UTES Tromsø, Norway
High enthalpy storage technology

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UTES Workshop
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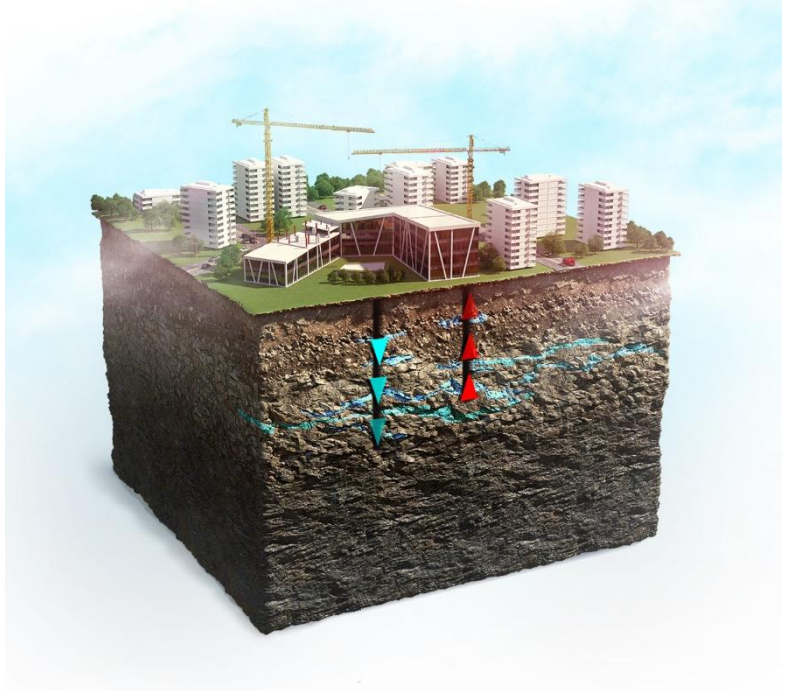
«Storage is key!»

IEA Geothermal GEOTHERMICA INITIATIVE GEOTHERMAL IWG

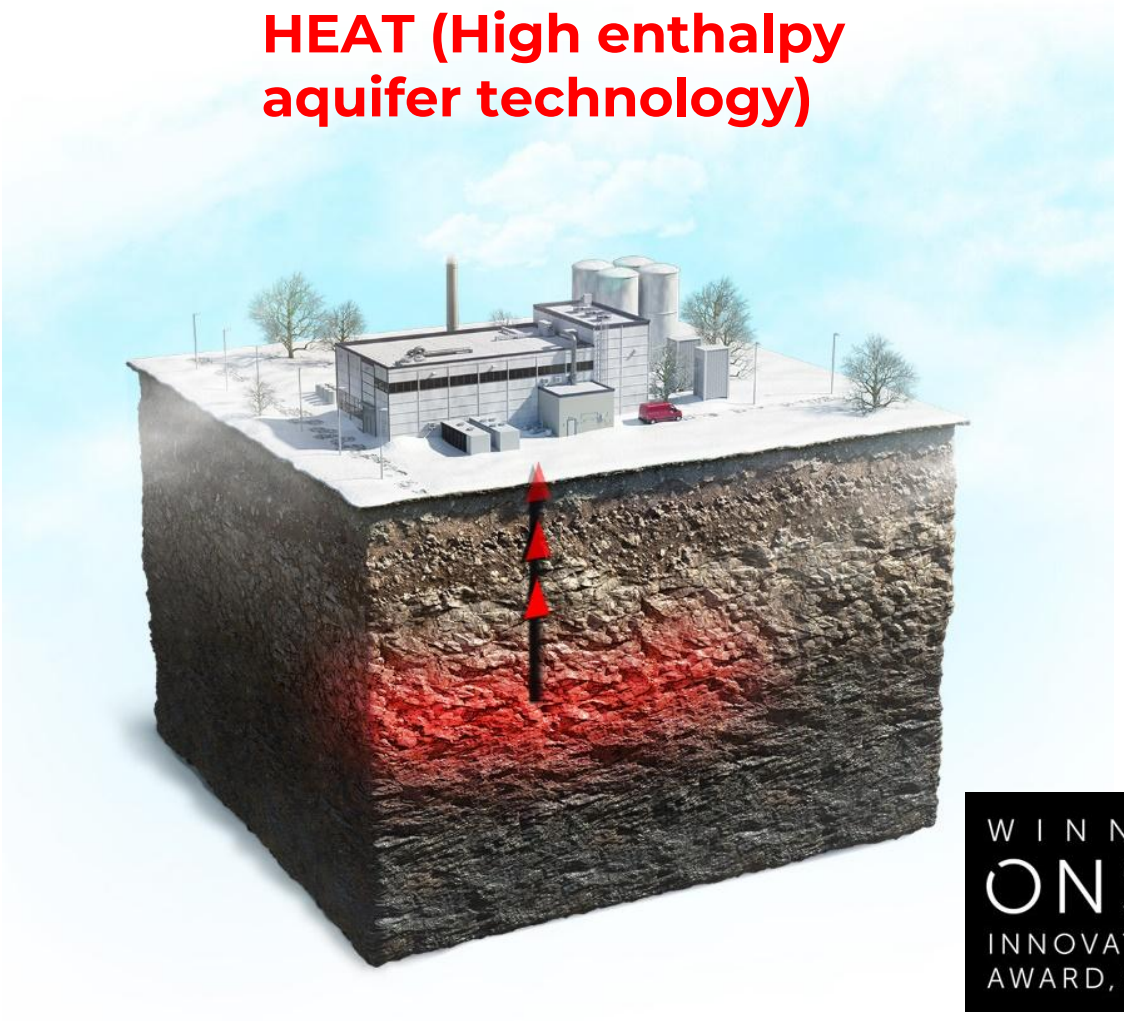
Ruden Energy

LEAT (low enthalpy aquifer technology)



