Optimal and sustainable use of the subsurface for ATES

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My message to GQ13:

• Organise ATES systems beyond individual system
• Organise ATES systems during operational phase
Aquifer Thermal Energy Storage

- 50% energy reduction
- Climate & aquifers
- 10% growth/year
- Permit system
Spatial impact

- Uncertainties
  - Large permits
  - Safe design rules

- Urban areas
  - High demand

- Temperature distribution in subsurface
  - Expected vs practice
Scarcity of space

Because of:
• Precautionary principle
• Longevity of impact

Resulting in:
• Suboptimal use
&
• Not sustainable use of subsurface
Self-organization as perspective

→ More ATES systems
→ Insight in distribution of heat and cold

→ Corrective feedbacks
→ Incentives for temperance

"I think you should be more explicit here in step two."
Self-organizing systems

Communication must lead to:
- Self configuration
- **Self optimizing**
- Self healing

ATES Systems
Self organization vs. Precaution

**Permit**
- Uncertainty
- Estimate of energy use
- Precautionary principle
- No temperance (only within issued permit)

**Self organization**
- Evolving model
- Actual data
- Optimize at collective level
- Market; value of heat and cold
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