
HEATSTORE

Record of dissemination activities: reports, papers, conference contributions and media articles

Prepared by: Holger Cremer, TNO

Checked by: Geoffroy Gauthier, PlanEnergi

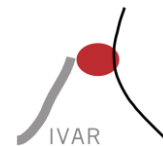
Please cite this report as: Cremer, H. (2021): Record of dissemination activities: reports, papers, conference contributions and media articles. HEATSTORE project report, GEO THERMICA – ERA NET Cofund Geothermal. 16 pp.

This report represents HEATSTORE project deliverable number D6.5.3.

TNO innovation
for life



storengy



KWR



u^b



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.

This project has been subsidized through the ERANET cofund GEOTHERMICA (Project n. 731117), from the European Commission, RVO (the Netherlands), DETEC (Switzerland), FZJ-PtJ (Germany), ADEME (France), EUDP (Denmark), Rannis (Iceland), VEA (Belgium), FRCT (Portugal), and MINECO (Spain).



About HEATSTORE

High Temperature Underground Thermal Energy Storage

The heating and cooling sector is vitally important for the transition to a low-carbon and sustainable energy system. Heating and cooling is responsible for half of all consumed final energy in Europe. The vast majority – 85% - of the demand is fulfilled by fossil fuels, most notably natural gas. Low carbon heat sources (e.g. geothermal, biomass, solar and waste-heat) need to be deployed and heat storage plays a pivotal role in this development. Storage provides the flexibility to manage the variations in supply and demand of heat at different scales, but especially the seasonal dips and peaks in heat demand. Underground Thermal Energy Storage (UTES) technologies need to be further developed and need to become an integral component in the future energy system infrastructure to meet variations in both the availability and demand of energy.

The main objectives of the HEATSTORE project are to lower the cost, reduce risks, improve the performance of high temperature (~25°C to ~90°C) underground thermal energy storage (HT-UTES) technologies and to optimize heat network demand side management (DSM). This is primarily achieved by 6 new demonstration pilots and 8 case studies of existing systems with distinct configurations of heat sources, heat storage and heat utilization. This will advance the commercial viability of HT-UTES technologies and, through an optimized balance between supply, transport, storage and demand, enable that geothermal energy production can reach its maximum deployment potential in the European energy transition.

Furthermore, HEATSTORE also learns from existing UTES facilities and geothermal pilot sites from which the design, operating and monitoring information will be made available to the project by consortium partners.

HEATSTORE is one of nine projects under the GEO THERMICA – ERA NET Cofund and has the objective of 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 maximize geothermal heat production and optimize 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 2 to 5 years, and provide an outlook for utilization potential towards 2030 and 2050.

The 23 contributing partners from 9 countries in HEATSTORE have complementary expertise and roles. The consortium is composed of a mix of scientific research institutes and private companies. The industrial participation is considered a very strong and relevant advantage which is instrumental for success. The combination of leading European research institutes together with small, medium and large industrial enterprises, will ensure that the tested technologies can be brought to market and valorised by the relevant stakeholders.

Document Change Record

This section shows the historical versions, with a short description of the updates.

Version	Short description of change
2021.11.11	Final edited version
2021.11.19	Revised final edited version

Table of Content

About HEATSTORE	3
1 Introduction	5
2 Dissemination activities	5
2.1 HEATSTORE website and storymap UTES potential	5
2.2 HEATSTORE annual conferences	5
2.3 HEATSTORE webinar series	5
2.4 HEATSTORE workshops on roadmap for underground thermal energy storage	6
2.5 HEATSTORE national conferences and workshops	6
2.6 Deliverables for consortium-restricted use only (confidential).....	7
2.7 Deliverables published on project website (www.heatstore.eu).....	7
2.8 Other scientific reports published on project website (www.heatstore.eu)	9
2.9 Milestone reports published on project website (www.heatstore.eu)	9
2.10 Scientific journal papers	9
2.11 Conference proceedings papers	10
2.12 Conference participations.....	12
2.13 Media visibility	14

1 Introduction

Results generated in the HEATSTORE project were shared with stakeholders and various user groups via different channels. These include the project website on which most deliverable reports were published, scientific publications and conference contributions. HEATSTORE was prominently represented with various contributions from all work packages on two of the biggest geothermal conferences: the European Geothermal Congress (The Hague, June 2019) and the World Geothermal Congress (Reykjavik, April-October 2021). HEATSTORE also gained significant media attraction in various newspapers and branch magazines in all participating countries. The complete overview of disseminated results and information is presented below.

2 Dissemination activities

2.1 HEATSTORE website and storymap UTES potential

<https://www.heatstore.eu/>

[HEATSTORE - UTES screening \(arcgis.com\)](#)

2.2 HEATSTORE annual conferences

1st Annual Conference. 3-4 July 2019, Utrecht, The Netherlands (organized by TNO, 50 participants).

2nd Annual Conference. 26 May 2020, organized as web-conference (organized by TNO & ETHZ, 64 participants).

2.3 HEATSTORE webinar series

The HEATSTORE consortium organized a webinar series with 6 webinars in Sept.-Oct. 2021. The webinars were fully virtual, presentations are available on the HEATSTORE website.

Webinar 1 (7 Sept. 2021): Challenges in Underground Thermal Energy Storage. Presented by H. Cremer (TNO), P. Ramsak (RVO), T. Vangkilde-Pedersen (GEUS). 66 participants.

Webinar 2 (14 Sept. 2021): Advances in subsurface characterization and simulation. Presented by T. Driesner (ETHZ), L. Guglielmetti (Univ. Geneva), A. Daniilidis (Univ. Geneva). 53 participants.

Webinar 3 (21 Sept. 2021): Integrating UTES and DSM in geothermal district heating networks. Presented by K. Allaerts (VITO), P.A. Sørensen (PlanEnergi), M. Clarijs (TNO) and R. Octaviano TNO). 48 participants.

