GEOTHERMICA

HEATSTORE
HIGH TEMPERATURE UNDERGROUND THERMAL ENERGY STORAGE (HT-UTES)

KNOWLEDGE SHARING AND MONITORING MEETING, 27. OCTOBER 2021

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heatstore

High Temperature Underground Thermal Energy Storage

HEATSTORE FACTS AND FIGURES

- GEOTHERMICA ERA-NET funded project focused on demonstration of high-temperature underground thermal energy storage, HT-UTES
- Consortium of 23 partners in 9 European countries, coordinated by TNO, the Netherlands
- Strong involvement of industry, providing close to 50% project funding
- 6 demonstration sites, 8 case studies
- 16.3 MEUR total project budget

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TNO innovation for life
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ecw energy
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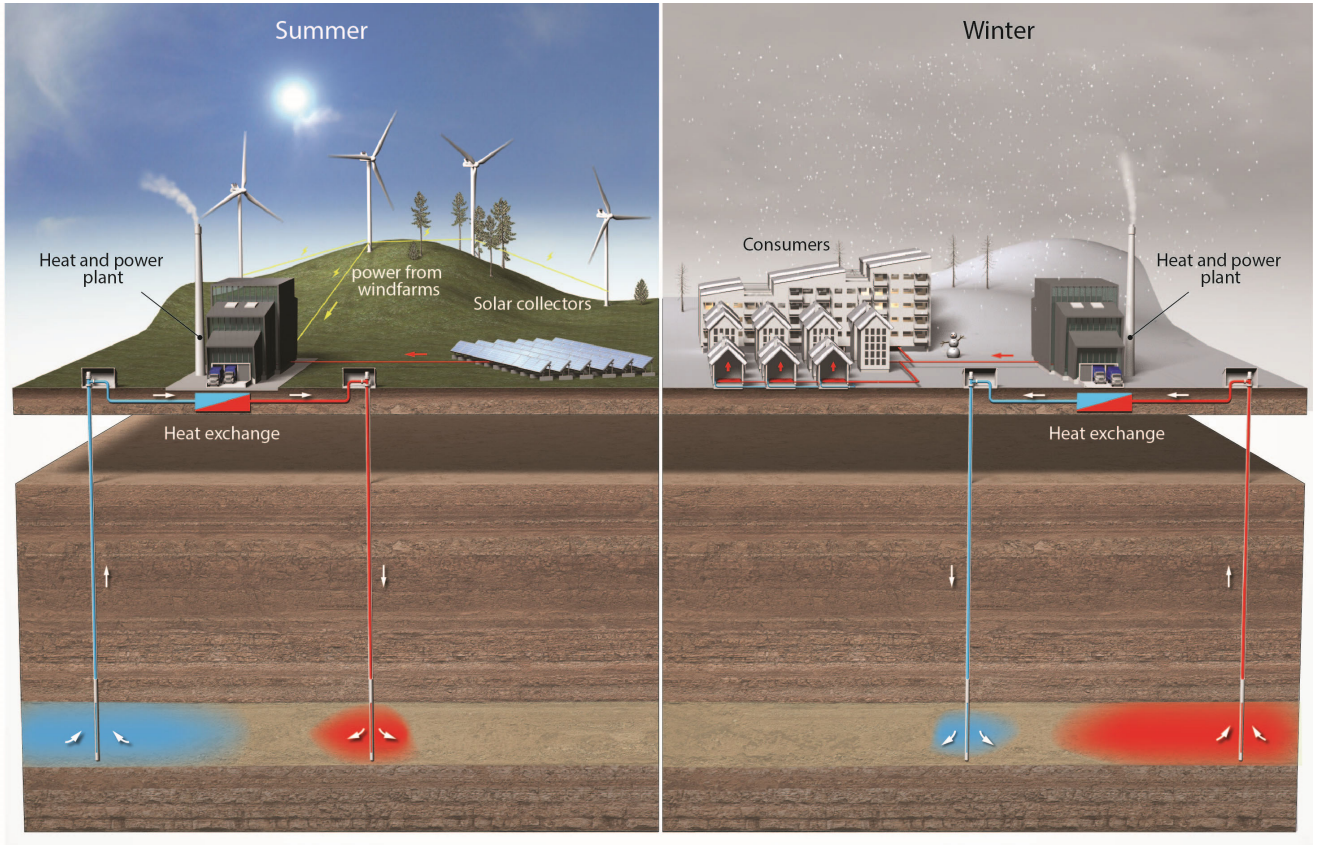
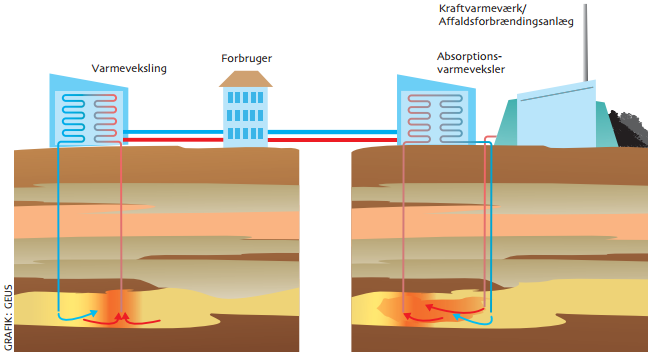
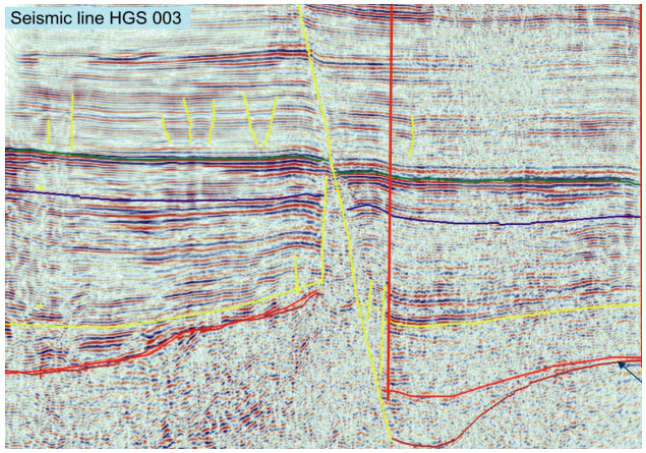
unine
UNIVERSITÉ DE NEUCHÂTEL
KEMPENS WARMTEBEDRIJF
groene warmte uit de regio
ewb
PlanEnergi
GEUS
SIG
Fraunhofer IEG
SPIE
delta h
Ingenieurgesellschaft
UPC
OR
Reykjavík Energy
IVAR