Utilizing ground water directly- more effective and reduces wells drilled and well depth

HEAT (High enthalpy aquifer technology)

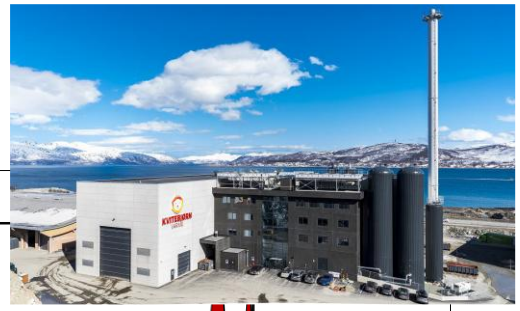


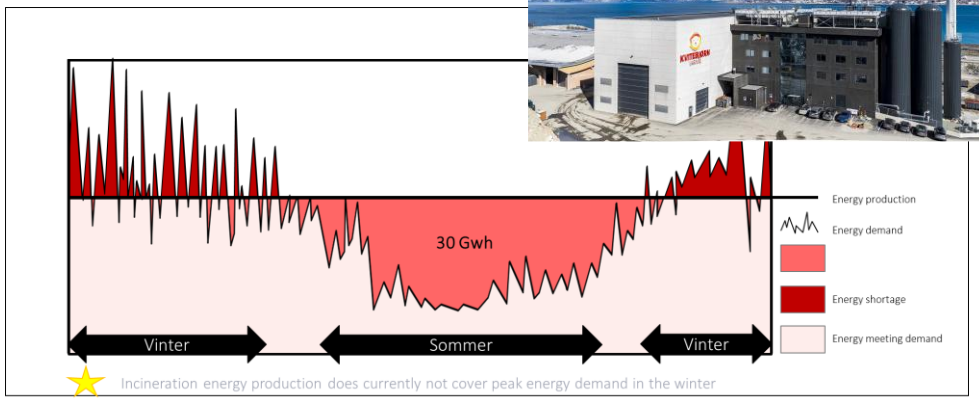
High temp seasonal storage

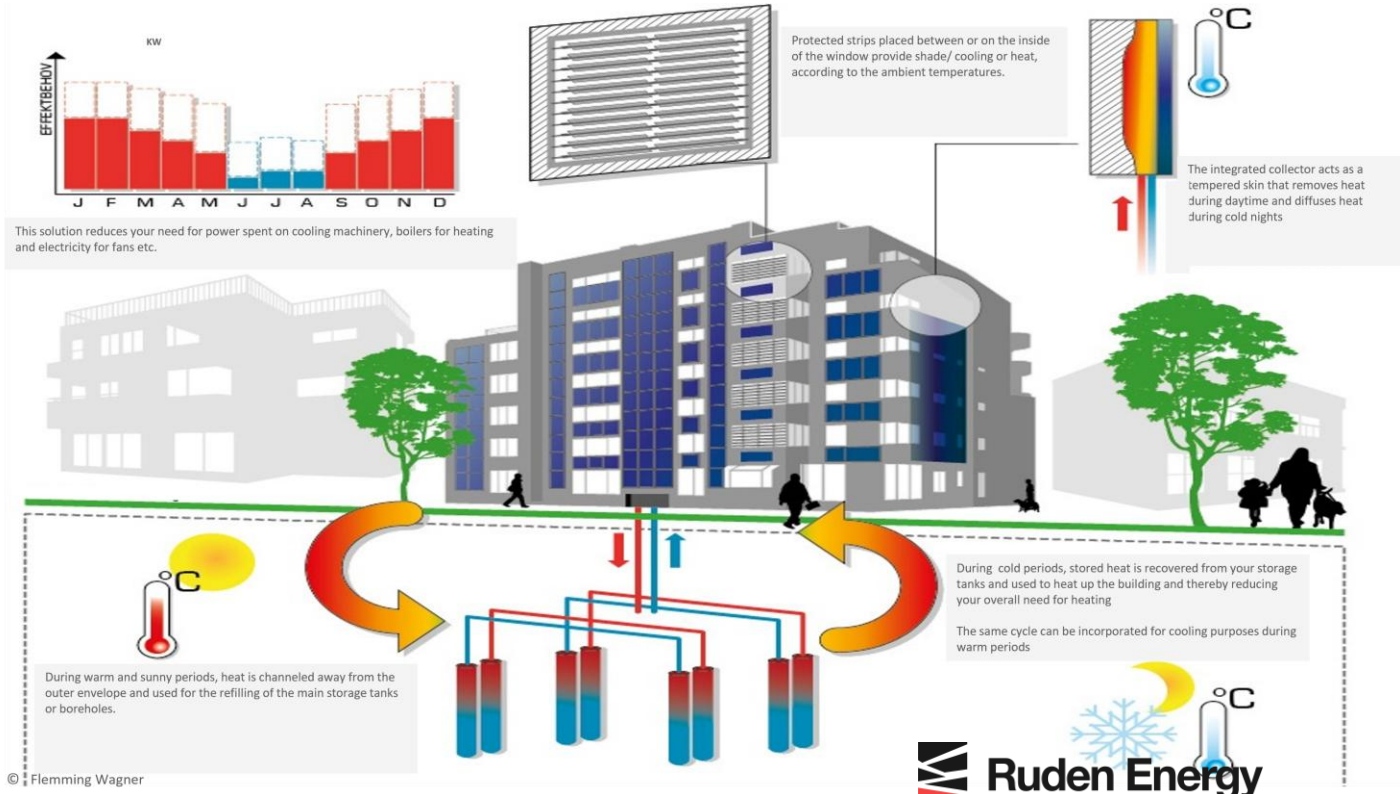
WINNER ONS 2022 INNOVATION AWARD, SME

Ground source energy storage

- Huge amount of waste/excess energy worldwide
