Learning from Sociotechnical Analogues for Monitoring of DGD

A Comparative Perspective on Wind Farms, Fracking, Carbon Capture and Storage (CCS) and Deep Geological Nuclear Waste Disposal

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Agenda

- Status Quo, NWG in Germany and Leading Questions
- Methode: Analysis of Sociotechnical Analogues
- Sociotechnical Ensembles
- The Analysed Major Infrastructure Projects
  - Wind Farms
  - Fracking
  - Carbon Capture and Storage
  - Final DGD Repository for Radioactive Waste
- Main Results & Conclusion

The Status Quo: An Unsolved Problem

Spent fuel interim storage Ahaus
Source: dpa

Morsleben
Source: dpa

- 370,000 tonnes of heavy metal of spent fuel (WNA 2018)
- No permanent repository for highly radioactive waste
- Double jeopardy: safety and security issues (Brunnengräber 2019)
- Challenges for future monitoring concepts → Known and unknown risks; „unknown unknowns“ (Eckhardt/Rippe 2016)
- Deep-rooted scepticism towards authorities and technology

Nuclear Waste Governance in Germany

- Decide, Announce, Defend (D-A-D Strategy)
- Gorleben as an example how it won´t work
- Development of a strong anti-nuclear movement
- Working Group on the Selection Process for a Repository Site (AkEnd) (1999-2002)
- StandAG – Repository Site Selection Act (2013/2017)
- Commission for a Permanent Storage of Radioactive Waste (2014-2016)
- Commission to Review Funding of Nuclear Phase-out (2016)
- New institutional architecture (BfE, BGE, NBG)

Leading Questions and Hypotheses

Questions:

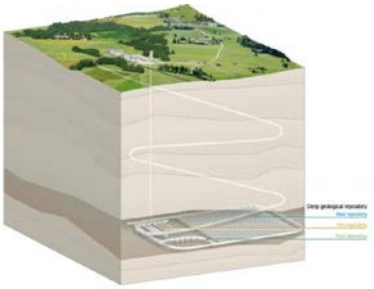
- What are the main challenges related to a long-term monitoring of such infrastructure projects and what are possible strategies to tackle these challenges related to the disposal of high-level radioactive waste?
- What is the role of public and civil society actors in the planning, deployment and monitoring of major energy infrastructure projects?

Hypothesis:

- We claim that the development of monitoring systems without civil society´s involvement is not effective and recommendable. A broad inclusion of different actors can help to design and improve monitoring systems.
- Critical questioning of future monitoring concepts and a topical dialogue between natural and social scientists, engineers, politicians and civil society with addition of local and lay knowledge can help identifying problems, mitigating conflicts and enables a more robust decision-making.

Method: Analysis of Sociotechnical Analogues

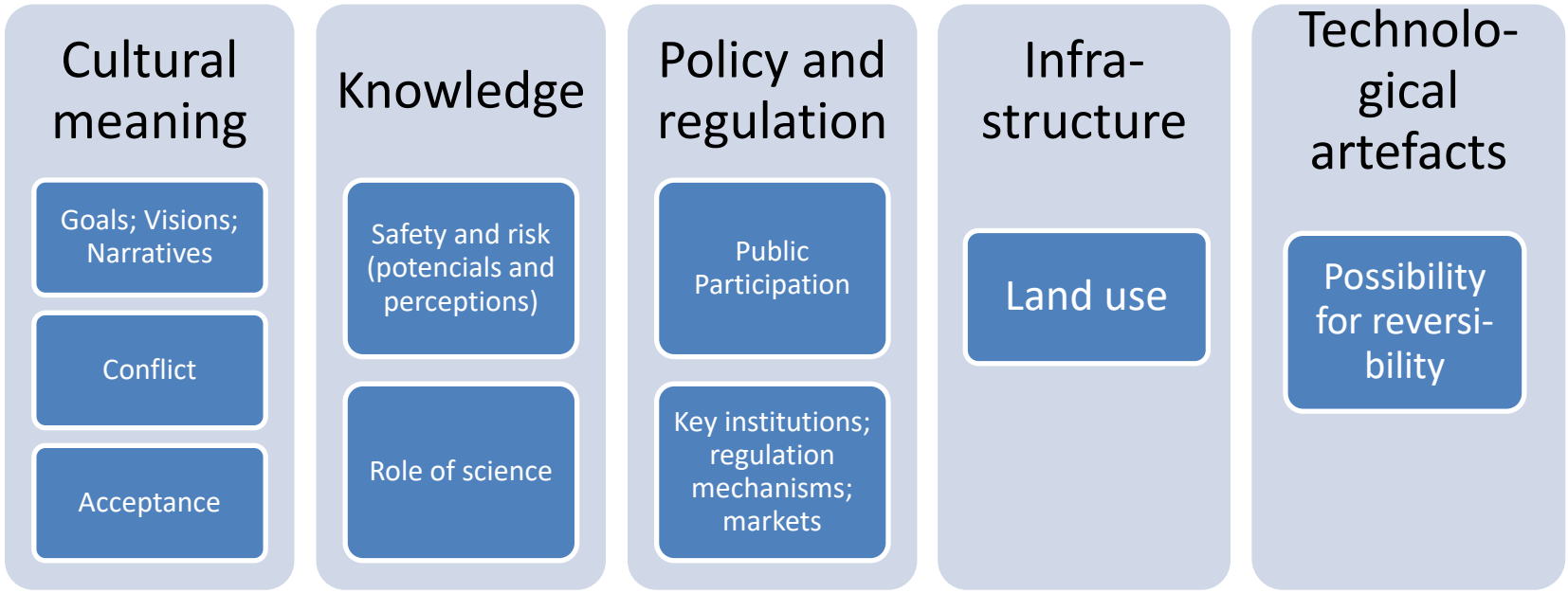
- Analysis of similiar infrastructure projects
- creation of an indirect experience horizons
- translate the findings regarding solutions of problems as well as upcoming social problems from one socio-technical context into another