Webinar 4 (28 Sept. 2021): Abandoned coal mines – promising sites to store heat in the underground. Presented by I. Nardini (IEG Fraunhofer), F. Hahn (IEG Fraunhofer) and L. Oppelt (Bergakademie Freiberg). 39 participants.

Webinar 5 (5 Oct. 2021): The ECW Energy HT-ATES project in the Netherlands. Presented by W. Bos (ECW Energy), B. Godschalk, P. Oerlemans and N. Franco Pinto (all IF Technology). 56 participants.

Webinar 6 (12 Oct. 2021): The role of UTES in the future EU energy system – a moderated discussion. Presented by J. Koornneef (TNO), Jacopo Tosoni (EASE) and Gonzalo Fernández Costa (EC DG Ener). 51 participants.

2.4 HEATSTORE workshops on roadmap for underground thermal energy storage

HEATSTORE Workshop. Roadmap for Underground Thermal Energy Storage. Workshop I. 4 March 2021 (virtual workshop with the entire HEATSTORE consortium and representatives of the national funding agencies).

HEATSTORE Workshop. Roadmap for Underground Thermal Energy Storage. Workshop II. 25 March 2021 (virtual workshop with the entire HEATSTORE consortium and representatives of the national funding agencies).

HEATSTORE Workshop. Roadmap for Underground Thermal Energy Storage. Workshop III. 22 April 2021 (virtual workshop with the entire HEATSTORE consortium and representatives of the national funding agencies).

2.5 HEATSTORE national conferences and workshops

Danish knowledge sharing day. 18 June 2019. Aarhus, Denmark (organized by GEUS and PlanEnergi; with four presentations by GEUS and PlanEnergi staff).

“Hengill day” workshop. 6 December 2019, OR headquarters, Reykjavík, Iceland. With participants from Reykjavík Energy, the Iceland Geosurvey and the University of Iceland. Workshop included a presentation on the Hengill reservoir model and the HEATSTORE Icelandic high temperature case study collaboration.

Danish knowledge sharing day. 28 October 2020. Web-conference, Denmark (organized by GEUS and PlanEnergi; with 11 presentations by GEUS, PlanEnergi and external national and international stakeholders).

Webinar at UPC. 22 October 2020. Vidal, R., A Geothermal Energy Concept based on Heat Storage in Geological Media. Webinar cycle in Hydrogeology and geochemistry, October 22. Hydrogeology Group (Associated Unit CSIC-UPC, Barcelona).

Intégration de la géothermie dans le système thermique, Presentation to Geneva Cantonal Energy Office, Geneva, 23 November 2020.

Azores national Heatstore meeting. 15 December 2020. IVAR researchers organized a virtual meeting of the HEATSTORE – Geothermica Era-net. December, 15. Invited researchers and end-users of the FRCT, EDA Renováveis S.A. and CIVISA (virtual meeting in Portuguese with three presentations).

- Matias, D., Moreno, L., Viveiros, F., Silva, C., Oliveira, S. (2020). Aplicação de geotermómetros a emissões fumarólicas. Desafios e oportunidades. Reunião virtual projeto do HEATSTORE [In Portuguese]. Oral presentation.
- Pereira, M.L., Matias, D., Viveiros, V., Uchôa, J., Zanon, V. (2020). Contributo da petrografia para o estudo de sistemas geotérmicos. Reunião virtual projeto do HEATSTORE [In Portuguese]. Oral presentation.
- Uchôa, J., Viveiros, F., Matias, D., Pereira, L. (2020). Modelação de dados espaciais em Sistemas de Informação Geográfica. Estratégias e limitações. Reunião virtual projeto do HEATSTORE [In Portuguese]. Oral presentation.

Institute of Earth Sciences, University of Iceland. Reservoir simulations of the Hengill geothermal system – current model and efforts to incorporate greater depths and higher temperatures into the modeling scheme. A virtual presentation on the Icelandic high temperature case study within HEATSTORE, 7 May 2021.

University of Neuchâtel – Exploration & Development of Deep Geothermal Systems Program. Presentation on Geothermal utilization in the Hengill area and efforts to incorporate greater depths and higher temperatures into the modeling scheme as part of the HEATSTORE project. Virtual workshop, 7 May 2021.

Webinar: Explore the possibilities for geological heat storage in your area – June 16, 2021. Webinar organized by GEUS in Danish, presenting the web-tool developed by GEUS for HEATSTORE Task 6.1.

Danish knowledge sharing day. Heat storage and monitoring results. 27 October 2021. Aalborg and Dronninglund (organized by GEUS and PlanEnergi, 7 presentations and site visit).

Festive opening of the Dutch HT-ATES project in Middenmeer, The Netherlands. 29 October 2021. 100 participants from politics, industry and science. Several speeches and walking tours at the HT-ATES installations.

2.6 Deliverables for consortium-restricted use only (confidential)

- D2.1: Driesner, T. (ed.) (2019) Initial report on tools and workflows for simulating subsurface dynamics of different types of High temperature Underground Thermal energy Storage. HEATSTORE project report, GEOTHERMICA – ERANET Cofund Geothermal. Unpublished report, 143 pp.
- D3.1: Allaerts, K. (2019) Minutes of the first workshop on design and system integration. HEATSTORE project report, GEOTHERMICA – ERANET Cofund Geothermal. Unpublished report, 3 pp.
- D3.2: Allaerts, K. (ed.) (2019) Technical report on the characteristics of heat demand and supply at the demonstrator sites. HEATSTORE project report, GEOTHERMICA – ERANET Cofund Geothermal. Unpublished report, 56 pp. + appendices.
- D3.4: Vanschoenwinkel, J. et al. (2019) Design and execution of business case models for the demonstration sites. HEATSTORE project report, GEOTHERMICA – ERA NET Cofund Geothermal. Unpublished report, 41 pp + appendices.
- D6.5.1: Sørensen, P.A., Koornneef, J. (2019) HEATSTORE Plan for communication and dissemination. HEATSTORE project report, GEOTHERMICA – ERANET Cofund Geothermal. Unpublished report, 7 pp.
- D7.1: Cremer, H. et al. (2019) Mid-term review report HEATSTORE. HEATSTORE project report, GEOTHERMICA – ERANET Cofund Geothermal. Unpublished report, 36 pp.