- Seasonal storage can save energy and relive electrical energy grid and boost district/local heat production
- Energy batteries for fluctuant and seasonal renewable sources
- Local conflict free energy production with no use of REE, no use of surface space or no natural intervention







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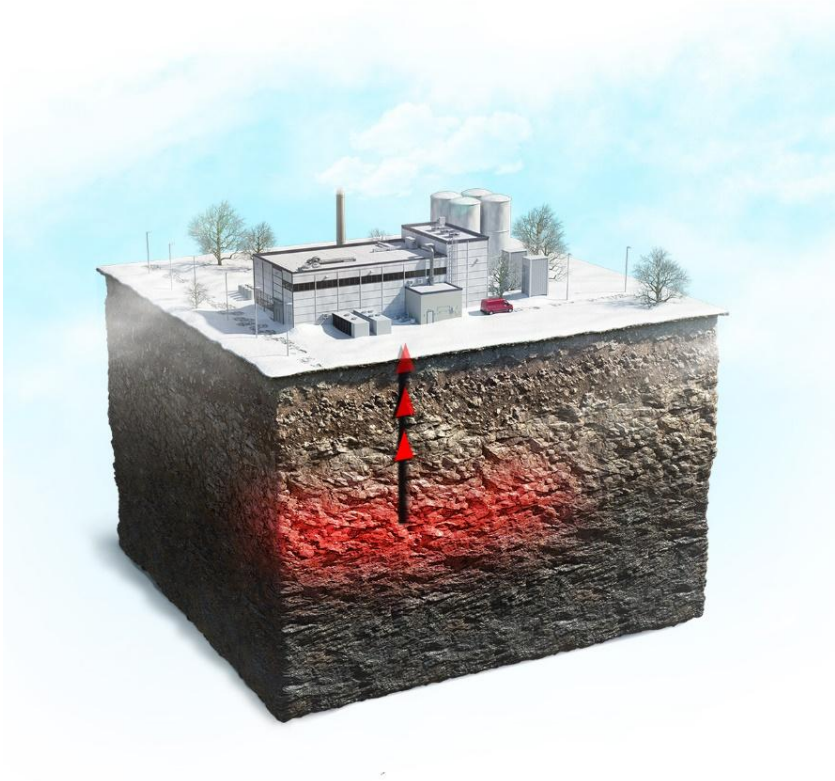
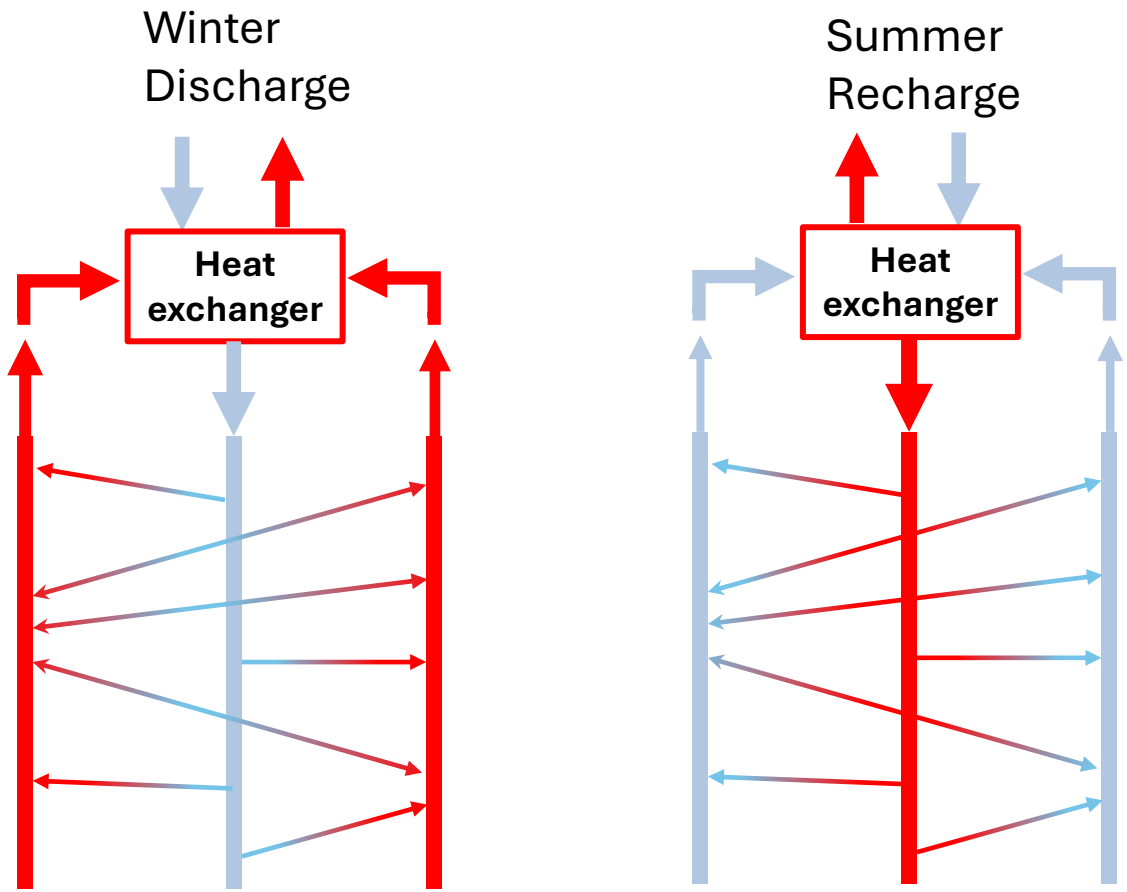
High enthalpy aquifer technology