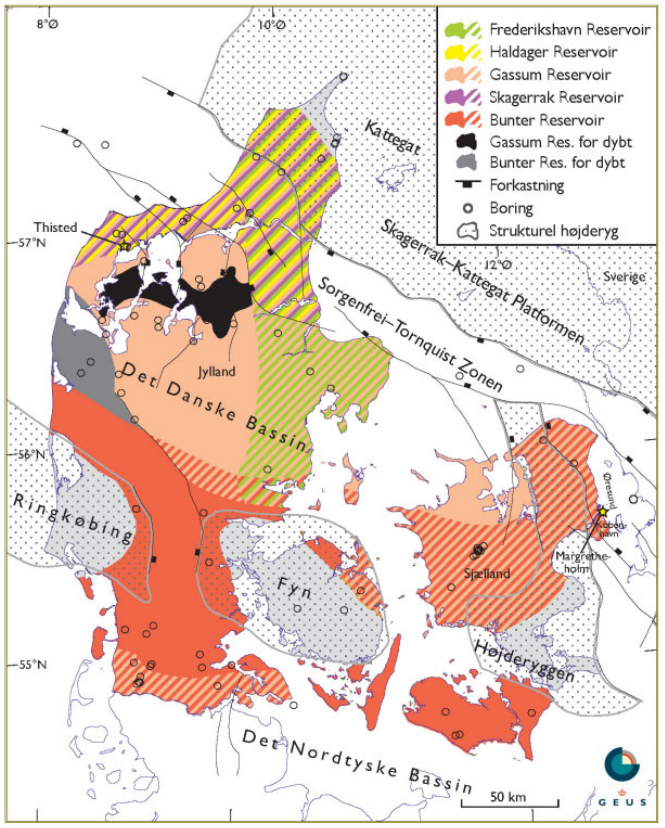
AQUIFER THERMAL ENERGY STORAGE (ATES)