2.7 Deliverables published on project website (www.heatstore.eu)

- D1.1: Kallesøe, A.J., Vangkilde-Pedersen, T. (eds.) (2019) Underground Thermal energy Storage (UTES) – state-of-the-art, example cases and lessons learned. HEATSTORE project report, GEOTHERMICA – ERANET Cofund Geothermal. 130 pp. + appendices.
- D1.2: Nielsen, J.E., Vangkilde-Pedersen, T. (eds.) (2019) Underground Thermal energy Storage (UTES) – general specifications and design. HEATSTORE project report, GEOTHERMICA – ERANET Cofund Geothermal. 58 pp.
- D1.3 Guglielmetti, L. (ed.) (2021) Screening of the national potential for UTES. HEATSTORE project report, GEOTHERMICA – ERANET Cofund Geothermal. 87 pp.
- D1.4/D4.2/D4.3 Hamm, V. et al. (2021): Synthesis of demonstration projects and case studies realized in HEATSTORE – Best practice guidelines for the development of UTES. HEATSTORE project report, GEOTHERMICA – ERANET Cofund Geothermal. 61 pp.
- D2.1 Driesner, T. (ed.) (2021) Final report on tools and workflows for simulating subsurface dynamics of different types of High Temperature Underground Thermal Energy storage. HEATSTORE project report, GEOTHERMICA – ERANET Cofund Geothermal. 348 pp.
- D2.2: Tómasdóttir, S. & Gunnarsson, G. (eds.) (2019): HEATSTORE – Interim report on UTES-type/site-specific simulators based on academic/research codes. HEATSTORE project report, GEOTHERMICA – ERA NET Cofund Geothermal. 55 pp.
- D2.2 Tómasdóttir, S. & Gunnarsson, G. (eds.) (2021): HEATSTORE – Final report on UTES-type/site-specific simulators based on academic/research codes. HEATSTORE project report, GEOTHERMICA – ERA NET Cofund Geothermal. 58 pp.
- D2.3: Alt-Epping, P. & Mindel, J. (eds.) (2020): HEATSTORE – Benchmarking and improving models of subsurface heat storage dynamics. HEATSTORE project report, GEOTHERMICA – ERA NET Cofund Geothermal. 104 pp.
- D3.3: Allaerts, K. et al. (2021): UTES and its integration in the heating system - Defining optimal design and operational strategies for the demonstration cases. HEATSTORE project report, GEOTHERMICA – ERANET Cofund Geothermal. 96 pp. Revised version published on 31 October 2021.

- D3.6: Werkman, E. et al. (2019) Incorporation of a new generation smart energy management algorithm (HeatMatcher) in CHESS. HEATSTORE project report, GEOTHERMICA – ERANET Cofund Geothermal. 21 pp.
- D4.1: Hahn, F. et al. (2019) Feasibility assessment & design for demonstration projects – learnings of an international workshop. HEATSTORE project report, GEOTHERMICA – ERANET Cofund Geothermal. 22 pp.
- D5.1: Hahn, F. (ed.) (2019) Monitoring plans: demonstration projects and case studies. HEATSTORE project report, GEOTHERMICA – ERANET Cofund Geothermal. 29 pp.
- D5.2 Oerlemans, P. (ed.) (2021) Monitoring data availability of the UTES demonstration projects and case studies, status 2021. HEATSTORE project report, GEOTHERMICA – ERANET Cofund Geothermal. 12 pp.
- D5.2 Oerlemans, P., Drijver, B. (2021) Effects of HT-ATES on the subsurface – the NIOO case study. An evaluation of the effects of a HT-ATES system (45 °C) on the subsurface. HEATSTORE project report, GEOTHERMICA – ERANET Cofund Geothermal. 78 pp.
- D5.2 Guglielmetti, L., Houlié, N., Nawratil de Bono, C., Martin, F., Coudroit, J. (2021) Monitoring results for the Geneva HT-ATES case-study. HEATSTORE project report, GEOTHERMICA – ERANET Cofund Geothermal. 33 pp.
- D5.3 Diaz-Maurin, F., Saaltink, M.W. (2021) Model validation for subsurface dynamics. HEATSTORE project report, GEOTHERMICA – ERANET Cofund Geothermal. 111 pp.
- D5.4 Koenen, M., Tümer, C., Rey, C., Gauthier, G. (2021) Validation report of system integration modelling. HEATSTORE project report, GEOTHERMICA – ERANET Cofund Geothermal. 21 pp.
- D5.5 Armandine Les Landes, A. et al. (2021) Uncertainty management in underground thermal energy storage development and operation. HEATSTORE project report, GEOTHERMICA – ERANET Cofund Geothermal. 73 pp.
- D6.1 UTES Screening – Subsurface potential for heat storage. HEATSTORE project report, GEOTHERMICA – ERANET Cofund Geothermal. Web GIS platform accessible via <https://www.heatstore.eu/> and [HEATSTORE - UTES screening \(arcgis.com\)](https://arcgis.com)
- D6.2 Mirjolet, F. et al. (2021) Regulatory and policy boundary conditions for UTES. HEATSTORE project report, GEOTHERMICA – ERANET Cofund Geothermal. 116 pp.
- D6.3 Hahn, F. et al. (2021) Report on evaluation of new business models for flexible energy systems with UTES in Europe. HEATSTORE project report, GEOTHERMICA – ERANET Cofund Geothermal. 116 pp.
- D6.4 Koornneef, J. et al. (2021) Roadmap for flexible energy systems with underground thermal energy storage towards 2050. HEATSTORE project report, GEOTHERMICA – ERANET Cofund Geothermal. 57 pp.
- D6.5.2 Borch, K. (2021) Public acceptance of UTES and geothermal projects – best practice learnings. GEOTHERMICA – ERANET Cofund Geothermal. 17 pp.
- D6.5.3 Cremer, H. (2021) Summary of dissemination activities: reports, papers, conference contributions and media articles. HEATSTORE project report, GEOTHERMICA – ERANET Cofund Geothermal. 16 pp.
- D6.6 Guglielmetti, L., Bloemendal, M. Hahn, F., Hilleke Mortensen, M., Koornneef, J, eds. (2021) Environmental effects of UTES in Europe. HEATSTORE project report, GEOTHERMICA – ERANET Cofund Geothermal. 118 pp. Revised version published on 25 October 2021.

