

HEATSTORE WEBINAR SERIES

HOW TO DEVELOP UNDERGROUND THERMAL ENERGY STORAGE (UTES) PROJECTS?

Learnings from the European HEATSTORE project

Host: TNO, The Netherlands



7, 14, 21, 28 Sept. and 5, 12 Oct. 2021 | all 15-16 h (CEST)

Register on www.heatstore.eu

HEATSTORE WEBINAR SERIES 2021

All webinars are at 15 – 16 h CEST

Tuesday 7 Sept. (Holger Cremer, TNO): Challenges in Underground Thermal Energy Storage (UTES)

Tuesday 14 Sept. (Thomas Driesner, ETH Zurich): Advances in subsurface characterization and simulation

Tuesday 21 Sept. (Koen Allaerts, VITO): Integrating UTES and DSM in geothermal district heating networks

Tuesday 28 Sept. (Florian Hahn, Fraunhofer IEG): Abandoned coal mines – promising sites to store heat in the underground

Tuesday 5 Oct. (Bas Godschalk, IF Technology): The ECW Energy HT-ATES project in the Netherlands

Tuesday 12 Oct. (Joris Koornneef, TNO): The role of UTES in the future EU energy system – a moderated table discussion.



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HEATSTORE

- HEATSTORE = GEOTHERMICA ERA-NET co-fund project
- 16.3 M€ | 23 partners in 9 EU countries
- 6 demonstration sites, 8 case studies.
- Coordination: TNO Netherlands Organization for Applied Scientific Research)

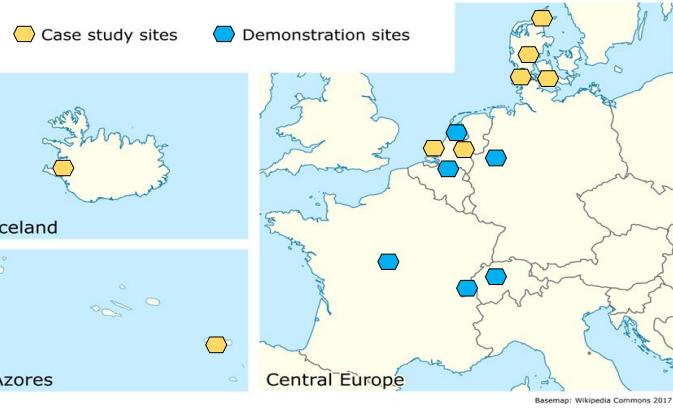


heatstore
High Temperature
Underground Thermal Energy Storage

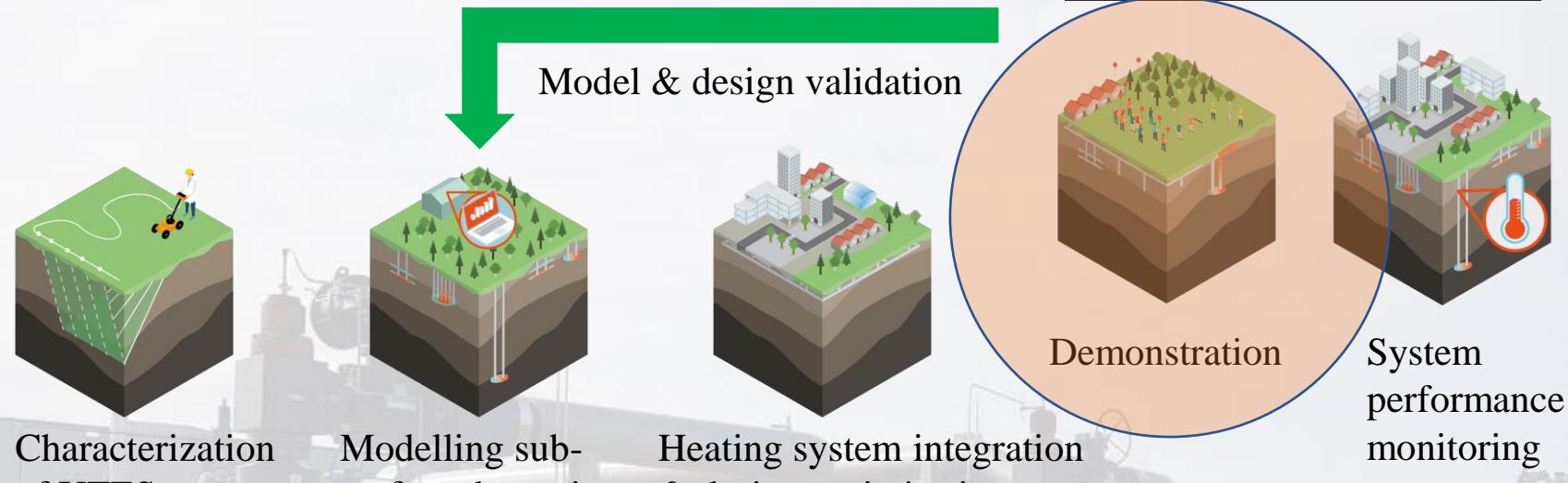
GEOTHERMICA



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- Best practice guidelines: Design & System integration | Business models | Regulatory framework | Stakeholder perception & engagement | Monitoring technical, economic and environmental performance



Fast track market uptake

- Roadmap Europe: Technical future potential UTES and DSM in Europe | New business models | Stakeholder engagement | Roadmap for fast track uptake

Design

Demonstration

Replication and scale-up

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High Temperature Underground
Thermal Energy Storage

GEO THERMICA



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HEATSTORE – 28 Sept. 2021

Abandoned coal mines – promising sites to store heat in the underground



- Isabella Nardini (Fraunhofer IEG): Convenor & Opening
- Florian Hahn (Fraunhofer IEG): The MTES project in Bochum, Germany
- Lukas Oppelt (TU Bergakademie Freiberg): Green energy from abandoned mines – status quo and project results of VODAMIN II and GeoMAP



