Tapping Geothermal Energy: Mutable Immobilities and Experimental Virtues of Nonknowledge

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Tapping the Heat

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What is Geothermal Energy?

Geothermal (Greek): *geo* (earth), *therme* (heat) → Energy derived from the natural heat below the earth’s crust

Geothermal Energy: usable from room temperature to 200°C.

Geothermal Reservoirs:
(1) low temperature (10°C up to ca. 150°C) → mainly household level, normally from up to 400 m
(2) high temperature (>150°C): household but mainly electricity, 4km (and more) deep

In general: Temperature rises about 17 °C to 30 °C by every kilometer deeper
Drill, Baby, Drill

- Accessing geothermal heat, a “skill-intensive enterprise,”
- Knowledge of what to encounter in the deep is miniscule,
- Drilling Engineer #1: “As novel options for resource use in the underground come up, novel risks have to be expected that are either not fully understood or are as yet unknown.”
- Drilling Engineer #2: “There are not enough pre-explorations of local specificities available, but we need to move forward nevertheless.”

Taken from: http://www.conservation.ca
The Lure of the Old

Representative of a drilling company: “The technologies we are using are basically 60, even 80 years old. For shallow geothermal sources it is basically transferred from traditional well drilling, for deeper drilling the technology is taken from natural gas drilling. The only rather new thing is some increase in efficiency via the coaxial probes.”

→ Immutable Mobilities or Mutable Immobilities → Relational shape is being held but also changed.....
The Shape of Things to Drill

- Geothermal drilling heads are full with electronic devices,
- Geothermal drilling technologies convey greater volumes of liquid than in conventional oil drilling,
- The drilling equipment is subject to a high rate of failure especially at high temperatures.

“The difficulties inherent in directional drilling are aggravated in geothermal wells because both the electronic tools used to control and survey the well trajectory and elastomer elements in the motors are susceptible to malfunction at high temperatures.”


While still being identifiable as oil and gas drilling rig, the environing socio-technical networks have changed towards more “ignorance perseverance.”

Drilling head photo courtesy of Michael Stauffacher, ETH Zürich
If you Can’t Stand the Heat…

- To allow electronic tools to work at higher temperatures, the electronics are “flasked.”
- Because of this the accuracy of measurements is often questionable
- Problem: Further funding for research is difficult due to the market size and technical challenges

Technical improvements are undertaken in the context of use:

“Many drilling companies are tinkering towards individual solutions. We are talking small detail solutions, nothing commercially available, all drilling companies have their own little knack”

(representative Drilling Company #1, quote used by courtesy of Alena Bleicher)
Knowledge Production in the Context of Drilling

• Failures are likely in geothermal drilling operations.

• At the same time: Unexpected occurrences are the motor of producing new knowledge about successful drilling.

→ Science and engineering in an experimental avenue?
Experiments Towards Success: More Art than Science?


*What do drilling engineers say?*

“You often can’t explain why and where you’ll find heat. You have a rough idea, but when you actually find it you’re surprised nonetheless.”

“Expecting the unexpected, that’s everyday normality for us.”

“Instinct.”
Experimenting/Experimental Society

“All Life is Experimentation”: The Chicago Schools of Sociology, Philosophy, and Pedagogy (1900-1930), e.g., Jane Addams, John Dewey, Albion Small, Robert E. Park et al.

Social Experiments and Quasi-Experiments (1960s): Donald Campbell et al.

Real life experiments (1980/90s) as criticism of extending research processes and its related risks beyond the limits of the laboratory into the wider society: Wolfgang Krohn et al.

2000s onwards: Public Experiments, Real world Experiments, European Experiments, Experiments in Governance etc.
Are we ready for the Experimental Society? (when dealing with geothermics)

- Moving downward is characterized both by the most generalized principles (nomothetic) **AND** knowledge that is highly site specific (idiosyncratic),

- However, “engineering can proceed even in the absence of a complete and correct pre-existing scientific understanding of the natural phenomena involved” (Henry Petroski),

- Are the experimental strategies observed in geothermal decision making indicative of a change in practical ways of coping with uncertainty and ignorance? → The official rhetorics may still suggest otherwise, but …. 