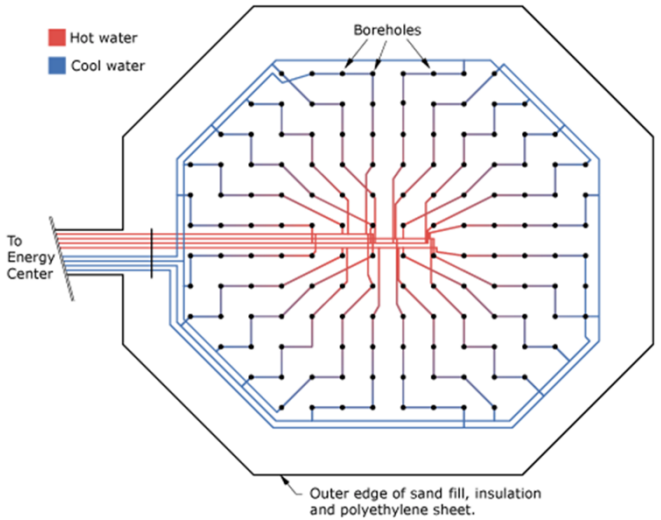
HIGH-TEMPERATURE ATES (HT-ATES)

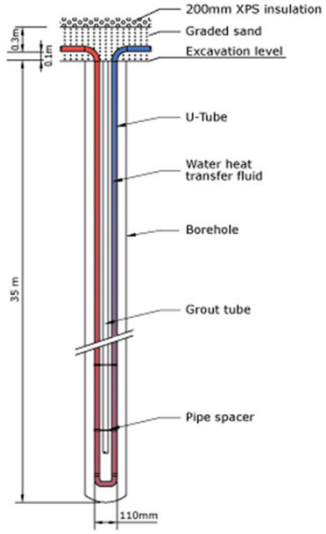


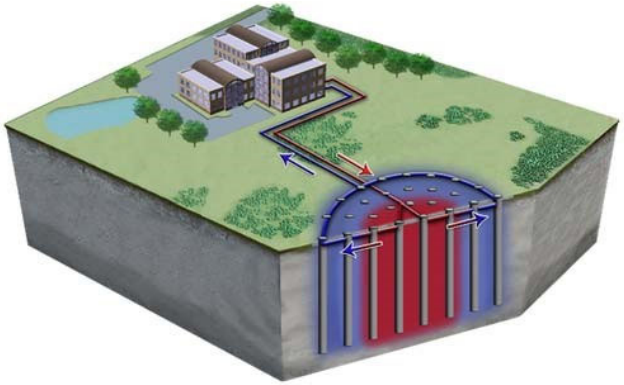


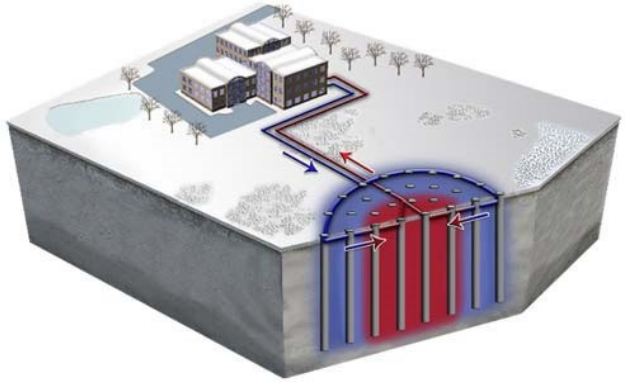


BOREHOLE THERMAL ENERGY STORAGE (BTES)