2.8 Other scientific reports published on project website (www.heatstore.eu)

- Dijkstra, H. et al. (2020) Workflow to evaluate the risk of mineral scaling in a HT-ATES system and application to a potential site in Middenmeer, The Netherlands. TNO report 2020R10437. 56 pp.
- Ditlevsen, C. (2021) Vurdering af potentialet for geologisk varmelagring (UTES) – Aarhus Kommune. Danmarks og Grønlands Geologiske Undersøgelse, Rapport 2021/26, 35 p. (in Danish with English abstract).
- Griffioen, J. (2020) A literature review on the precipitation of Ca, Ca-Mg and Fe carbonates and its inhibition under HT-ATES conditions. TNO report 2020R11204. 63 pp.
- Kallesøe, A.J., Mortensen, M.H. (2021) Vurdering af potentialet for geologisk varmelagring (UTES) – Esbjerg området. Danmarks og Grønlands Geologiske Undersøgelse, Rapport 2021/11, 29 p. (in Danish with English abstract).
- Kallesøe, A.J., Mortensen, M.H. (2021) Vurdering af potentialet for geologisk varmelagring (UTES) – Odense området. Danmarks og Grønlands Geologiske Undersøgelse, Rapport 2021/12, 35 p. (in Danish with English abstract).
- Kallesøe, A.J., Mortensen, M.H. (2021) Vurdering af potentialet for geologisk varmelagring (UTES) – Ringkøbing-Videbæk området. Danmarks og Grønlands Geologiske Undersøgelse, Rapport 2021/13, 36 p. (in Danish with English abstract).
- Kallesøe, A.J., Mortensen, M.H. (2021) Vurdering af potentialet for geologisk varmelagring (UTES) – Guldborgsund området. Danmarks og Grønlands Geologiske Undersøgelse, Rapport 2021/14, 31 p. (in Danish with English abstract).
- Koumrouyan, M. (2019). Geomechanical Characterization of Geothermal Exploration Borehole: Implication for the GEO-01 Well in Geneva. Master Thesis, University of Neuchatel.
- Van Unen, M. et al. (2020) HEATSTORE risk assessment approach for HT-ATES applied to demonstration case Middenmeer, The Netherlands. TNO report 2020R10192. 34 pp.
- Gauthier, G. (2020) Benchmarking and improving models of subsurface heat storage dynamics. Comparison of Danish PTES and BTES installation measurements with their corresponding TRNSYS models. HEATSTORE project report, GEOTHERMICA – ERANET Cofund Geothermal. 47 pp. This report is a contribution from the Danish team to D2.3.

2.9 Milestone reports published on project website (www.heatstore.eu)

- MS1.2 Mortensen, M.H. & Ditlevsen, C. (2020) National screening process for Underground Thermal Energy Storage (UTES) sites in Denmark. 9 pp.
- MS1.3 Boullenger, B. et al. (2020) Seismic reprocessing for shallow structure of aquifers. 18 pp.
- MS5.5 Rohmer, J. et al. (2020) Theoretical framework for the representation of uncertainties. 14 pp.

2.10 Scientific journal papers

- Birdsell, D.T., Adams, B.M., Saar, M. (2021) Minimum transmissivity and optimal well spacing and flow rate for high-temperature aquifer thermal energy storage from economic and reservoir engineering constraints. *Applied Energy*, 289, <https://doi.org/10.1016/j.apenergy.2021.116658>.
- Mindel, J. and 16 others (2021) Benchmark study of simulators for thermo-hydraulic modelling of low enthalpy geothermal processes. *Geothermics* 96: 102130 (<https://doi.org/10.1016/j.geothermics.2021.102130>).
- Viveiros, F., Chiodini, G., Cardellini, C., Caliro, S., Zanon, V., Silva, C., Rizzo, A.L., Hipólito, A, Moreno, L. (2020). Deep CO₂ emitted at Furnas do Enxofre geothermal area (Terceira Island, Azores archipelago). An approach for determining CO₂ sources and total emissions using carbon isotopic data. *Journal of Volcanology and Geothermal Research*, 401: 106968.
- Viveiros, F., Silva, C., Moreno, L., Pacheco, J.E., Ferreira, T. (2020) Secondary manifestations of volcanism – an open window to understand geothermal resources in the Azores archipelago. *Comunicações Geológicas* 107, Especial I, 89-91.

