to the organization of nuclear decommissioning
- We analyze these observed models on an organizational level (Tier 1); contracting on Tier 2, i.e., individual tasks (e.g., component segmentation) are not analyzed
- The results for the observed third-party introduction schemes are shown on the right



Nuclear Decommissioning Organization in the United Kingdom

Parent-Body-Organization

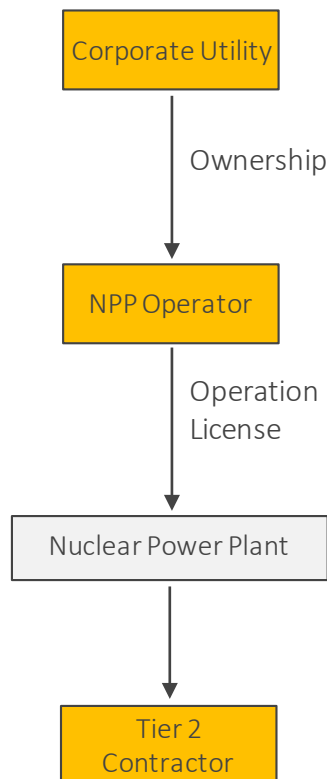


- From 2004 onwards, the UK introduced the “Parent-Body-Organization” (PBO) model to nuclear decommissioning
- The goal was to introduce competition to nuclear decommissioning while keeping (financial) liabilities for decommissioning and waste management with the state
- After initial efficiency gains, the scheme was retracted in steps for all nuclear assets as inefficiencies became apparent
- Today, the UK’s decommissioning industry is fully vertically integrated

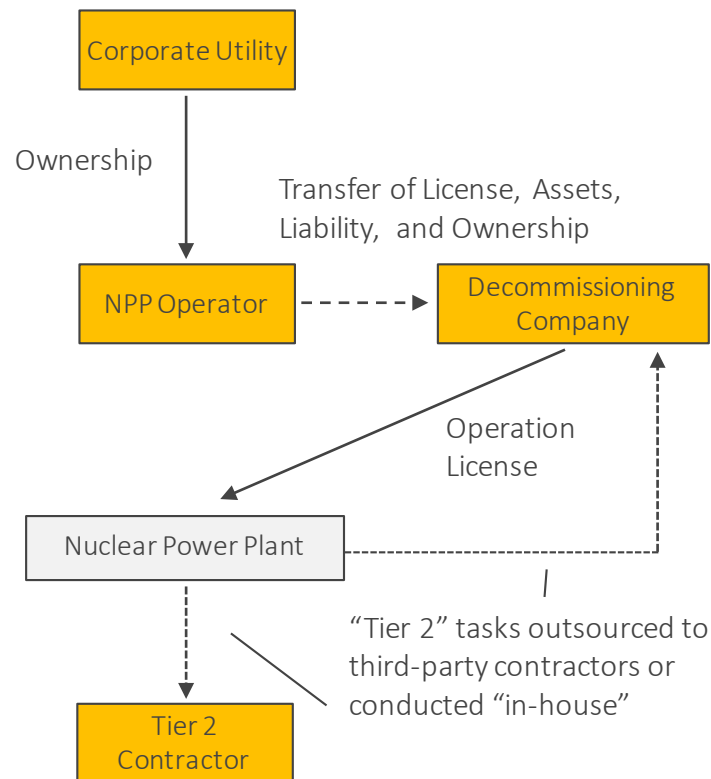
Nuclear Decommissioning Organization in the United States