4TH HEATSTORE WEBINAR

THE MTES PROJECT IN BOCHUM, GERMANY

28 SEP. 2021, WEB-CONFERENCE

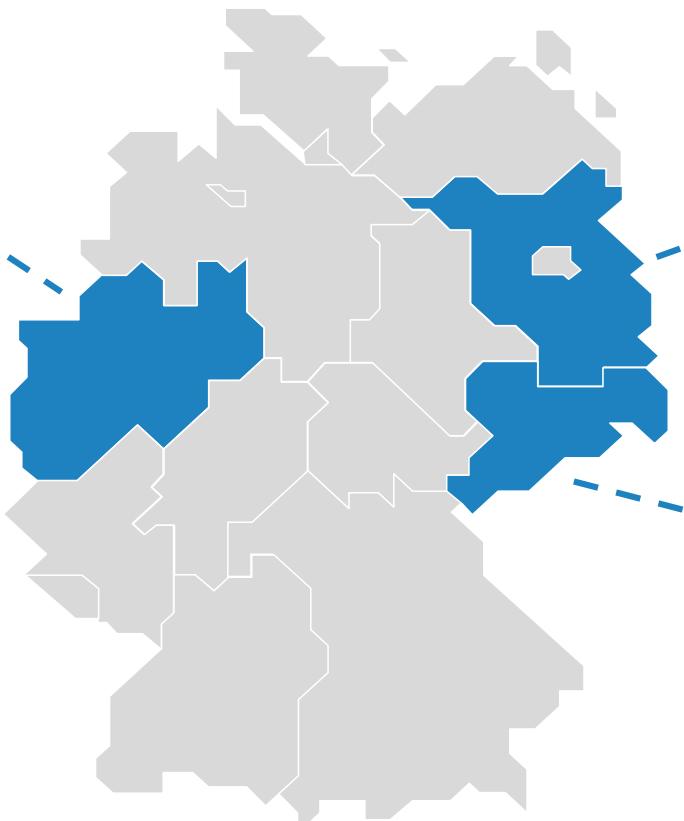
FLORIAN HAHN WITH CONTRIBUTIONS FROM THE HEATSTORE CONSORTIUM

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High Temperature Underground Thermal Energy Storage

Gründung Fraunhofer IEG als selbstständige Einrichtung zum 01.12.2019 und Integration GZB zum 01.01.2020 zu Fraunhofer

Nordrhein-Westfalen:

- Institutsteil »Geothermie« in **Bochum**, **Aachen**, **Weisweiler** mit Integration GZB und in enger Kooperation RUB, Hochschule Bochum und RWTH Aachen
- Institutsteil »Sektorenkopplung im Quartier« in **Jülich** in enger Kooperation mit RWTH Aachen

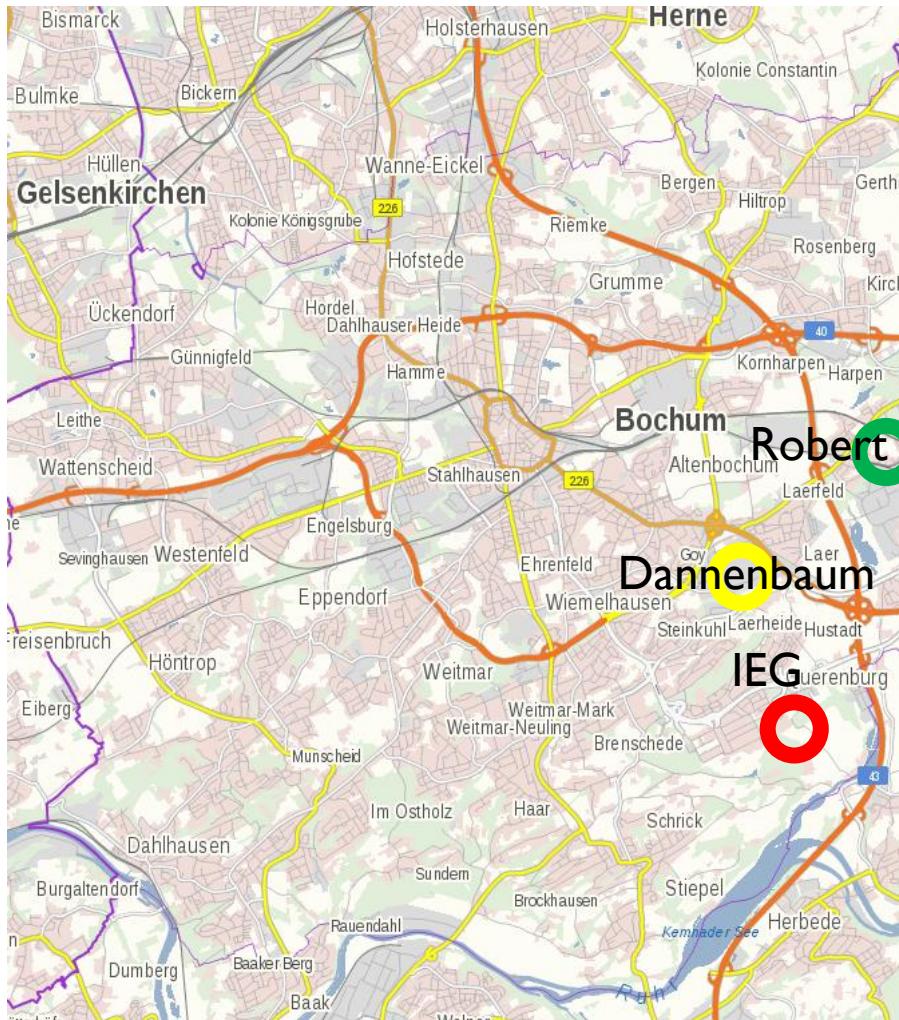


Brandenburg:

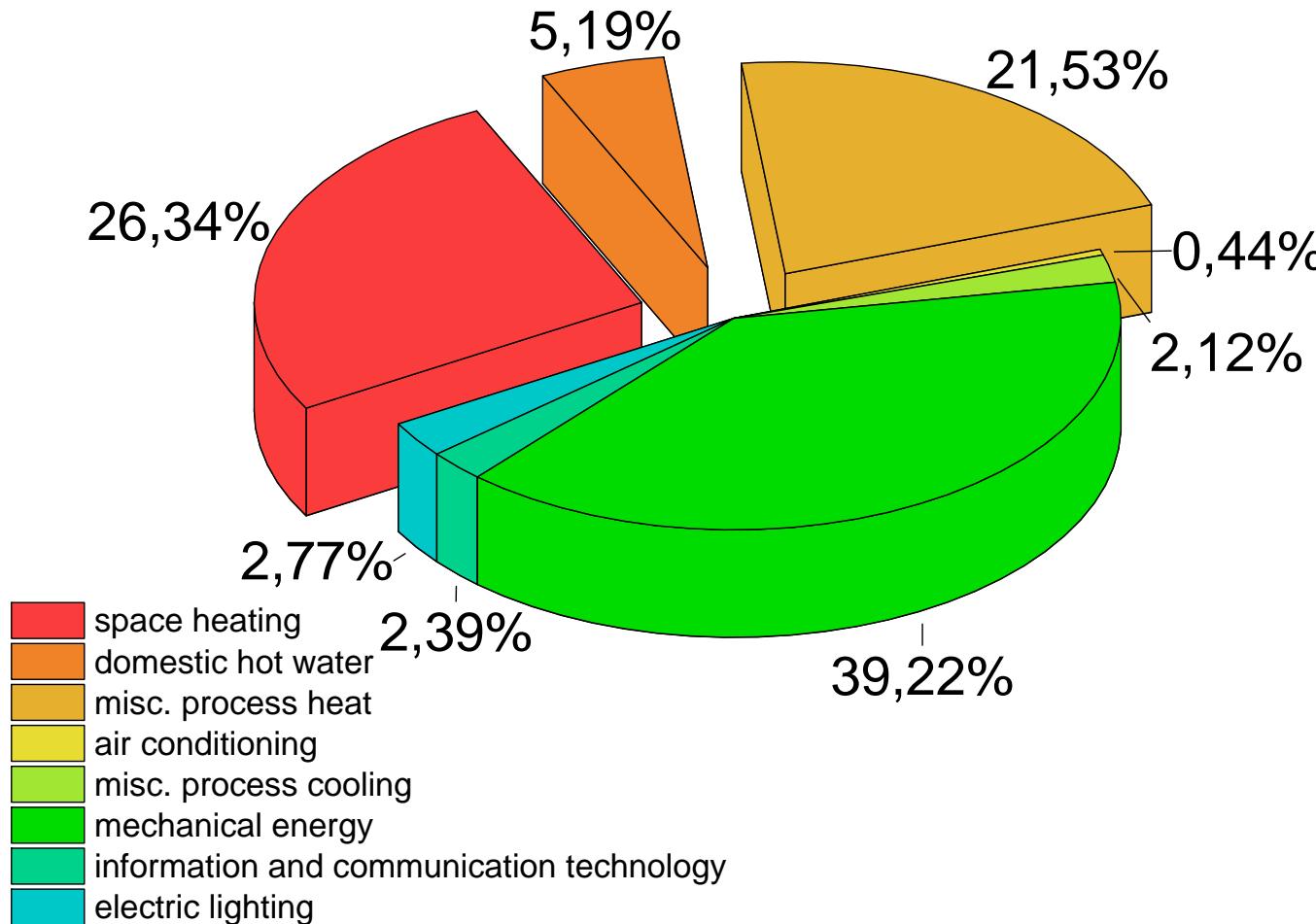
- Institutsteil »Energieinfrastruktur« in **Cottbus** in enger Kooperation mit BTU Cottbus-Senftenberg

Sachsen:

- Außenstelle des Institutsteils »Energieinfrastruktur« in **Zittau** in enger Kooperation mit Hochschule Zittau/Görlitz

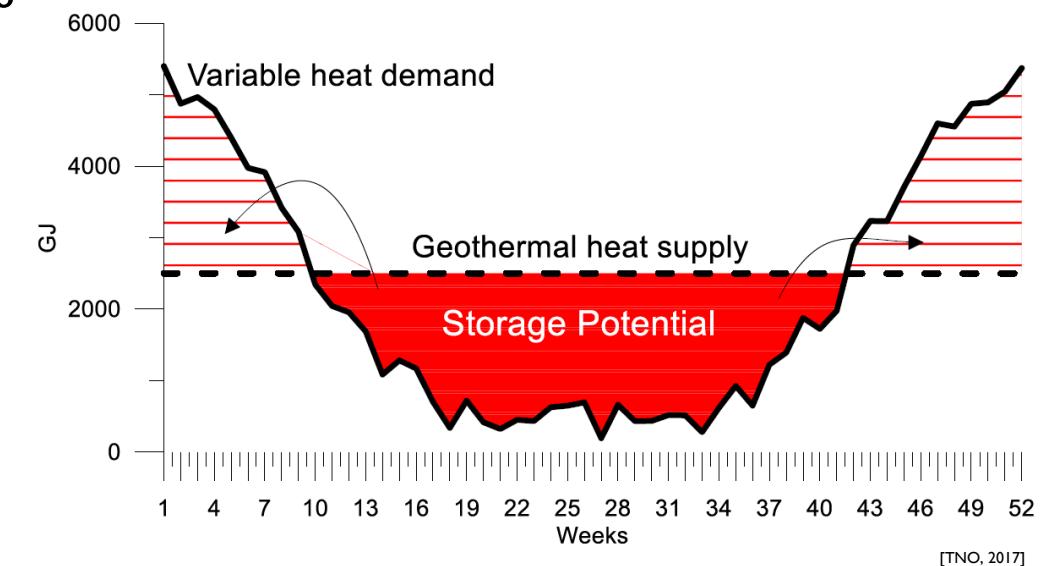


MOTIVATION



■ Germany 2020: 11.691 PJ

	Percentage	RE portion [%]
Overall heating	53,06	6,32
Space heating	26,34	4,5
Domestic hot water	5,19	0,65
Mis. Process heat	21,53	1,17

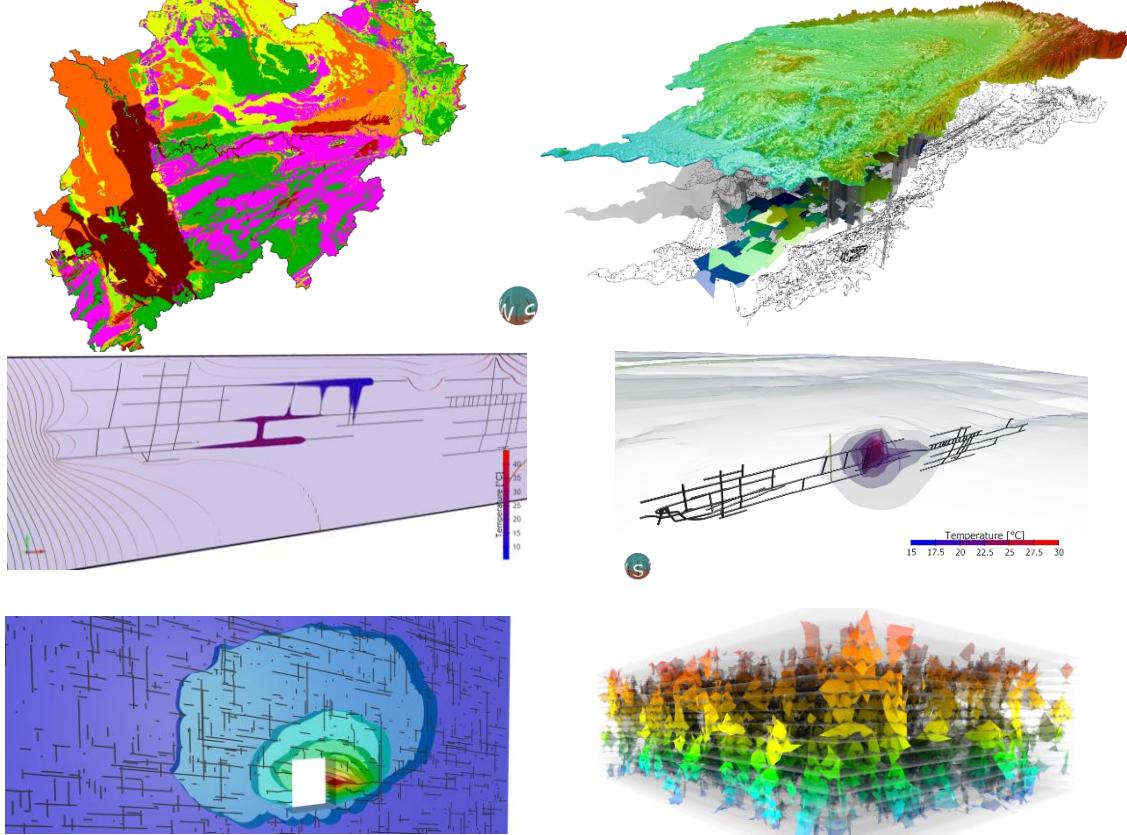
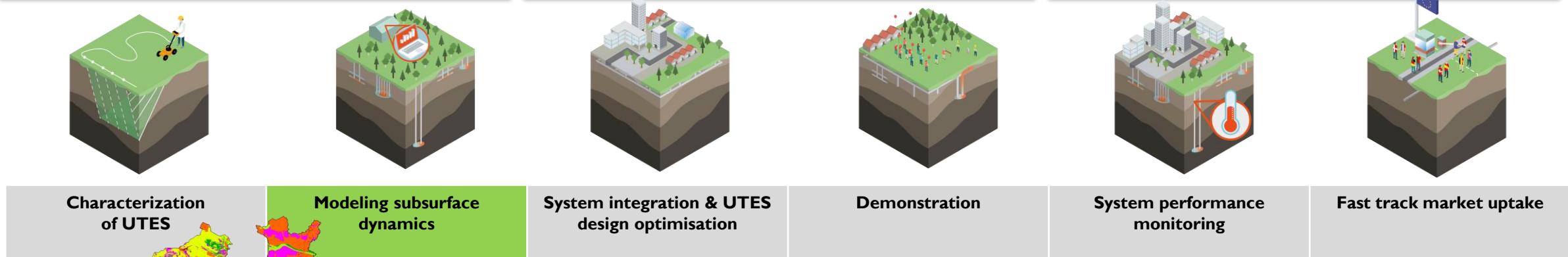