2.11 Conference proceedings papers

European Geothermal Congress 2019, The Hague, The Netherlands, 11-14 June 2019

- Beernink, S., Hartog, N., Bloemendal, M., van der Meer, M. (2019) ATES systems performance in practice: analysis of operational data from ATES systems in the province of Utrecht, The Netherlands. Proceedings European Geothermal Congress 2019, The Hague, The Netherlands, 11-14 June, 2019.
- Bloemendal, M., Beernink, S., Hartog, N., van Meurs, B. (2019) Transforming ATES to HT-ATES, insights from Dutch pilot project. Proceedings European Geothermal Congress 2019, The Hague, The Netherlands, 11-14 June, 2019.
- Drijver, B., Bakema, G., Oerlemans, P. (2019) State of the art of HT-ATES in The Netherlands. Proceedings European Geothermal Congress 2019, The Hague, The Netherlands, 11-14 June, 2019.
- Hahn, F., Jagert, F., Bussmann, G., Nardini, I., Bracke, R., Seidel, T., König, C. (2019) The reuse of the former Markgraf II colliery as a mine thermal energy storage. Proceedings European Geothermal Congress 2019, The Hague, The Netherlands, 11-14 June, 2019.
- Koornneef, J., Guglielmetti, L., Hahn, F., Egermann, P., Vangkilde-Pedersen, T., Aradóttir, E.S., Allaerts, K., Viveiros, F., Saaltink, M. (2019) HEATSTORE: high temperature underground thermal energy storage. Proceedings European Geothermal Congress 2019, The Hague, The Netherlands, 11-14 June, 2019.
- Koumrouyan, M., Sohrabi, R., Valley, B. (2019) Geomechanical characterization of geothermal exploration borehole for Aquifer Thermal Energy Storage (ATES) development in Geneva, Switzerland. Proceedings European Geothermal Congress 2019, The Hague, The Netherlands, 11-14 June, 2019.

InSAR - Radar satellite interferometry and ground deformation workshop, Geneva, Switzerland, 3 April 2019

- Birdsell D and Saar M.O. (2019) Predicting Surface Deformation for Geothermal Energy with a Thermo-Poro-Elastic Model, Oral Presentation, InSAR - Radar satellite interferometry and ground deformation workshop, Geneva, Switzerland, 3 April 2019.

AAPG 3rd Hydrocarbon - Geothermal Cross Over Technology Workshop, Geneva, Switzerland, 9 - 10 April 2019

- Birdsell, D. and Saar, M.O. (2019). Use of a coupled thermo-hydro-mechanical model to constrain the risk of ground surface deformation due to subsurface energy storage and production, Poster Presentation, AAPG 3rd Hydrocarbon - Geothermal Cross Over Technology Workshop, Geneva, Switzerland, 9 - 10 April 2019.

World Geothermal Congress 2020, Reykjavik, Iceland, 26 April - 2 May 2020. Conference postponed to April-October 2021 due to Covid-19 pandemic. Organized as virtual conference 'WGC 2020+1' on several dates in 2021.

- Birdsell, D., Saar, M. (2021): Modelling Ground Surface Deformation at the Swiss HEATSTORE Underground Thermal Energy Storage Sites. Proceedings of the World Geothermal Congress 2020+1, Reykjavik, Iceland, April-October 2021.
- Eruteya, O., Guglielmetti, L., Makhloufi, Y., Moscariello, A. (2021): 3-D Static Model to Characterize Geothermal Reservoirs for High-Temperature Aquifer Thermal Energy Storage (HT-ATES) in the Geneva Area, Switzerland. Proceedings of the World Geothermal Congress 2020+1, Reykjavik, Iceland, April-October 2021.
- Ferreira de Oliveira, G., De Haller, A., Guglielmetti, L., Makhloufi, Y., Moscariello, A., (2021): Application of Chemostratigraphy and Petrology to Characterize the Reservoirs of the Mesozoic Sequence Crossed by the GGeo-01 Well: Potential for Direct Heat Production and Heat-Storage. Proceedings of the World Geothermal Congress 2020+1, Reykjavik, Iceland, April-October 2021.
- Godschalk, B., Provoost, M., Schoof, F. (2021) Netherlands country update. Proceedings of the World Geothermal Congress 2020+1, Reykjavik, Iceland, April-October 2021.
- Guglielmetti, L. and 22 others (2020) HEATSTORE SWITZERLAND: New opportunities of geothermal district heating network sustainable growth by High Temperature Aquifer Thermal Energy Storage

- development. Proceedings of the World Geothermal Congress 2020+1, Reykjavik, Iceland, April-October 2021.
- Hahn, F., Jagert, F., Bussmann, G., Nardini, I., Bracke, R., Seidel, T., König, C. (2021) The reutilization of a small coal mine as a Mine Thermal Energy Storage. Proceedings of the World Geothermal Congress 2020+1, Reykjavik, Iceland, April-October 2021.
- Kallesøe, A.J., Vangkilde-Pedersen, T., Nielsen, J.E., Bakema, G., Egermann, P., Maragna, C., Hahn, F., Guglielmetti, L., Koornneef, J. (2021) HEATSTORE – Underground Thermal Energy Storage (UTES) – State of the Art, Example Cases and Lessons Learned. Proceedings of the World Geothermal Congress 2020+1, Reykjavik, Iceland, April-October 2021.
- Koornneef, J., Guglielmetti, L., Hahn, F., Egermann, P., Vangkilde-Pedersen, T., Aradóttir, E.S., Allaerts, K., Viveiros, F., Saaltink, M. (2021) HEATSTORE Project Update: High Temperature Underground Thermal Energy Storage. Proceedings of the World Geothermal Congress 2020+1, Reykjavik, Iceland, April-October 2021.
- Mindel, J.E. & Driesner, T. (2021) HEATSTORE: Preliminary design of a High Temperature Aquifer Thermal Energy Storage (HT-ATES) system in Geneva based on TH simulations. Proceedings of the World Geothermal Congress 2020+1, Reykjavik, Iceland, April-October 2021.
- Moscariello, A., Guglielmetti, L. and 15 others (2021) Heat production and storage in western Switzerland: advances and challenges of intense multidisciplinary geothermal exploration activities, an eight year progress report. Proceedings of the World Geothermal Congress 2020+1, Reykjavik, Iceland, April-October 2021.
- Rey, C., Maragna, C., Egermann, P., Perreaux, M. (2021) Modelling of an innovative HT-BTES (smart) design with lateral recovery boreholes to reduce heat losses : development and preliminary result. Proceedings of the World Geothermal Congress 2020+1, Reykjavik, Iceland, April-October 2021.
- Sohrabi, R., Valley, B. (2021) Thermo-Hydraulic-Mechanical (THM) Experiments and Numerical Simulations to Quantify Heat Exchange Characteristics of Fractured Limestone Reservoirs for Aquifer Thermal Energy Storage (ATES). Proceedings of the World Geothermal Congress 2020+1, Reykjavik, Iceland, April-October 2021.
- Tómasdóttir, S., Gunnarsson, G., Aradóttir, E.S.P. (2021) Possible seasonal injection of surplus hot water from the Hengill Area into a low temperature system within Iceland's capital area. Proceedings of the World Geothermal Congress 2020+1, Reykjavik, Iceland, April-October 2021.
- Viveiros, F., Silva, C., Matias, D., Moreno, L., Driesner, T., Zanon, V., Uchôa, J., Cruz, J.V., Freire, P., Pereira, M.L., Pacheco, J. (2021). Geochemical tools as a contribution to improve geothermal potential on the Azores archipelago. Proceedings of the World Geothermal Congress 2020+1, Reykjavik, Iceland, April-October 2021.