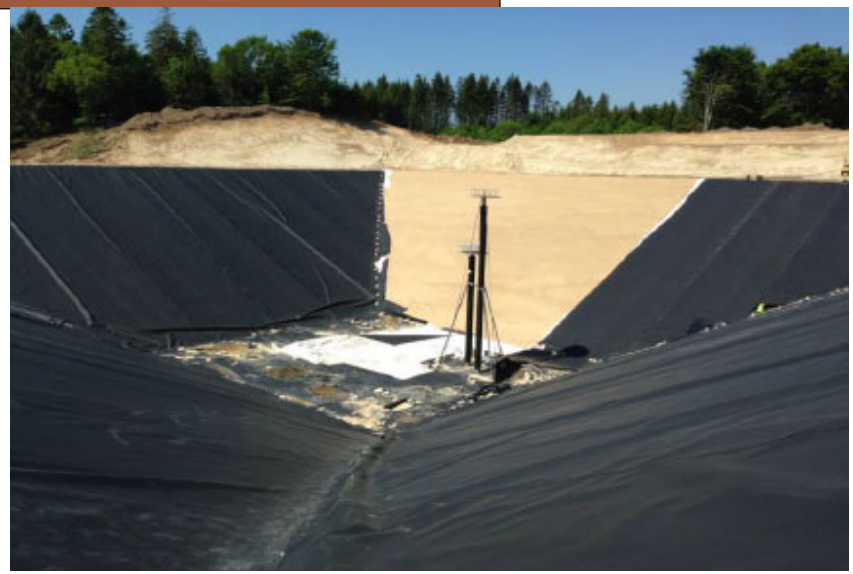




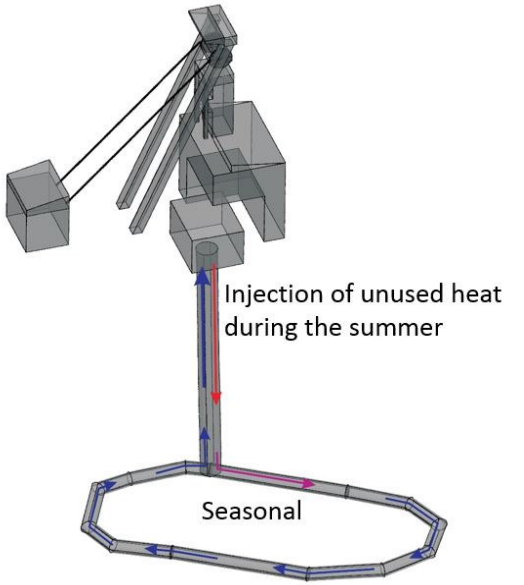


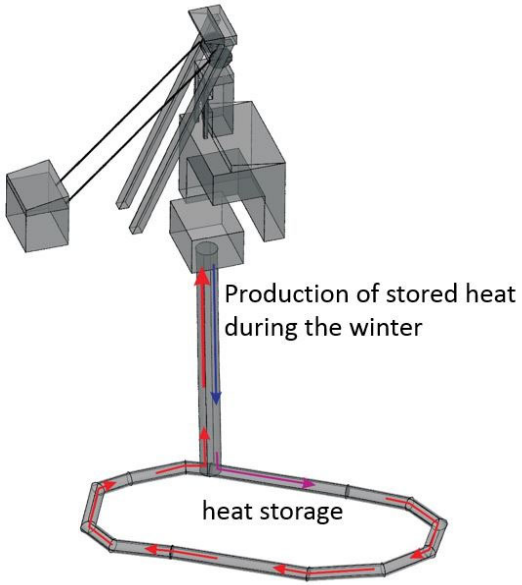


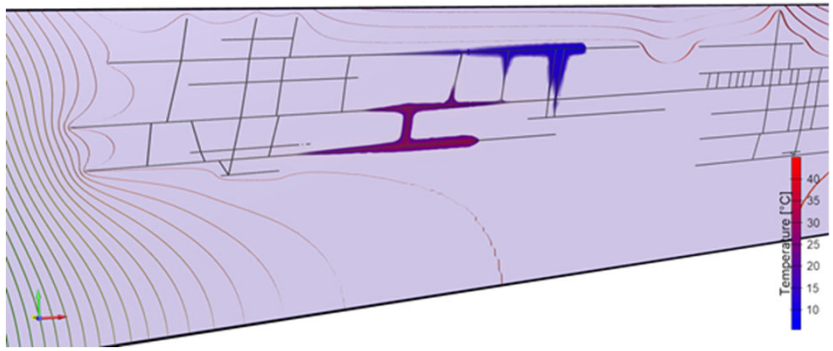
PIT THERMAL ENERGY STORAGE (PTES)



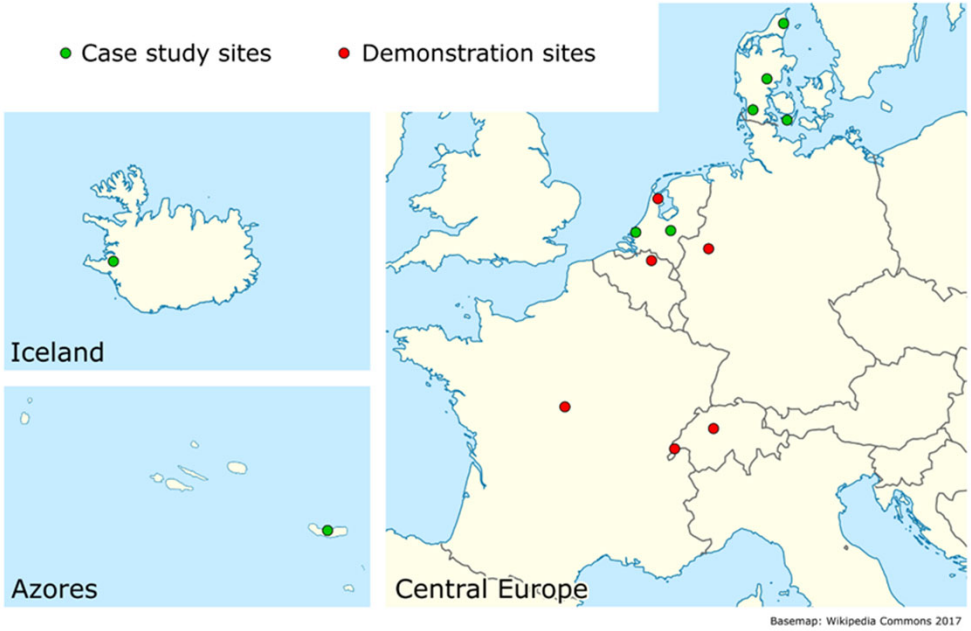
MINE THERMAL ENERGY STORAGE (MTES)