- Utilizing water filled fractures as a radiator for energy storage
- Circulation of hot water in injection and production wells during periods of excess energy
- Thermal energy is stored in rock volume and retrieved by circulating colder water through the system



High enthalpy aquifer technology

- Develop/modify a distributed network of fractures in a restricted rock volume.
- Hydraulic stimulation to increase fracture permeability'

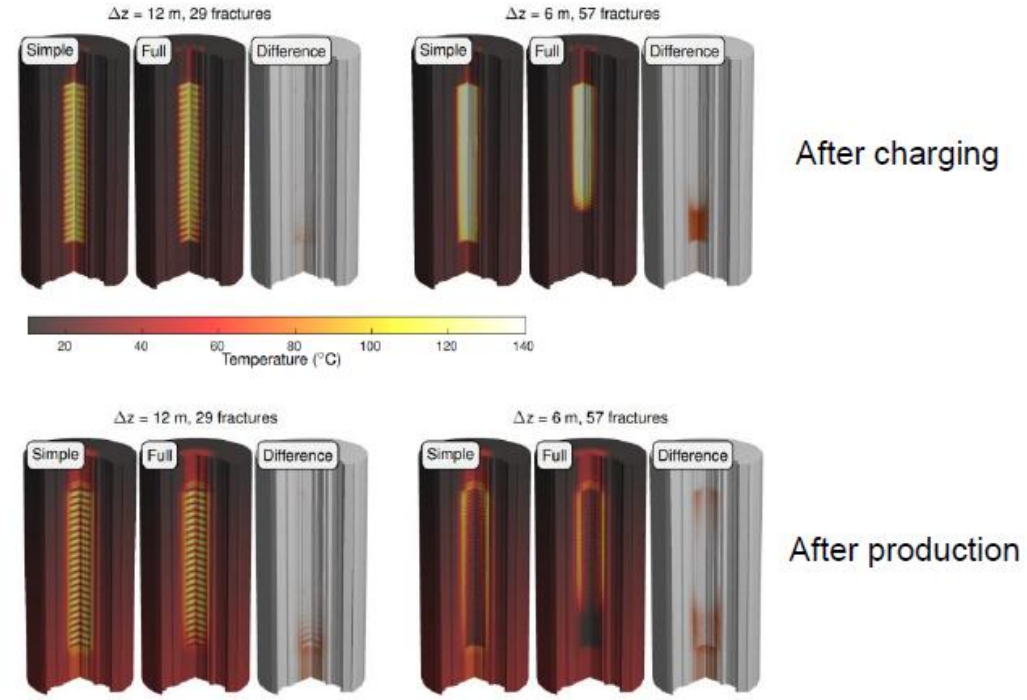


Tromsø UTES energy storage needs

- **Effect:** **5-9 MW**
- **Injection** **140°C**
- **Return temp** **65-100°C**
- **Number of wells** **11**
- **Well depth** **300**
- **Store** **20 GWh**
- **Retrieve** **10+GWh**