GET2020 – 1st Geoscience & Engineering in Energy Transition Conference, 16-18 November 2020, Strasbourg, France

- Drijver, B., Oerlemans, P., Bos, W. (2020) Full-scale HT-ATES tests demonstrate that current guidelines considerably overestimate sand production risks in deeper unconsolidated aquifers-concept. Proceedings GET2020, Strasbourg, France, November 16-18, 2020.

18th Swiss Geoscience Meeting, Online, Hosted by ETH Zurich, 6-7 November 2020

- Birdsell D. et al.(2020) Determination of minimum transmissivity for high-temperature aquifer thermal energy storage from reservoir-engineering and economic constraints, Contributed Talk, 18th Swiss Geoscience Meeting, Online, Hosted by ETH Zurich, 6-7 November 2020.

2.12 Conference participations

European Geothermal Congress 2019, The Hague, The Netherlands, 11-14 June 2019

Beernink, S. et al. (2019) ATES systems performance in practice: analysis of operational data from ATES systems in the province of Utrecht, The Netherlands. Oral presentation.

Bloemendal, M. et al. (2019) Transforming ATES to HT-ATES, insights from Dutch pilot project. Poster presentation.

Drijver, B. et al. (2019) State of the art of HT-ATES in The Netherlands. Oral presentation.

Hahn, F. et al (2019) The utilization of the former Markgraf II colliery as a mine thermal energy storage. Oral presentation.

Koornneef, J. et al. (2019) HEATSTORE: high temperature underground thermal energy storage. Oral presentation.

DECOVALEX 2019 Symposium – DEvelopment of COupled models and their VALidation against Experiments, Brugg, Switzerland, 4-5 November 2019.

Birdsell, D.T., Saar, M.O. (2019) Coupled Thermo-Hydro-Mechanical Model of Ground Surface Deformation at Swiss Heat Storage Sites. Oral presentation.

SCCER-SoE Annual Conference 2019: Hydropower and Geo-Energy in Switzerland: Challenges and Perspectives, Lausanne, 3 & 4 September 2019

Birdsell, D. and Saar, M.O. (2019). Modeling Ground Surface Deformation at the Swiss HEATSTORE Underground Thermal Energy Storage Sites. Poster Presentation.

Guglielmetti L. et al. (2019) HEATSTORE SWITZERLAND: New Opportunities for District Heating Network Sustainable Growth by High Temperature Aquifer Thermal Energy (HT-ATES) Storage. Oral presentation.

European Workshop on Underground Energy Storage, Paris, France, 7-8 November 2019

Koornneef, J. et al. (2019) HEATSTORE – High Temperature Underground Thermal Energy Storage. Oral presentation.

De Oliveira Filho, F. et al. (2019) District heating and thermal energy storage. Oral presentation.

Vangkilde-Pedersen, T. et al. (2019) Lessons learned from existing and past underground thermal energy storage systems. Oral presentation.

NRW Geothermiekonferenz, Bochum, Germany, 3 September 2020

Hahn, F. et al (2020) Die Erschließung eines Altbergbaus für die thermische Nachnutzung am Standort Bochum. Oral presentation.

Symposium Bodem Breed – 3 June 2021, Digital congress, the Netherlands

Oerlemans, P.J.A., Drijver, B., Pittens, B. (2019) Hoge Temperatuuropslag (HTO) bij ECW, Middenmeer; Een toelichting op het demonstratieproject van HEATSTORE. Oral presentation.

World Geothermal Congress 2020, Reykjavik, Iceland, 26 April -2 May 2020 (all listed contributions are submitted to the conference secretariat). Conference postponed to May 2021, and due to Covid-19 pandemic organized as virtual conference 'WGC 2020+1' on several dates in 2021. HEATSTORE was also represented at the on-site event in Reykjavik from 24-27 Oct. 2021, at the joint GEOTHERMICA booth.

Guglielmetti, L. et al. (2020) HEATSTORE SWITZERLAND: New opportunities of geothermal district heating network sustainable growth by High Temperature Aquifer Thermal Energy Storage development. Oral presentation.