Sociotechnical Ensembles

- Complexe sociotechnical interdependencies between different elements (Bijker)
- Transitions (Geels) as an interplay of multidimensional developments on three analytical levels:
- „**niches**“ – Anti-nuclear-movement, renewable energies
- „**regimes**“ – state-industrial nuclear complex
- „**socio-technical landscape**“ – Tschernobyl (1986), Fukushima (2011), Energy transition

Criteria-based Assessment

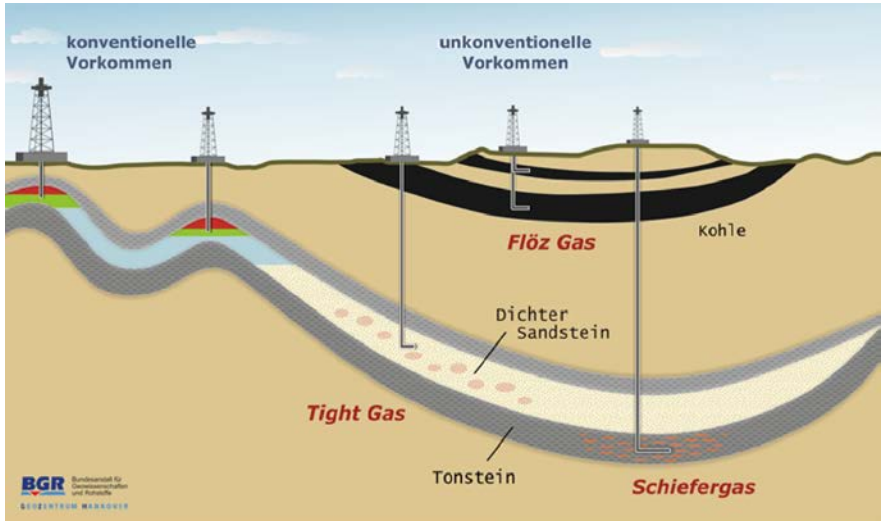


Wind Farms

By Brett Sayles

- One technical environmental innovation of the last decades (Ohlhorst 2009)
- Decentrale, renewable
- Developped from niche to widely recognized form of energy
- Protests against wind farms increase (Di Nucci /Krug 2018)

Fracking

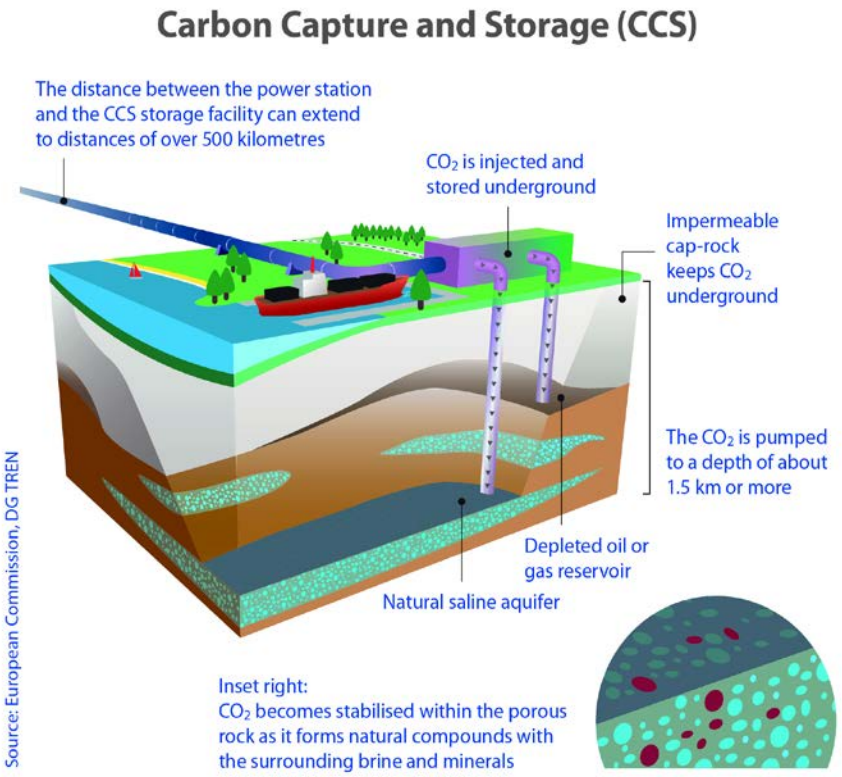


Source: BGR 2013

Welt.de, picture source: pi-Group

- A method to increase hydraulic conductivity e.g. to extract oil and gas from unconventional deposits
- In Germany mainly used in lower-saxony (325 fracs for tight gas, 3 fracs for shale gas)
- Most unconventional gas is produced in USA (543.575 billion m^3/a) (Statista 2017)