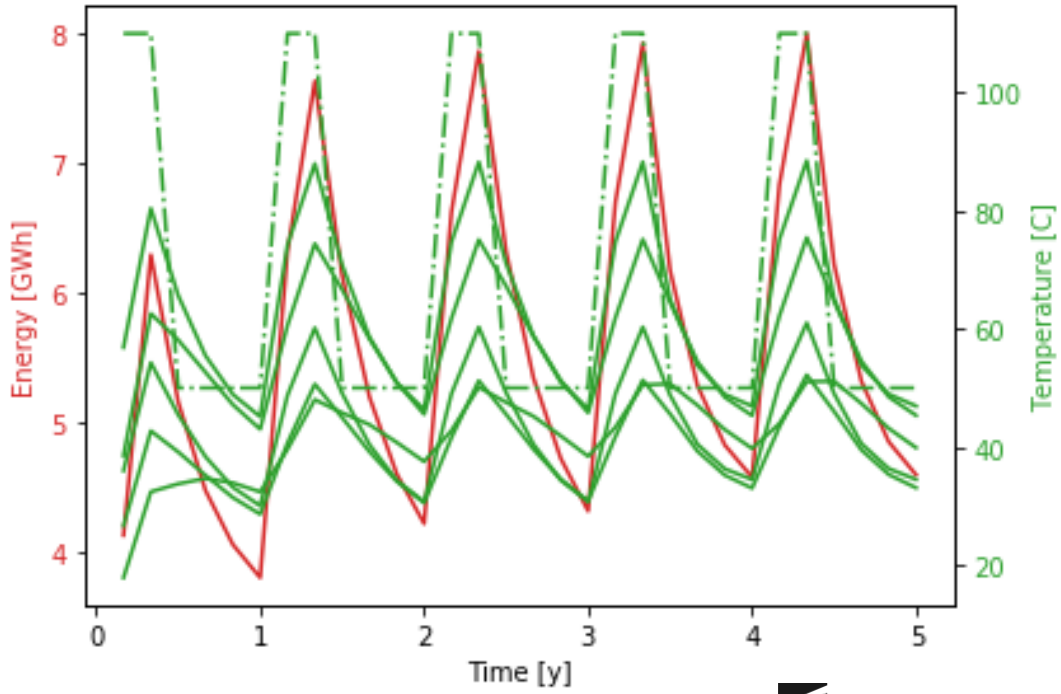
Stage 1: Modelling- designing the ideal well configuration and stimulation program

- **HEATBOX** Python/matlab developed in collaboration with Sintef and University of Bergen
- Software under development tailored for open loop seasonal storages