- Eruteya O., Guglielmetti L., Makhloufi Y., Moscariello A. (2020). 3-D Static Model to Characterize Geothermal Reservoirs for High-Temperature Aquifer Thermal Energy Storage (HT-ATES) in the Geneva Area, Switzerland. Oral presentation.
- Ferreira De Oliveira G., De Haller A., Guglielmetti L., Makhloufi Y., Moscariello A. (2020). Application of Chemostratigraphy and Petrology to Characterize the Reservoirs of the Mesozoic Sequence Crossed by the Geo-01 Well: Potential for Direct Heat Production and Heat-Storage. Oral presentation.
- Hahn, F. et al. (2020) The reutilization of a small coal mine as a Mine Thermal Energy Storage. Poster presentation.
- Kallesøe, A.J. et al. (2020) HEATSTORE – underground Thermal Energy Storage (UTES) – State of the Art, Example Cases and Lessons Learned. Oral presentation.
- Koornneef, J. et al. (2020) HEATSTORE Project Update: High Temperature Underground Thermal Energy Storage. Oral presentation.
- Mindel, J.E. & Driesner, T. (2020) HEATSTORE: Preliminary design of a High Temperature Aquifer Thermal Energy Storage (HT-ATES) system in Geneva based on TH simulations. Oral presentation.
- Moscariello et al. (2020) Heat production and storage in Western Switzerland: advances and challenges of intense multidisciplinary geothermal exploration activities, an 8-year progress report. Oral presentation.
- Quiquerez et al. (2020) Scenarios for Integration of Medium-Depth Geothermal Energy in an Evolving District Heating System: Case Study in Geneva (Switzerland). Oral presentation.
- Rey, C. et al. (2020) Modelling of an innovative HT-BTES(smart) design with lateral recovery boreholes to reduce heat losses: development and preliminary result. Oral presentation.
- Sohrabi, R., Valley, B. (2020) Thermo-Hydraulic-Mechanical (THM) Experiments and Numerical Simulations to Quantify Heat Exchange Characteristics of Fractured Limestone Reservoirs for Aquifer Thermal Energy Storage (ATES). Oral presentation.
- Tómasdóttir, S. et al. (2020) Possible seasonal injection of surplus hot water from the Hengill Area into a low temperature system within Iceland's capital area. Oral presentation.
- Viveiros, F., Silva, C., Matias, D., Moreno, L., Driesner, T., Zanon, V., Uchôa, J., Cruz, J.V., Freire, P., Pereira, M.L., Pacheco, J. (2020). Geochemical tools as a contribution to improve geothermal potential on the Azores archipelago. Oral presentation.

14th CCVG Workshop, Hokkaido, Japan, 29 May – 5 June 2020

- Silva, C., Viveiros, F., Carmo, R. (2020) Radon soil diffuse degassing at caldeiras da Ribeira Grande (São Miguel, Açores) – new degassing area. CANCELLED DUE TO COVID-19 PANDEMIC.
- Viveiros, F., Cardellini, C., Chiodini, G., Silva, C., Moreno, L., Matias, D. (2020) After three decades of soil CO₂ flux studies on volcanic areas - challenges and potentialities. CANCELLED DUE TO COVID-19 PANDEMIC.

IEA REWP Workshop, The role of storage beyond electricity. Virtual meeting by the International Energy Agency, 29 September 2020

- Godschalk, B. (2020) HEATSTORE project pitch.

Joint Programming Conference – Smart Energy Systems, Virtual meeting by the JPP SES and Geothermica program Cooperation Scoping group, 16 October 2020

- Cremer, H. (2020) HEATSTORE project pitch.

7th Geothermal get-Together, TU Delft, 4 November 2020

- Guglielmetti, L. (2020). HEATSTORE High Temperature Underground Thermal Energy Storage. Oral presentation.

Der Digitale Geothermiekongress 2020, German Geological Society, Virtual, 9-13 November 2020.

Hahn, F. et al. (2020) HEATSTORE – Die Erschließung eines Altbergbaus für die thermische Nachnutzung am Standort Bochum. Oral presentation.

Jagert, F. et al. (2020) Die Erschließung eines Altbergbaus für die thermische Nachnutzung im Rahmen von HEATSTORE: Status update. Oral presentation.

AGU Fall Meeting, online everywhere, 1-17 December 2020

Birdsell, D.T. et al. (2020) Minimum transmissivity for high-temperature aquifer thermal energy storage. Oral presentation.

ENERSTOCK2021 – 15th International Conference on Energy Storage, 9-11 June 2021, Ljubljana, Slovenia

Skov, C.K., Sørensen, P.A. (2020) Development and implementation of PTES in Copenhagen. Oral presentation.

British Geological Survey event 2021: Mine water heating and cooling: A 21st Century resource for decarbonization, Virtual, 10-11 March 2021

Hahn, F. et al. (2021) The Reutilization of a Small Coal Mine for Mine thermal Energy Storage. Oral presentation.

Virtual event by The Geological Society London – The role of subsurface research labs in delivering net zero – realising the potential of UKGEOS, 3-4 February 2021.

Koornneef, J., Goetzl, G. (2021) Heat storage. Oral presentation.

1st CCVG Virtual Workshop, 24-26 May 2021.

Viveiros, F., Cardellini, C., Chiodini, G., Silva, C., Moreno, L., Matias, D. (2021) After three decades of soil CO₂ flux studies on volcanic areas – challenges and potentialities. Poster presentation.

GeoKarlsruhe 2021 – Sustainable earth from processes to resources, 19-24 September 2021 (virtual conference)

Godschalk, B., Oerlemans (2021) First results of the full scale HT-ATES project in greenhouse area Middenmeer in the Netherlands. Oral presentation.

2.13 Media visibility

This section summarizes news reports in the media per country.

Europe

European Association for Storage of Energy website report entitled *Underground thermal energy storage facilitates the low-carbon transition of the heating and cooling sector* published on 1 Jan. 2018 about the HEATSTORE project ([Link](#)).

Belgium

www.energiesparen.be website report entitled *Extra steun voor onderzoek naar diepe aardwarmte* on 15 June 2018 (in Dutch; [Link](#)).

www.architectura.be website report entitled *Zomerwarmte opslaan om in de winter te gebruiken* published on 10 October 2018 (in Dutch; [Link](#)).

www.vito.be article in scientific magazine from VITO entitled *Flatten the curve en verschuif de energievraag met FLEXharvester/STORM District Energy Controller* published in December 2020.

www.vito.be Online info meeting / presentation for residents of the municipality of Mol and Dessel regarding the status and restart of the geothermal energy system. Link with Heatstore project is also explained, 31 March 2021 (in Dutch; [Link](#)).

Denmark

www.energiforskning.dk website report entitled *Højtemperatur varmelagring i undergrunden* (in Danish, [Link](#)).

www.planenergi.dk website report entitled *PlanEnergi deltager sammen med GEUS i EU GEOTHERMICA projektet HEATSTORE* (in Danish, [Link](#)).

www.geus.dk website report entitled *Grøn omstilling: Snart kan vores varme være geotermisk* (in Danish, [Link](#)).

www.pro.inch.dk website report entitled *Stort potentiale for varmelagring i grundvandsmagasiner* (in Danish, [Link](#)).

