

NORCE – Norwegian Research Centre

18. JANUAR 2022

NORCE – Norwegian Research Centre



- Independent research institute
- 700 employees
- Owned by 4 Norwegian Universities
- 6 departments: Energy, Technology, Social Sciences, Climate, Environment and Health
- Established in 2017 following a merge of 6 existing research institutes (UNI, IRIS, CMR, Teknova, Norut, Agderforskning)

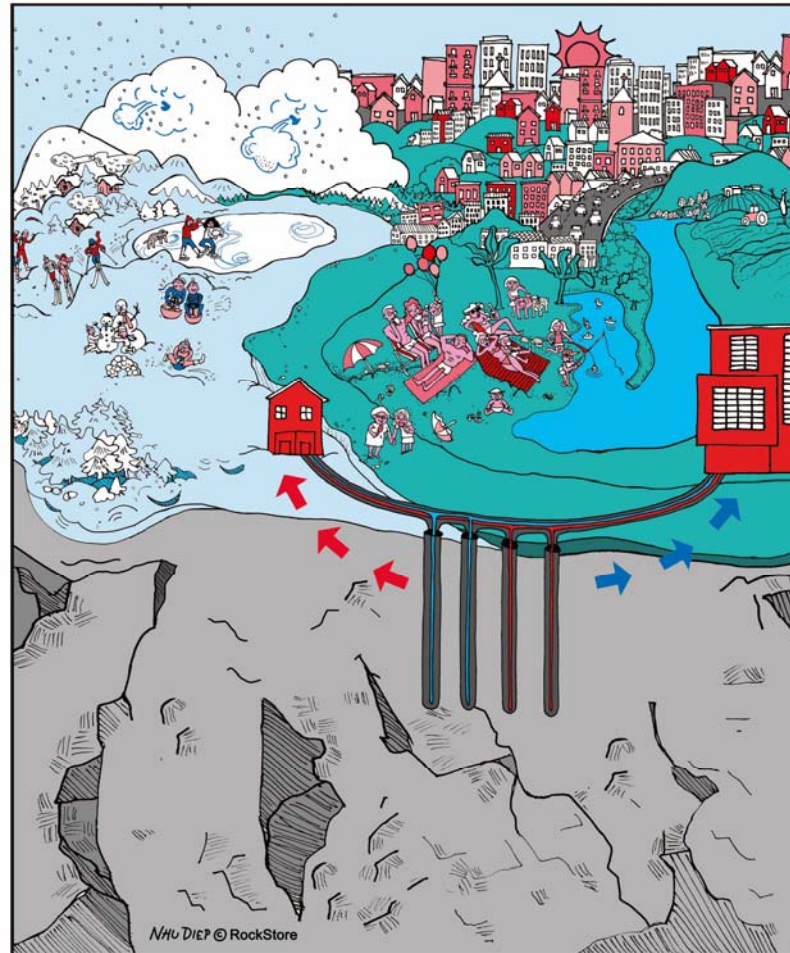


Energy systems

- **GHP applications**
- **UTES**
- **Direct-use heat**
- **Integrated energy systems**
 - PV &, solar thermal collectors
 - Hydrogen, Wind
 - CCS, PCM store
 - Smart systems
- **Energy system modelling**
 - Modelica, TRNSYS,
 - Optimising, LCA

Geology & Reservoir

- **Geology & Geophysics**
 - Crystalline & sedimentary
 - Geomatics & Virtual outcrops
- **Reservoir characterization**
 - Fractured & porous
 - Geochemistry & microbiology
 - Flow laboratories
- **Modelling & flow simulation**
 - Eclipse, CGS, Roxar, OpenPore



Social

- **Social embeddedness level**
- **LCA, sLCA & LCOE**
- **Environmental impact**

Monitoring

- **Distributed fibre-optic sensing**
 - DAS – acoustic, seismic, fluid flow
 - DTS – temperature
 - DCS – chemical
- **Synthetic Aparature Radar**
 - SAR / InSAR
 - Satellite, Airborne, Drone
 - Active faults, Environmental impact
- **Drone surveys**
 - small to large (BLOS) all classes

Well and borehole

- **Drilling**
 - Automation, Hard rock drilling,
 - Drillstring dynamics
- **Well operations**
 - Well integrity, Cementing, Barrier
 - evaluation, Risk management
- **Borehole heat exchangers**

HORIZON-CL5-2022-D3-01-04: Demonstrate the use of high temperature geothermal reservoirs to provide energy storage for the energy system



Ongoing national research project

RockStore – develop, demonstrate and monitor the next generation BTES

Case Studies:



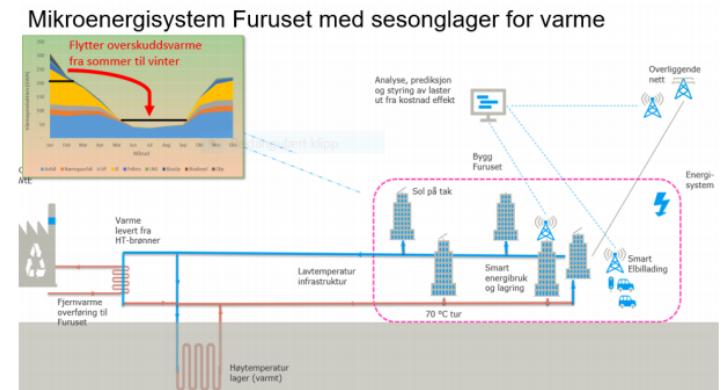
Xylem Emmaboda, Sweden

140 BHE of 150m
Storing industrial waste heat
DTS in two observation wells
Temp < 40°C
Ref. Andersson & Rydell, 2018



Fjell school, Norway

100 BHE of 50m
Storing summer heat by PV and air HP
Fiber for DTS in 11 BHEs
Temp < 45°C
Ref. Justo-Alonso et al. 2021



HT BTES for DH

Investigated in Oslo, Trondheim, Tromsø
Storing waste heat from incinerators

Current & recent projects

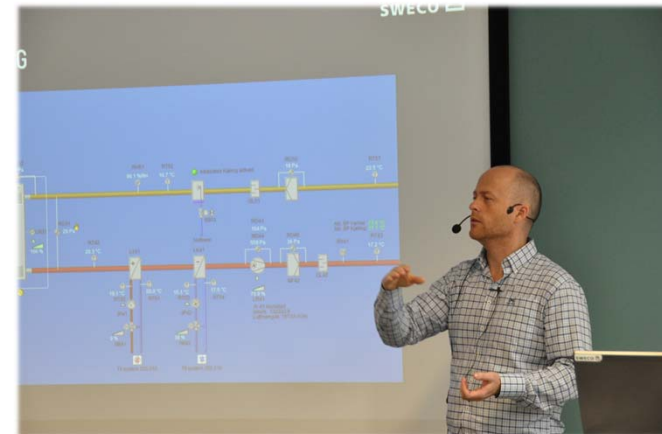


- **SEE4GEO** (Geothermica 2021-2023) Seismoelectric for geothermal reservoirs
- **Geothermal Village** (H2020 LEAP-RE, 2021-2023) Village-scale geothermal energy direct-use and ORC electric for Africa
- **Robinson** (Horizon 2020, 2021-) Energy island integrated energy systems
- **GEMex** (H2020 2016-2020) Geothermal cooperation with Mexico on Superhot and EGS systems
- **GeoWell** (H2020 2016-2019) - <https://cordis.europa.eu/project/id/654497>
- **INNO-Drill** (Research Council of Norway RCN 2016-2019) “Technology platform for research-based innovations in deep geothermal drilling”
- **RockStore** – develop, demonstrate and monitor the next generation BTES (Research Council of Norway RCN 2018-2022)
- **IEA Annex HPT 52** (Norwegian ENOVA, 2019-2021) Long term performance measurement of GHP Systems
- **Integrated Renewable Resources and Storage: Operation and Management** (Research Council of Norway RCN “INDNOR” 2019-2021) Cooperation with India
- **Improving the energy efficiency of geothermal energy utilisation by adjusting the user characteristics** (EEA Regional Cooperation (Poland, Hungary, Slovakia, Iceland, Norce)

The role of NORCE in the User4GeoEnergy project



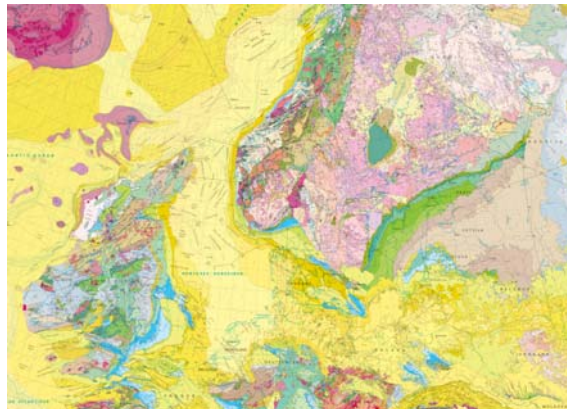
1. We are leading WP3 Capacity Building
2. We are organizing site visit in Norway in 2022



Knowledge sharing – Norwegian contribution

Energy technology

- Geothermal heat pump technology
- Utilisation of low-temperature energy
- Underground thermal energy storage
- Integrated energy solutions
- Energy efficiency



Geological map

Monitoring technology

- Fiber optic measurements
- Satellite /Drones
- Flow measurements

Knowledge transfer from oil industry

- Drilling and well integrity
- Reservoir characterization
- Reservoir simulations