After charging

After production



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Stage 2: Well drilling

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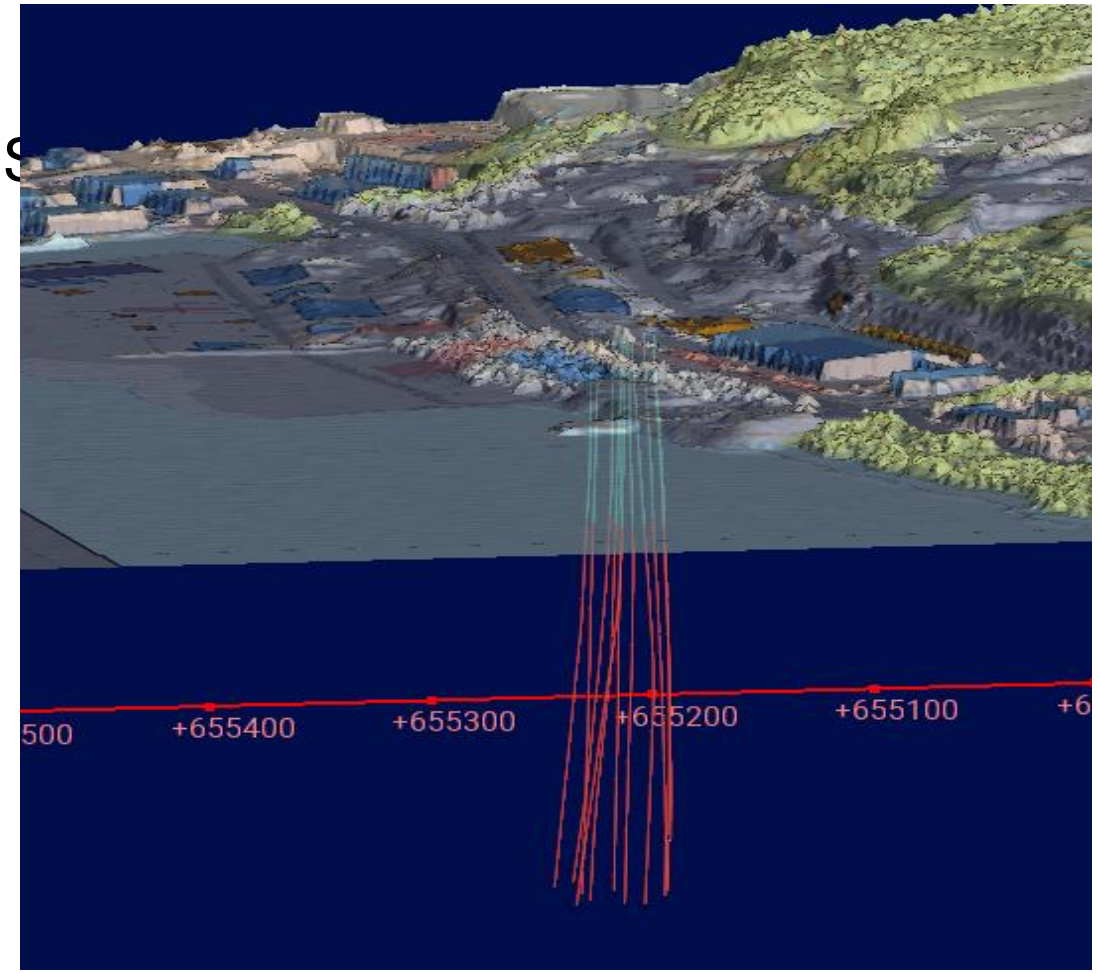
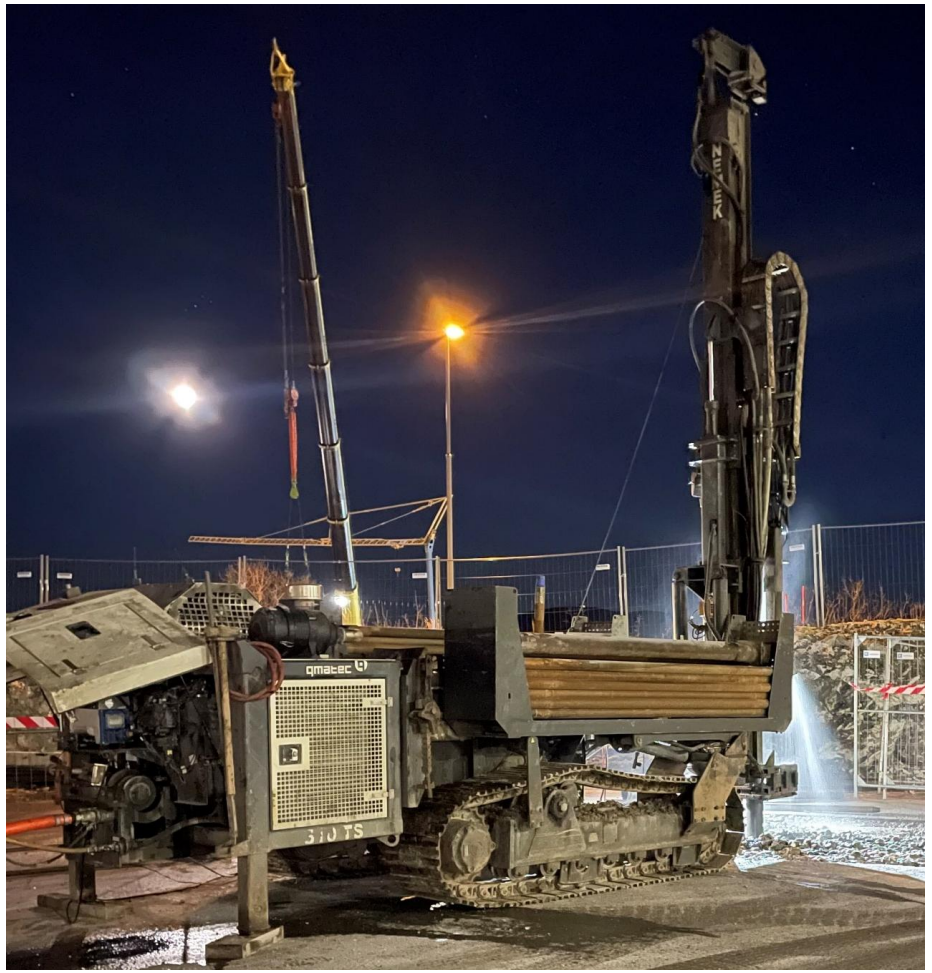
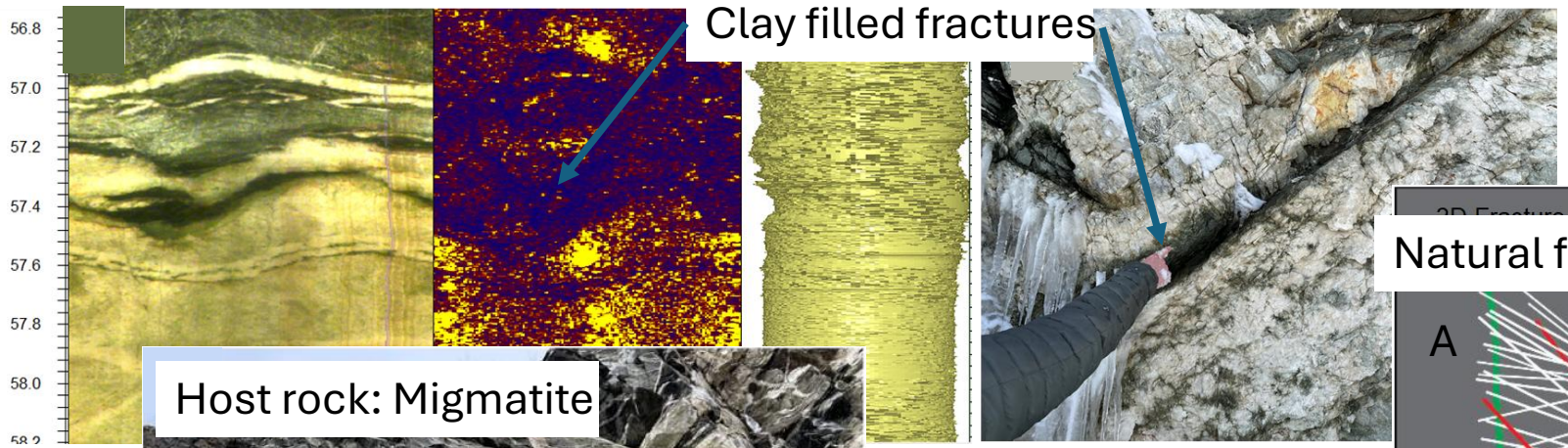