Characterization of UTES		Modeling subsurface dynamics		System integration & UTES design optimisation		Demonstration		System performance monitoring		Fast track market uptake	
Year	Production in t	Comment	Employees								
1953		Commissioning									
1954	10.528	Max. production	49								
1955	10.250		57								
1956	8.346		54								
1957	7.919		48								
1958		Closure									

- Spinning mill Ackermann Inc. in Heilbronn
- Daily production: 40 – 50 t
- Overall production: 37.043 t
- Expectations not fulfilled
- Low volatile bituminous coal





Complexity

- Regional scale
- Site scale
- Local scale



Characterization
of UTES

Modeling subsurface
dynamics

System integration & UTES
design optimisation

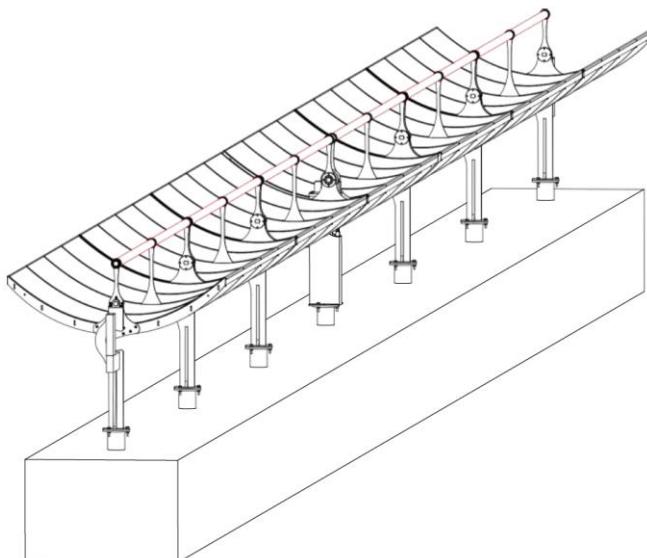
Demonstration

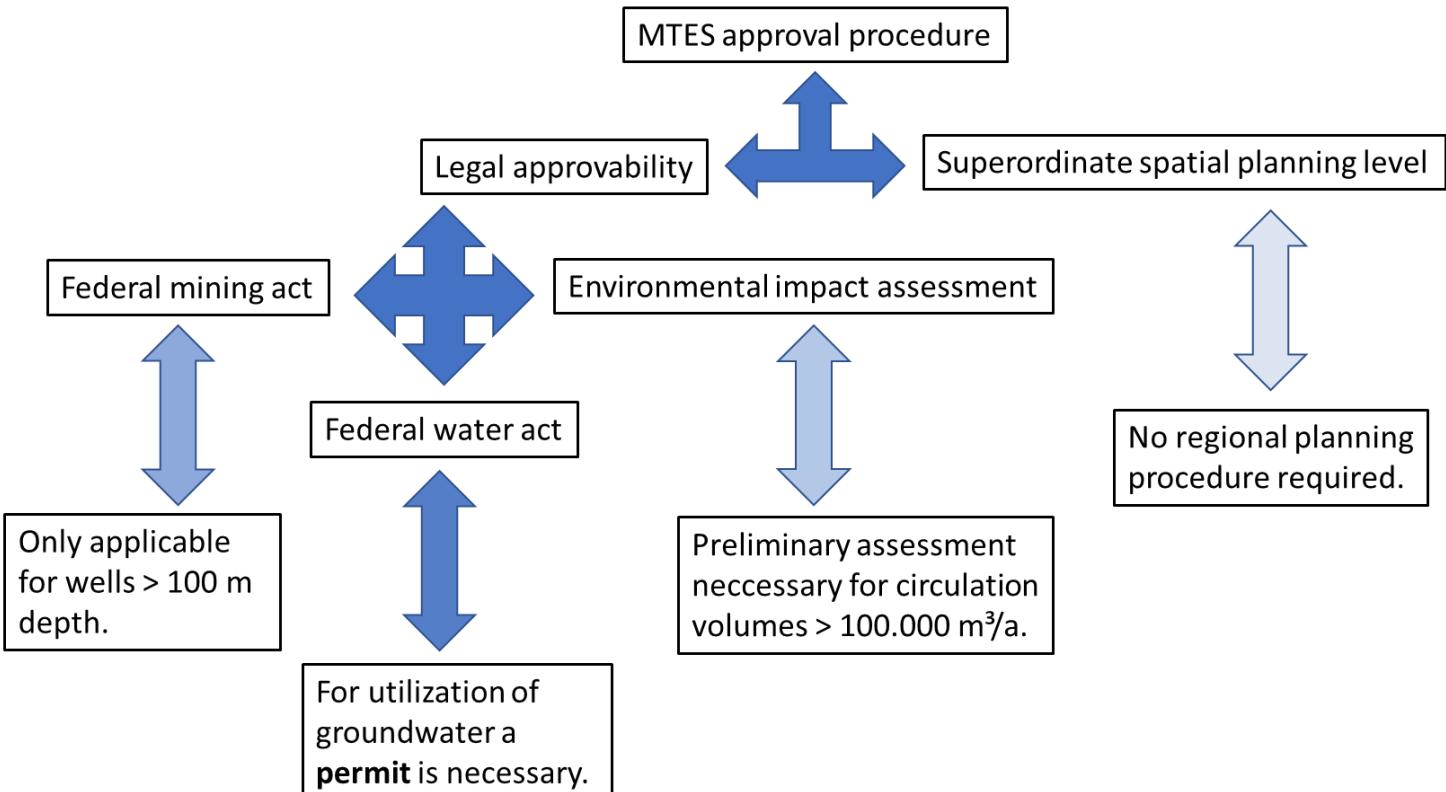
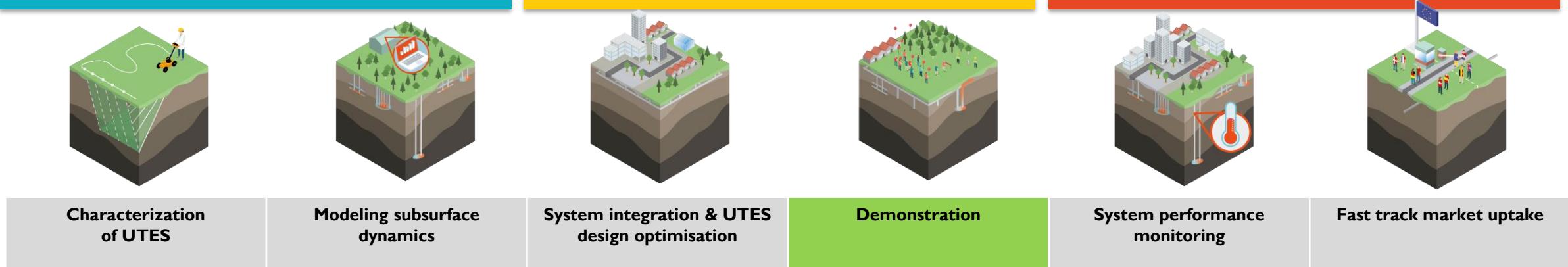
System performance
monitoring