Germany

Geothermische Energie journal report (ed. 93) by the “Bundesverband Geothermie” published in Sep. 2019 (in German).

Bundesverband Geothermie webinar on 3 July 2020 includes the contribution ‘Grubenwasser als Wärmelieferant – Kann aus Ewigkeitslasten ein Ewigkeitsnutzen generiert werden?’ (in German).

The **Westdeutsche Allgemeine Zeitung** published an article entitled *Bochumer Projekt könnte für Wärmewende im Ruhrgebiet sorgen* on 04 Sep. 2020 (in German, [Link](#)).

The **Süddeutsche Zeitung** published an article entitled *Tief im Westen* on 19 Dec. 2020 (in German, [Link](#)).

The Netherlands

In **VPRO television** documentary on Energy Storage “De race om de super batterij” Heat storage a.o. was highlighted. 7 February 2021 (in Dutch, [Link](#)).

In **BodemenergieNL Nieuwsbrief** an article entitled HEATSTORE – op weg naar hoge temperatuuropslag in de ondergrond on 12 February 2021 (in Dutch, [Link](#)).

In **Noordhollands Dagblad** an article entitled *Miljoenen in aardwarmte* published on 2 Feb. 2021 (in Dutch, [Link](#)).

Energiea published an online article entitled *Experiment met seizoensopslag aardwarmte binnenkort van start in Middenmeer* on 7 Sept. 2020 (in Dutch, [Link](#)).

In **Noordhollands Dagblad** an article entitled *Mooi om koploper te zijn* published on 2 Sept. 2020 (in Dutch, [Link](#)).

Energiea published an online article entitled *Ondergrondse thermosfles voor seizoensopslag aardwarmte tuinders* on 30 Oct. 2019 (in Dutch, [Link](#)).

In **Noordhollands Dagblad** an article entitled *Project grootschalige opslag warmte van ECW in Middenmeer grootste in Europa* published on 23 Oct. 2019 (in Dutch, [Link](#)).

In the **ThinkGeoEnergy** Newsletter of 9 Sept. 2019, the HEATSTORE deliverable report ‘Underground Thermal energy Storage (UTES) – state-of -the-art, example cases and lessons learned’ is discussed and promoted.

HEASTORE is mentioned in the **Dutch national climate agreement** (in Dutch: Het Klimaatakkoord), released on 28 June 2019. In Chapter C1.11 ‘More sustainable heat’ under d) Development & innovation agenda, the report says: “Additionally to the European project HEATSTORE, the heat sector engages in the development of seasonal high temperature storage”.

Cobouw website report entitled *TNO: ‘Prijs warmtenetten halveren met bodenwarmte’* published on 11 Oct. 2018 (in Dutch; [Link](#)).

Engineeringnet website report entitled *Europees consortium demonstreert ondergrondse seizoensopslag zomerwarmte* published on 11 Oct. 2018 (in Dutch; [Link](#)).

Utilities website report entitled *Doel: 20 procent minder kosten voor opslag en gebruik zomerwarmte* published on 4 Oct. 2018 (in Dutch; [Link](#))

FluxEnergie.nl website report entitled *Schaalvergroting voor bodemopslag warmte in Kop van Noord-Holland* published on 4 Oct. 2018 (in Dutch; [Link](#)).

Vlaanderen is energie website report entitled *Extra steun voor onderzoek naar diepe aardwarmte* published on 15 June 2018 (in Dutch; [Link](#)).

Portugal

IVAR website reports the 2nd Year Annual Meeting mentioning the work performed by IVAR. The title is “*Investigadores do IVAR participam em reunião virtual do projeto Heatstore – Geothermica Era-net*”, published on the 26 May 2020 (in Portuguese, [Link](#)).

IVAR website reports the HEATSTORE project highlighting the main objectives of the national project (in Portuguese; [Link](#)).

IVAR website reports that *IVAR participa em projet europeu que pretende desenvolver tecnologias para armazenar calor no subsolo*, published on 10 October 2018 (in Portuguese; [Link](#)).

Correio dos Açores newspaper reports *Os Açores vão ser caso de estudo de criação de tecnologias para armazenar calor no subsolo*, published on 11 October 2018 (page 9, in Portuguese).

Açoriano Oriental newspaper report *Geotermia ‘detetada’ por modelos informáticos*, published on 23 January 2021 (in Portuguese)

IVAR website reports the virtual HEATSTORE national meeting “*Investigadores do IVAR organizam reunião virtual do projeto HEATSTORE – Geothermica Era-net*”, published on the 23 December 2020 (in Portuguese, <http://www.ivar.azores.gov.pt/noticias/Paginas/all-news.aspx?a=2>).

Broadcast on the local Azorian television, with 5 min on geothermal energy and HEATSTORE, broadcasted on 17 November 2021, in Portuguese, <https://www.rtp.pt/play/p9378/e580094/acores-cons-ciencia>.

Switzerland

Geotermia Svizzera website report entitled *Stockage thermique à haute température dans les aquifères profonds*, published on 10 October 2018 (in French, [Link](#)).

Geothermie Suisse website report entitled *Le premier rapport HEATSTORE à été publié*, published on 24 September 2019 (in French, [Link](#)).

Geo-Energie-Suisse AG company website project description entitled *HEATSTORE* (in French, [Link](#) and German, [Link](#)).

Iceland

OR website reports the HEATSTORE project as one of current research projects and describes the main objectives of the project (in Icelandic, [Link](#) and English, [Link](#)).

OR website reports on the two Icelandic case studies within HEATSTORE, the international collaboration within the project and the recent annual meeting. Entry entitled *OR þátttakandi í alþjóðlega verkefni HEATSTORE*, published on 5 June 2020 (in Icelandic, [Link](#)).