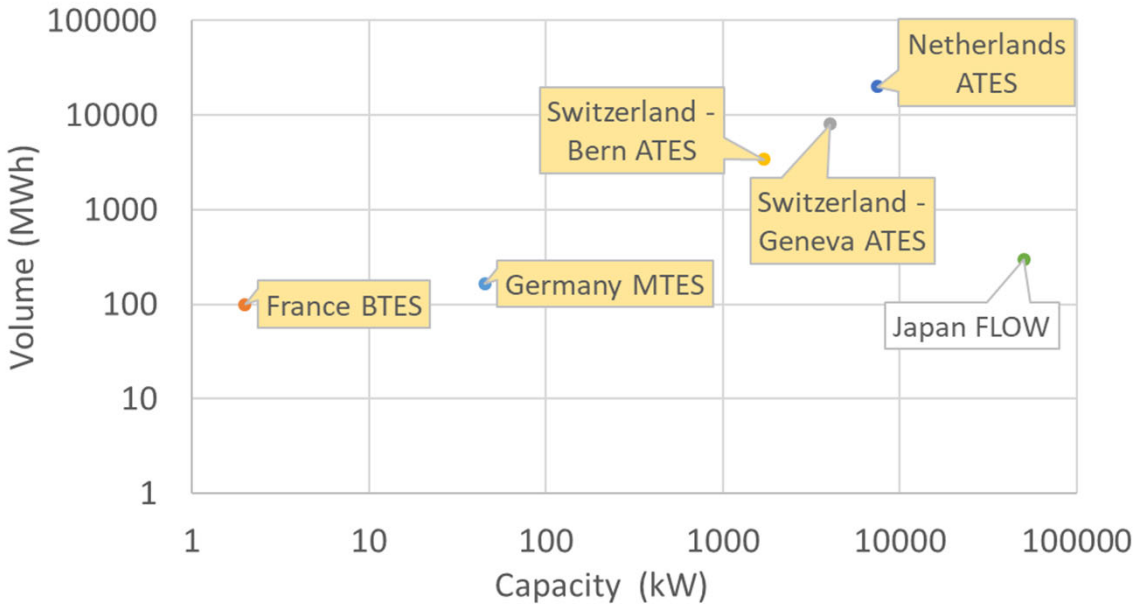






HEATSTORE DEMO/CASE STUDY SITES



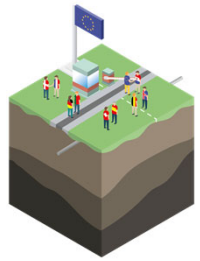


HEATSTORE DEMONSTRATION PROJECTS AND CASE STUDIES

- Demonstration projects:
  - HT-ATES in sand aquifer in the Netherlands in combination with deeper geothermal plant
  - HT-ATES in limestone in Geneva, Switzerland in combination with waste incineration
  - HT-ATES in molasse (conglomerates, sandstones and shales) in Bern, Switzerland in combination with combined heat and power
  - BTES in France in combination with solar collectors
  - MTES in Germany in combination with solar collectors
  - Demand Side Management in pilot project in Belgium in combination with geothermal plant
- Case studies:
  - Environmental monitoring of MT-ATES (45°C) pilot plant in Wageningen, the Netherlands
  - Monitoring data from MT-ATES (45°C) after conversion from LT-ATES by introducing solar collectors in Haag, the Netherlands
  - Monitoring data and experience from Dronninglund HT-PTES in Denmark
  - Monitoring data and experience from Gram HT-PTES in Denmark
  - Monitoring data and experience from Marstal HT-PTES in Denmark
  - Monitoring data and experience from Brædstrup HT-BTES in Denmark