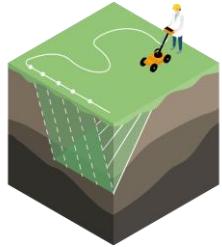
Fast track market uptake

Heat source

- 60 kW CSP plant
- hT heat pump
 - Coupling with district heating grid







Characterization
of UTES

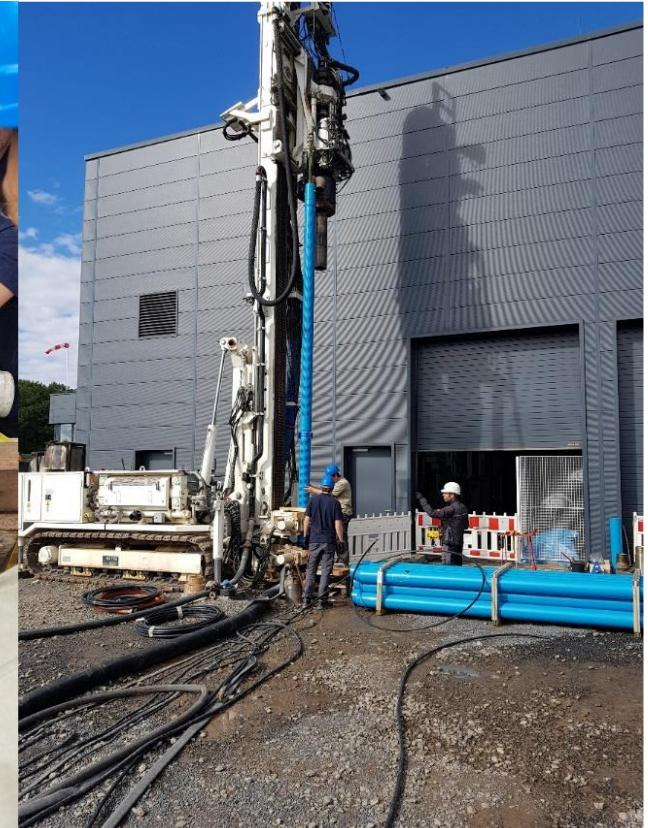
Modeling subsurface
dynamics

System integration & UTES
design optimisation

Demonstration

System performance
monitoring

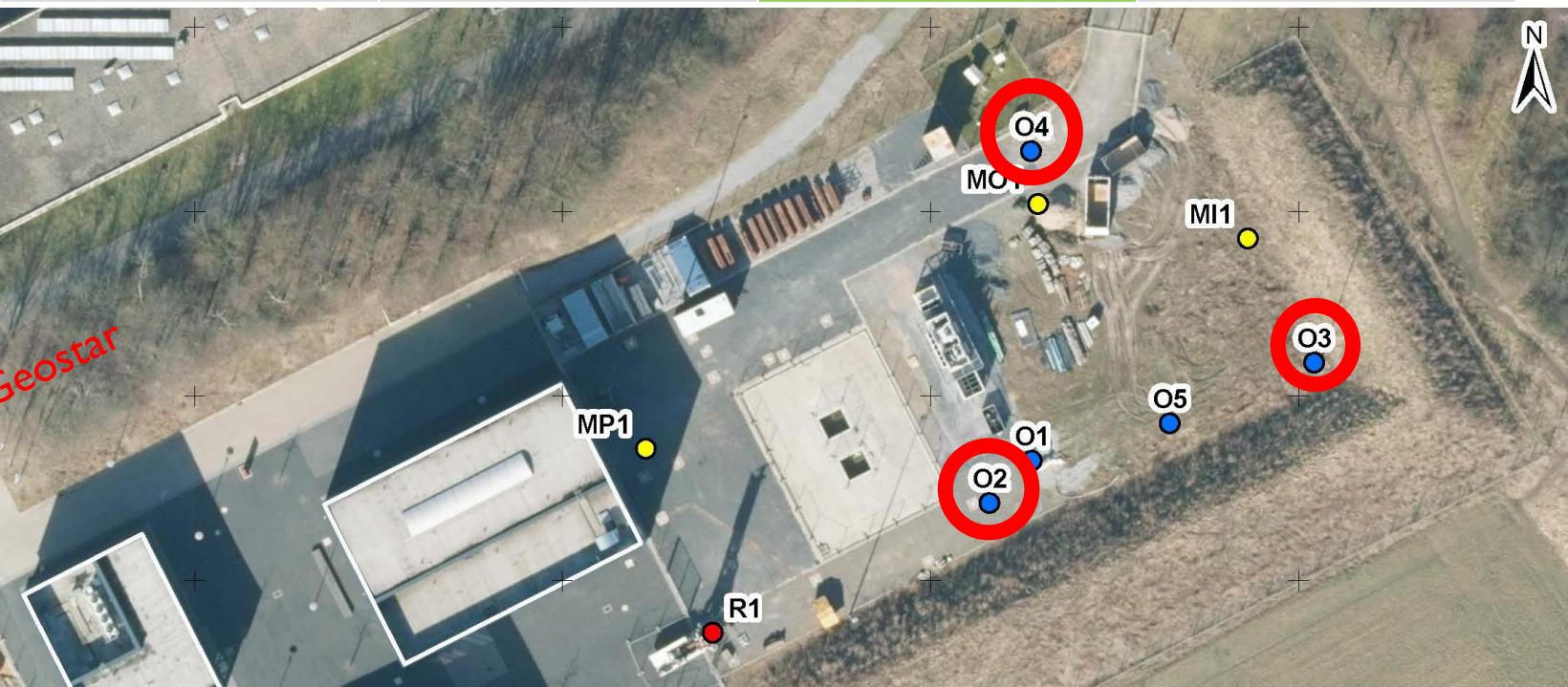
Fast track market uptake



- 15.06.20 – 11.09.20: DC and stabilizer; no RSS
- MPI vertical displacement: 20 cm



Characterization of UTES		Modeling subsurface dynamics		System integration & UTES design optimisation		Demonstration		System performance monitoring		Fast track market uptake	
	Final depth (m.b.g.)		Filter screen (m.b.g.)								