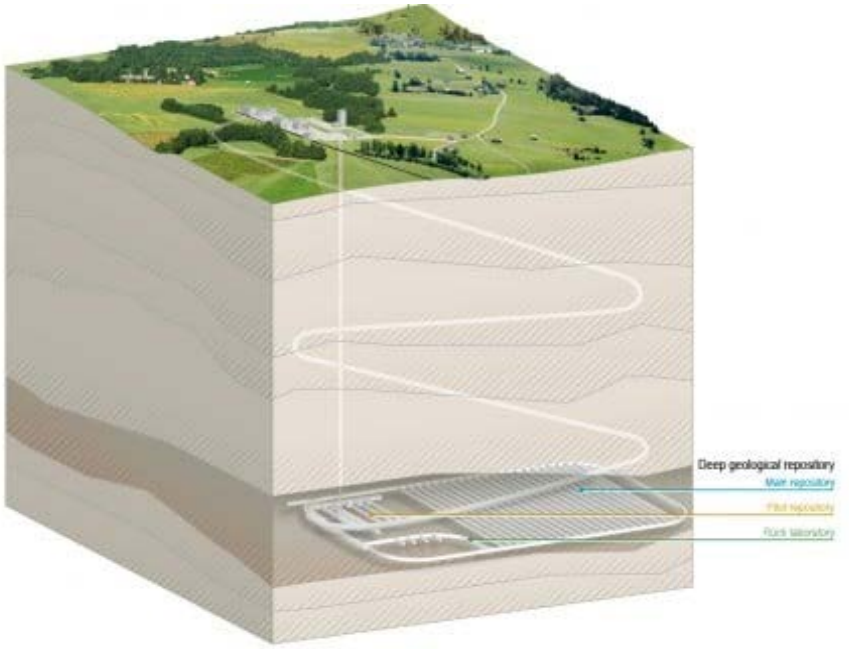
Carbon Capture and Storage (CCS)



Source: European Commission

- Method to inject CO_2 into underground and store it there
- Aim: less CO_2 in atmosphere, avoidance of more climate-wrecking gases
- 17 mayor projects in the world (Schmidt-Hattenberger 2018)
- IPCC: „negative emissions“
- Highly controversial whether this technology works and if it is necessary to meet climate agreements

Deep Geological Disposal (DGD)



Source: Eidgenössisches Nuklearsicherheitsinspektorat ENSI (2019)

- Isolation of high level radioactive waste for hundred thousands of years
- Some final repositories for low and medium level waste
- Additional research is need towards several aspects: barrier systems, host rock, etc.

Main Results I

Technical challenges

- “underground” technologies such as fracking, CCS and DGD, there is a lack of monitoring strategies / technologies (SRU 2013; Meyer-Renschhausen und Klippel 2017; Gullion 2015)
- lot of scientific uncertainties and unforeseeable factors (“relative knowledge”; “unknown unknowns”)
- No financial incentive for innovation for DGD

Main Results II

Social challenges

- CCS, fracking and DGD, trigger similar fears and negative risk perceptions
- Ability and competence of regulators and operators to deal with the risks and uncertainties is perceived as low
- Dominance of natural sciences and engineering; Disciplinary knowledge claims are highly contested → battle for sovereignty over the interpretation
- less trust in energy supply companies and state to protect citizens; science as part of the “regime”
- Conflicts rise and new protest culture (Bornemann and Saretzki 2018); past abuse of confidence can effect present projects

Conclusion

"(r)isk assessment and management are difficult when the form and extent of risks are unknown, which shifts decision making from the regulatory into a political arena (Falkner and Jaspers, 2012)." (Neville and Weinthal (2016) p. 590).

→ Societal debate about values and value trade-offs is necessary

<u>Broader inclusion of different types of knowledge in monitoring systems</u>

- Inter- and Transdisciplinary research
- Start of participation at an early point
- Integration of local and lay knowledge

<u>Develop a social monitoring strategy</u>

- Sensitivity towards past, present and future societal developments and dynamics; notice change of discourse and change of values

→ Independent authority that accompany the process

The National Civil Society Board (NBG)

Public activity of the NBG

Pictures by Dirk Seifert

Citizen hearing 2017 (NBG 2017)
Picture by Susanne Possinger

Thank you for your attention.

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