HEATSTORE WORK PACKAGE STRUCTURE

Technical future potential UTES and DSM in Europe
new business models
Stakeholder engagement and dissemination beyond the projects
Roadmap for fast track uptake

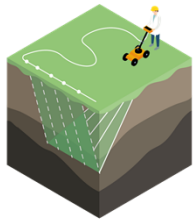


WP6 fast track market uptake

Design specifications
Best practices
Sub-surface dynamics
UTES performance
System integration

Model & design validation

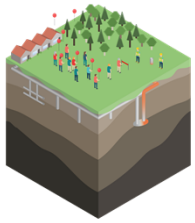
Detailed design
Operation of UTES and DSM technologies
Proof of technology
Monitoring technical, economic and environmental performance
Stakeholder engagement on project level



WP1 characterization

WP2 modelling

WP3 surface integration



WP4 demonstration

WP5 monitoring

Best practice guidelines:

- Design
- System integration
- Business model
- Regulatory framework
- Stakeholder engagement
- Monitoring
- Environmental performance

Design → **Demonstration** → **Replication and scale-up**

DANISH CONTRIBUTIONS BY PLANENERGI AND GEUS

WP1 Specifications and characterization for UTES concepts

- D1.1 Underground Thermal Energy Storage (UTES) – state-of-the-art, example cases and lessons learned
- D1.2 Underground Thermal Energy Storage (UTES) – general specifications and design
- D1.3 Screening of the national potential for UTES
  - 5 local screening reports (Århus, Odense, Esbjerg, Ringkøbing-Videbæk, Guldborgsund)
- D1.4_4.2_4.3 Demonstrator synthesis and best practice guidelines for UTES development

WP2 Tools and workflows for modeling the subsurface dynamics

- D2.1 Initial report on tools and workflows for simulating subsurface dynamics of different types of High Temperature Underground Thermal Energy Storage
- D2.3 Benchmarking and improving models of subsurface heat storage dynamics
- TR2.3 Comparison of Danish PTES and BTES installation measurements with their corresponding TRNSYS models

DANISH CONTRIBUTIONS BY PLANENERGI AND GEUS

WP3 Heating System integration and optimisation of design and operation

- D3.2 Technical report on the characteristics of heat demand and supply at the demonstrator sites
- D3.3 UTES and its integration in the heating system - Defining optimal design and operational strategies for the demonstration cases
- D3.4 Design and execution of business case models for the demonstration sites

WP4 Demonstrations and case studies: Detailed design and implementation in practice

- D4.1 Feasibility assessment & design for demonstration projects –learnings of an international workshop
- D1.4_4.2_4.3 Demonstrator synthesis and best practice guidelines for UTES development

DANISH CONTRIBUTIONS BY PLANENERGI AND GEUS

WP5 Monitoring and validation to assess system performance and workflow

- D5.1 Monitoring plans: demonstration projects and case studies
- D5.2 Analyses of gathered data of demonstration sites and case studies
- D5.3 Model validation for subsurface dynamics
- D5.4 Validation report of system integration modelling
- D5.5 Uncertainty Management in Underground Thermal Energy Storage Development and Operation

WP6 Fast-track market uptake in Europe & dissemination

- D6.1 GIS platform on technical future potential for underground thermal energy storage in countries under study
- D6.2 Regulatory and policy boundary conditions & guidelines for UTES
- D6.4 Roadmap for flexible energy systems with underground thermal energy storage towards 2050
- D6.5 Public acceptance of UTES and geothermal projects – best practice learnings
- D6.6 Environmental effects of UTES technologies in Europe

THANK YOU FOR YOUR ATTENTION

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HEATSTORE (170153-4401) is one of nine projects under the GEOTHERMICA – ERA NET Cofund aimed at accelerating the uptake of geothermal energy by 1) advancing and integrating different types of underground thermal energy storage (UTES) in the energy system, 2) providing a means to maximise geothermal heat production and optimise the business case of geothermal heat production doublets, 3) addressing technical, economic, environmental, regulatory and policy aspects that are necessary to support efficient and cost-effective deployment of UTES technologies in Europe. The three-year project will stimulate a fast-track market uptake in Europe, promoting development from demonstration phase to commercial deployment within two to five years, and provide an outlook for utilisation potential towards 2030 and 2050.

The GEOTHERMICA project is supported by the European Union's HORIZON 2020 programme for research, technological development and demonstration under grant agreement No 731117.