O1	100		16 - 70								
O2	146		127.7 – 143.7								
O3	129.5		87.8 – 103.8								
O4	194		163 - 183								
O5	29.3		open hole: 19 – 29.3								
O1 Geostar	108		separated filters: 15 - 20 / 70 - 100								
R1	508		open hole: 450 - 500								



- Loggers (temp. and pressure) installed in red circled monitoring wells
- DTS installed in yellow wells



Characterization
of UTES

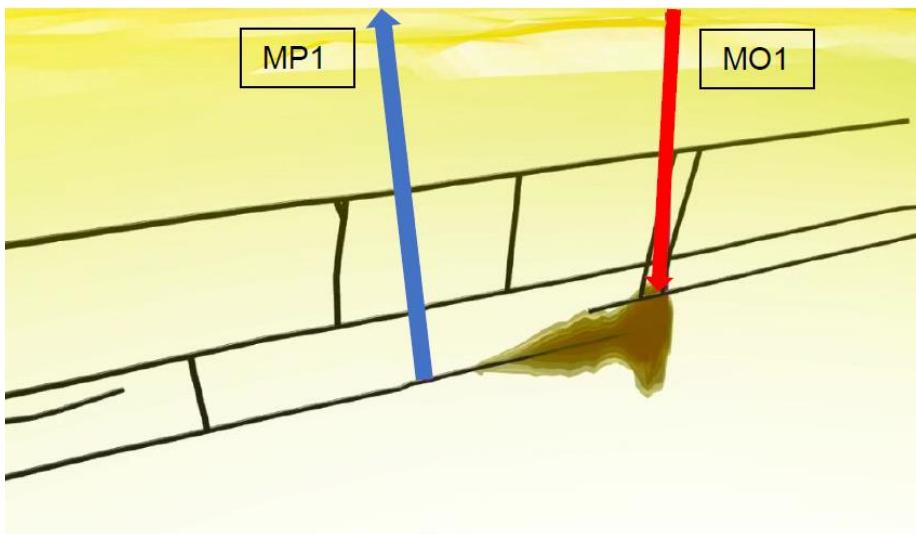
Modeling subsurface
dynamics

System integration & UTES
design optimisation

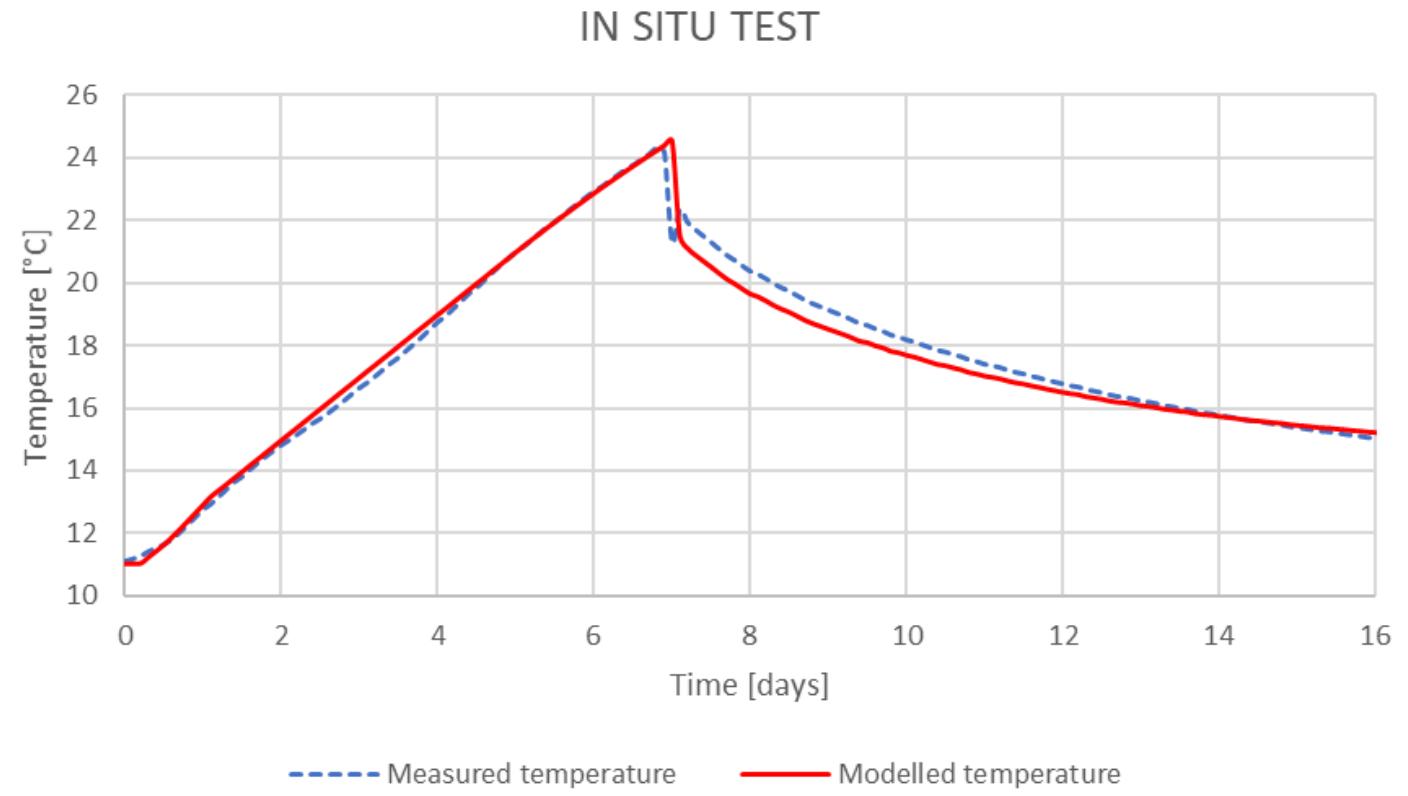
Demonstration

System performance
monitoring

Fast track market uptake



- MP1 cool site Ort 4 (11°C)
- MO1 hot site Ort 4 (max. 60°C)
- 1.234 m³; 5,8 m³/h; 50 MWh