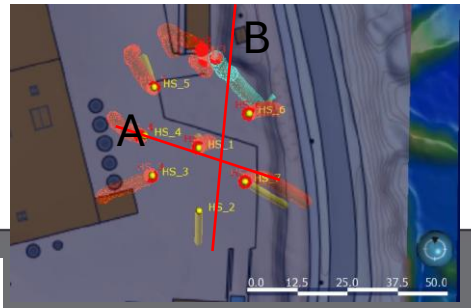
Stage 3: Geological and geophysical data

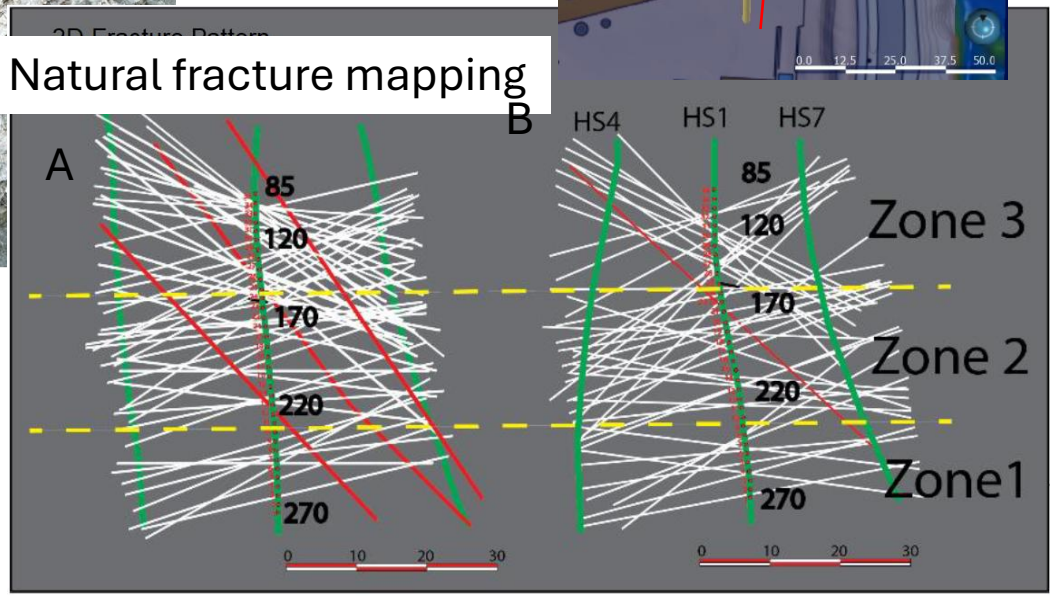
- Database on storage rock volume. Geophysical and optical/acoustic wire line logs, field mapping, sampling, well testing, thermal conductivity.



Anorthosite dyke

Amphibolite





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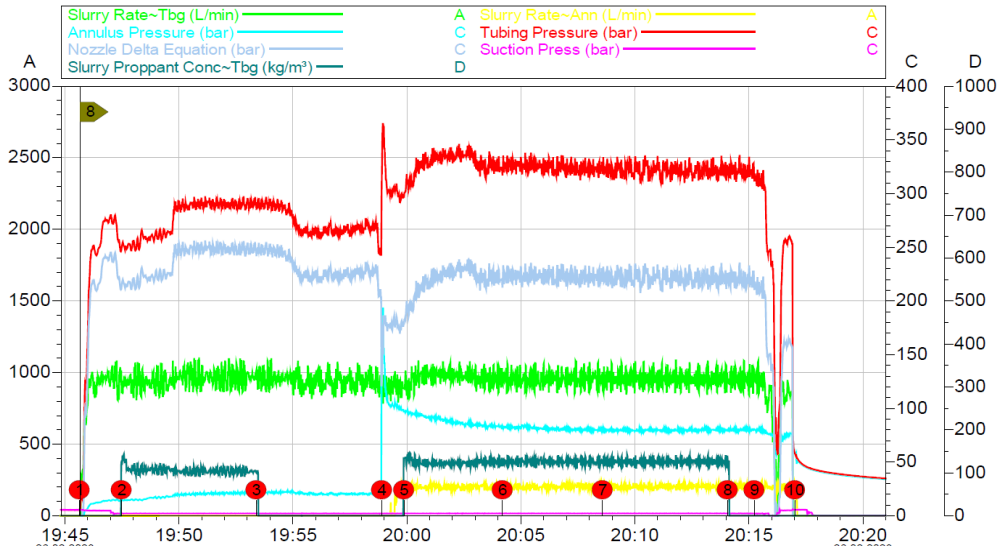
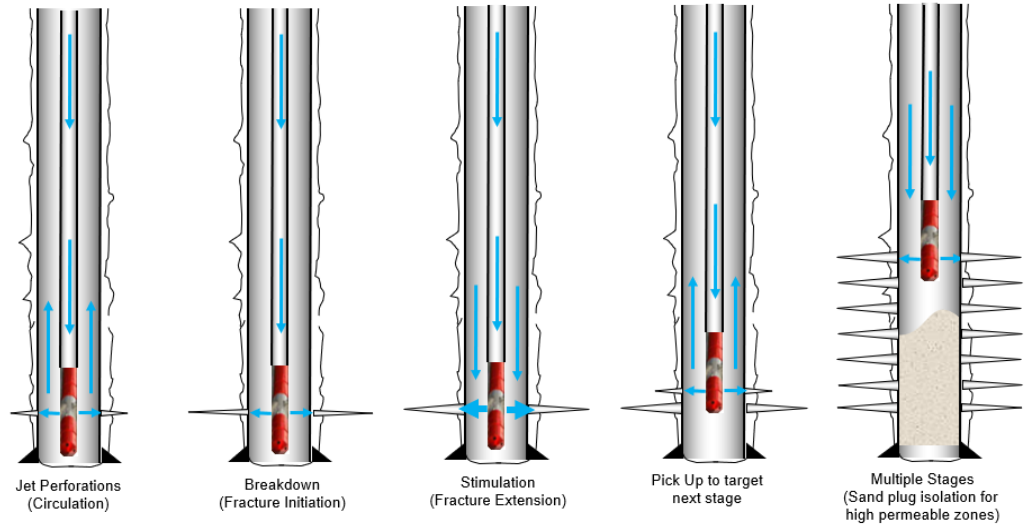
Stage 4 hydraulic stimulation