Two “new” organizational models have emerged

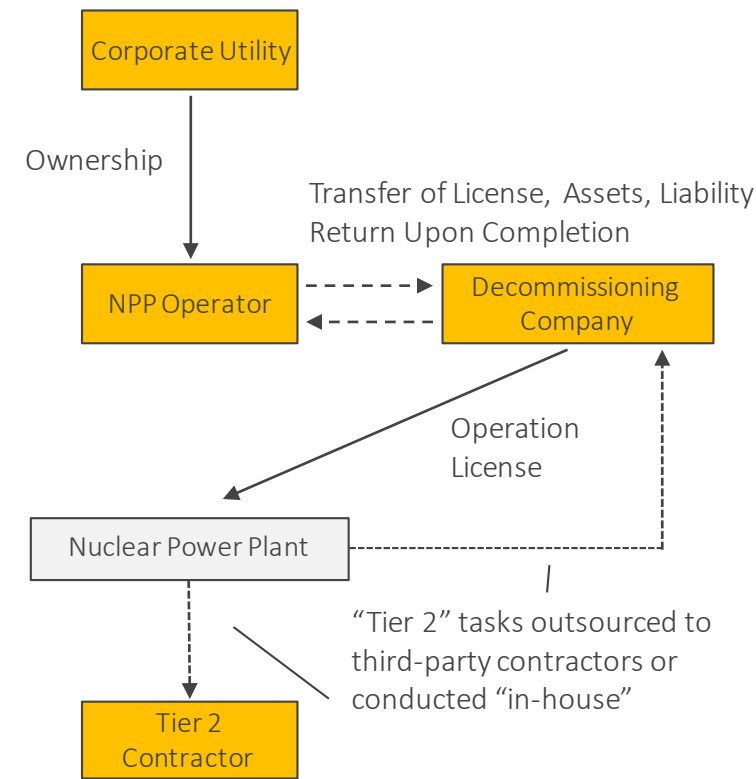
Operation and Conventional
Decommissioning



License Acquisition



License Stewardship



Nuclear Decommissioning Organization in the United States

License Stewardship and Acquisition Case Studies

License Stewardship

- EnergySolutions has international experience in nuclear decommissioning (former PBO in UK!)
- Leverages extensive asset base for decommissioning (low-level waste, waste processing, transportation, logistics)
- Completed decommissioning of Zion 1-2 and LaCrosse. Ongoing work at TMI-2 and Kewaunee
- Decommissioning of Zion completed within 13 years (2007-2020)
- Possibly Incentivized by access to Decommissioning Trust Fund and provision of waste removal route



License Acquisition

- All-inclusive fuel management contracts across U.S. and globally (wet and dry storage, ISFSI construction, spent fuel loading services)
- Supplier of NRC licensed dry cask storage
- Decommissioning subsidiary (HDI) currently overseeing decom at four NPPs (latest Palisades)
- Ongoing plans for consolidated interim waste storage facility in New Mexico ~ legal challenges



Nuclear Decommissioning Organization in the United States

Chances and Risks for International Decommissioning Industry?

These models can only function in the US because some necessary conditions are met (Stenger et al. (2019)):

- Flexible license transfer mechanisms
- Plant-specific nuclear decommissioning trust funds
- (financial) waste management responsibilities pooled with the US federal government

Chances

- Faster decommissioning reduces safety and security risks and possible reduces cost and sites can be reused for other (industrial) purposes
- Efficiency gains and learning might benefit future decommissioning projects as standardization and new technologies are implemented and might be implemented elsewhere!
- Clearly defined waste management pathways

Risks

- Profit-maximizing actors might cut corners in terms of security and safety
- Plants with limited DTF funds, high uncertainty or asset specificity might not be viable for model and might have to be “cleaned up” by final liability holder, which could be the state (or other actor)
- secure interim waste storage pathways limit the necessity to provide final solution



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Thank you for your attention!

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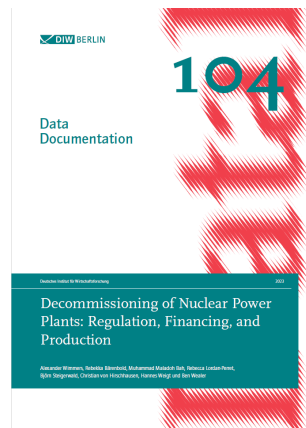
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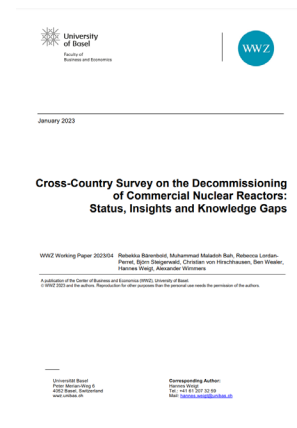
This research is freely accessible

DIW Data Documentation 104: Decommissioning of Nuclear Power Plants: Regulation, Financing, and Production



https://dx.doi.org/10.18723/diw_ddc:2023-104

WWZ Working Paper 2023/04: Cross-Country Survey on the Decommissioning of Commercial Nuclear Reactors



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