Characterization
of UTES

Modeling subsurface
dynamics

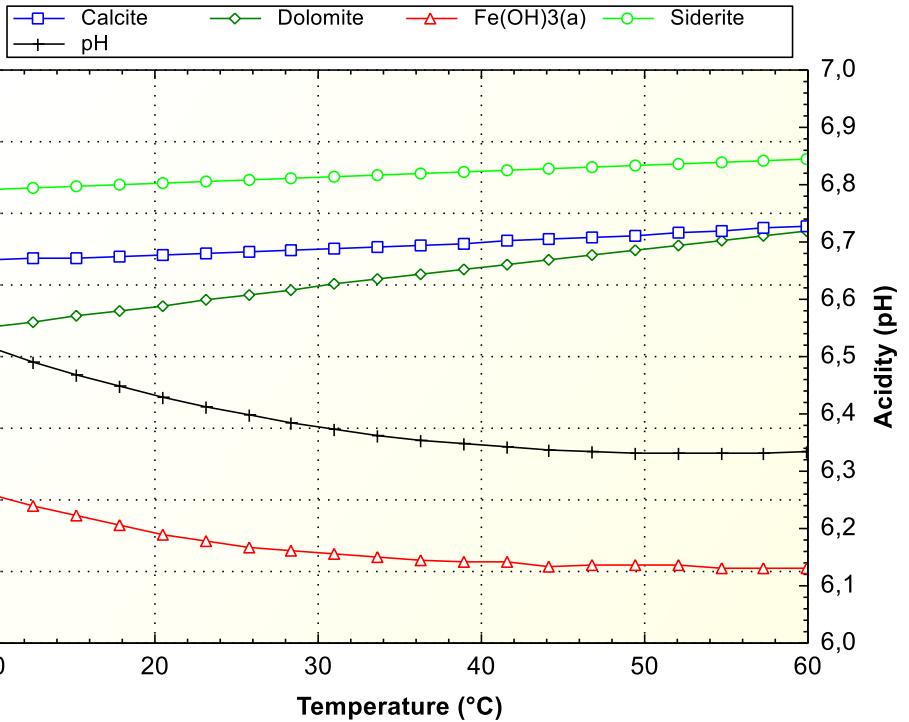
System integration & UTES
design optimisation

Demonstration

System performance
monitoring

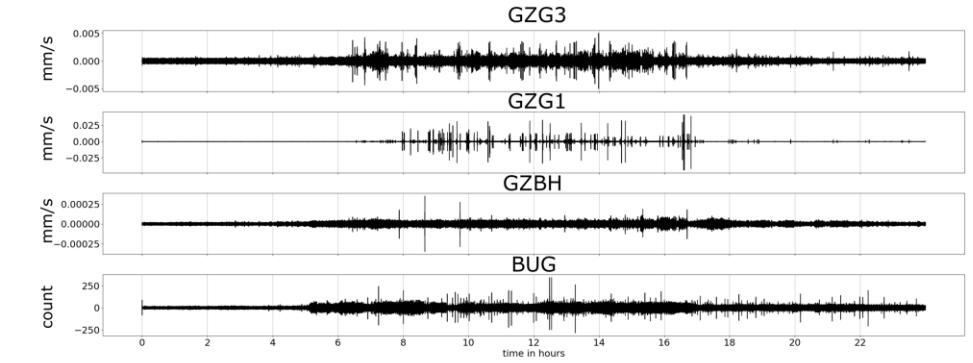
Fast track market uptake

Saturation Index during heat storing (5 Bar, Mine water)