Well control system

Return flow

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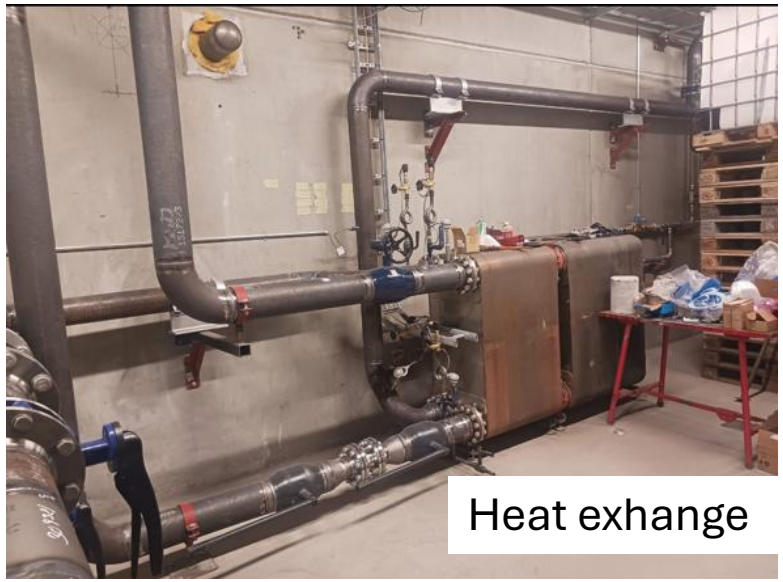
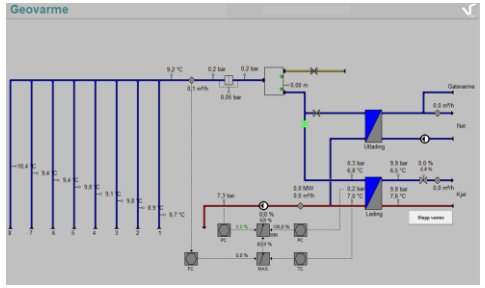
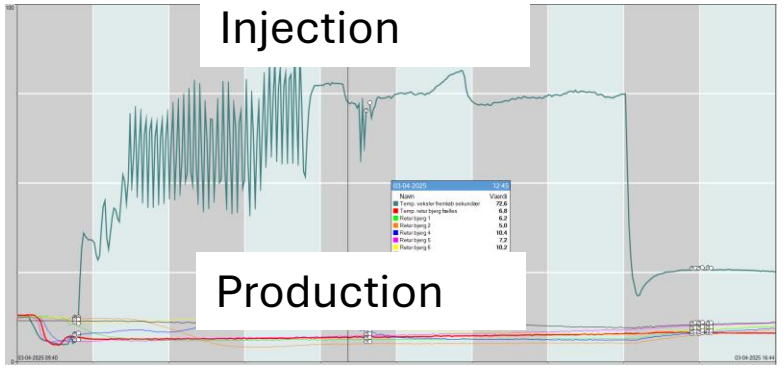
Stage 5: Energy central - initial storage testing



Heat exhange





Injection

Production

Well pipes

Way forward

- Storage start winter 2025
- Circulating test 0-60°C
- Summer 2025- store 10 Gwh injection 10 l/s - 100°
- Winter 25/26 test production
  - FTES concept proven - Possible to circulate fluid between wells through fracture networks
  - Significantly increases the heat exchange area compared to BTES systems
  - Testing during 2025 will reveal the full potential of the technology