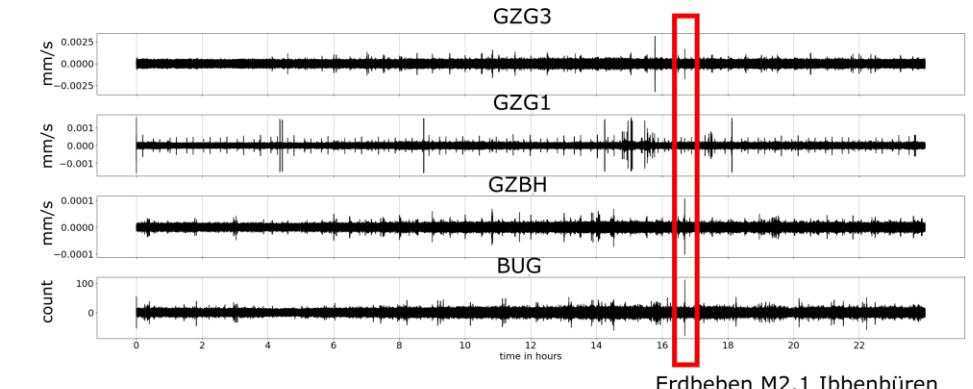




a) Thursday, 03.12.2020

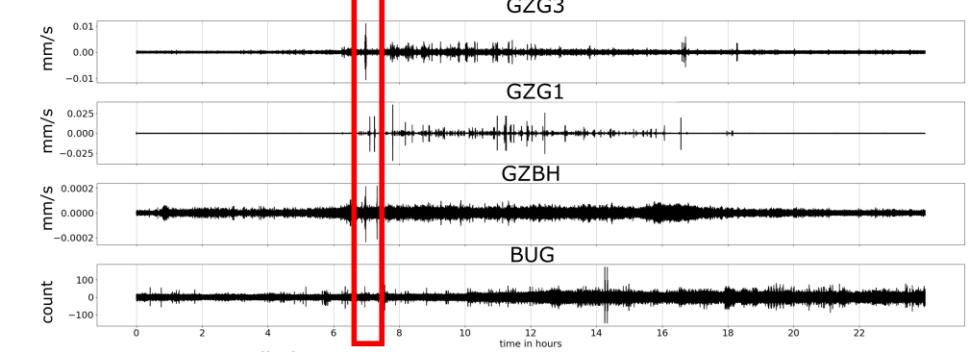


b) Sunday, 13.12.2020

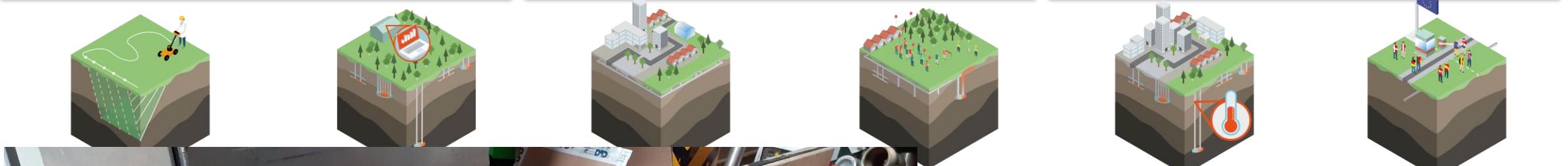


Erdbeben M2.1 Ibbenbüren

c) Monday, 07.12.2020



Erdbeben M1.2 Hamm

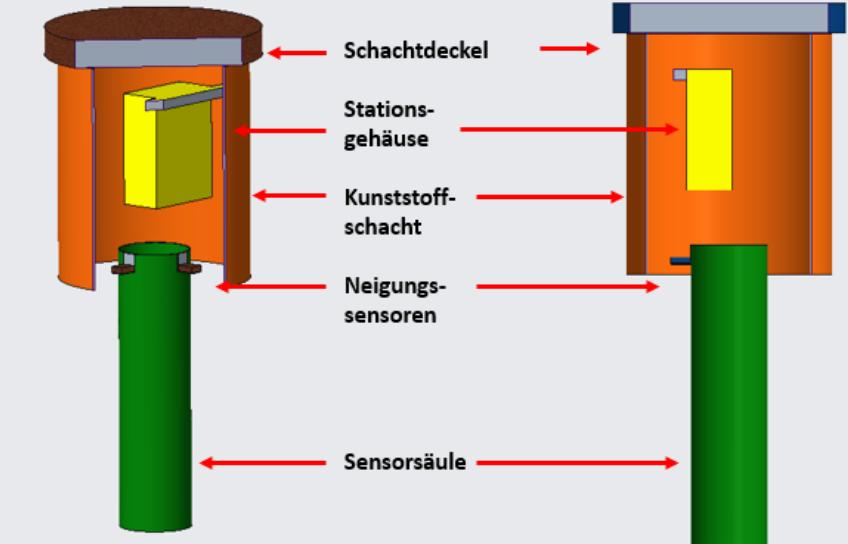


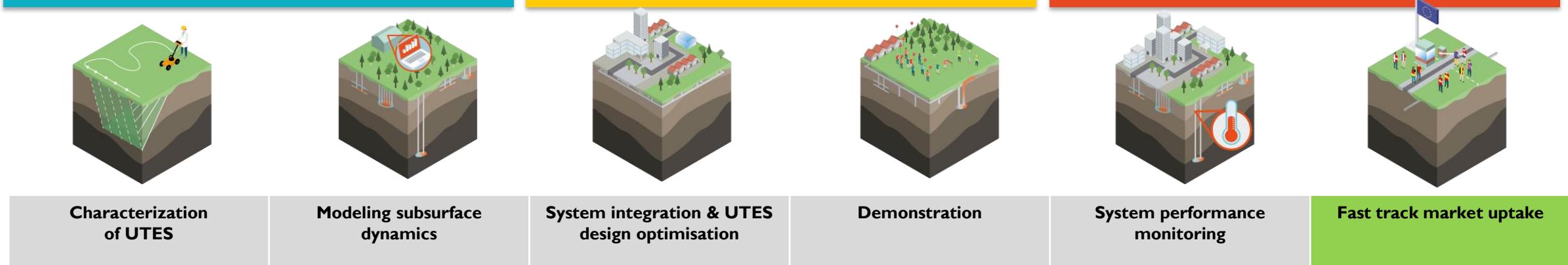
stration

System performance
monitoring

Fast track market uptake

- Mineberry: shaft monitoring

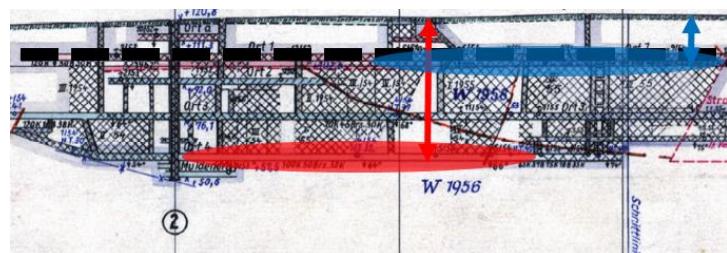




CSP plant



Summer



Mine thermal energy storage

Heating season

hT - heat pump

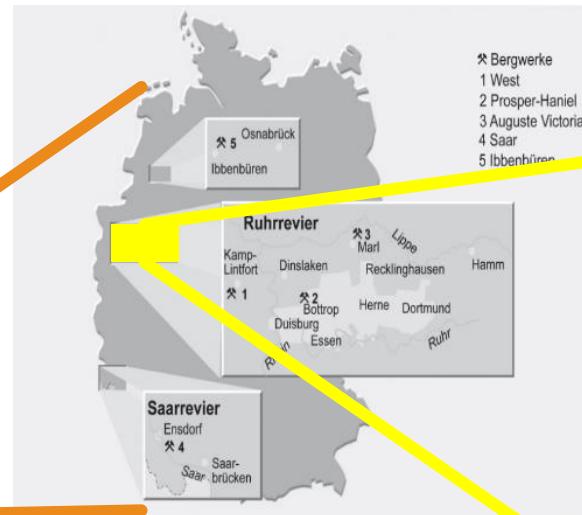
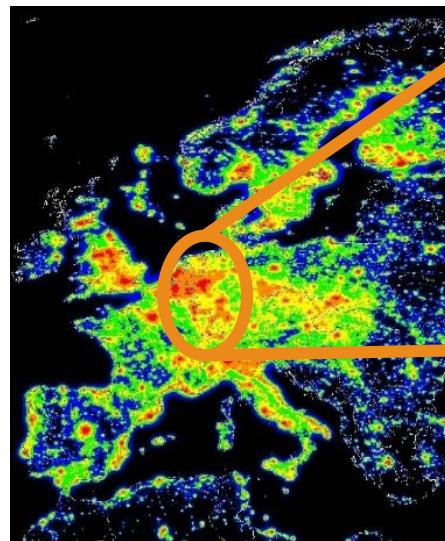


District heating grid
Bochum South



Outlook

Re-utilization of existing mining infrastructures and transformation of the district heating grid



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Jonas Lehmann
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Stefan Klein
Torsten Wiesend

Christoph König
Torsten Seidel

GLÜCKAUF!

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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.