Interreg
North-West Europe
DGE-ROLLOUT

EUROPEAN UNION

INTERNATIONAL CONFERENCE 'DEEP GEOTHERMAL – TECHNICAL CHALLENGES, UNCERTAINTIES AND RISKS'

NETHERLANDS ORGANISATION FOR APPLIED SCIENTIFIC RESEARCH TNO

Date: 16 October 2020

This report contributes to deliverables WP-M-D1.6 (International conference on 'Exploration support. International experiences and DGE-ROLLOUT pilots'), WP-C-D3.1 (Public technical event on DGE), and WP-T2-D3.4 (Seminars on the development of DGE in the Netherlands) of Interreg project DGE-ROLLOUT.

Content

Deep geothermal – technical challenges, uncertainties and risks

The web-conference 'Deep geothermal – technical challenges, uncertainties and risks' was organized on 29 Sept. 2020 by TNO Netherlands Organization for Applied Scientific Research.

A total of seven presentations were given in a morning and afternoon session, discussing various aspects of deep geothermal development including a state-of-the-art overview of deep geothermal, the development of deep geothermal by a German energy company, uncertainties with the calculation of the geothermal potential, Dinantian carbonates as potential target layer for deep geothermal, experiences with a deep geothermal project in Belgium.

Both the morning and afternoon sessions saw around 115 participants. Total number of attendants was 129 representing 22 countries.

Conference framework

The Interreg project "Roll-out of Deep Geothermal Energy in NW-Europe" (DGE-ROLLOUT) started in October 2018. DGE-ROLLOUT explores the possibilities in North-West Europe to use deep geothermal resources for the production of heat and electricity. Deep geothermal resources are regarded as one important contributor to the future energy mix. DGE-ROLLOUT focuses on potential deep geothermal resources in Germany, the Netherlands, Belgium and France.

The exploration of deep geothermal energy in most North-West European regions requires specific expertise and technologies in complex geological situations mostly consisting of karstified and faulted carbonates with very heterogeneous permeability distributions of the Dinantian period or coarse clastic rocks. DGE-ROLLOUT studies the challenges and risks of deep geothermal development in a number of technical work packages including (1) mapping and 3D geological maps, (2) decision and exploration strategies and (3) production optimization.

Further information on the DGE-ROLLOUT project is provided on a number of websites in different languages: in English, Deutsch, Nederlands-NL, Nederlands-B, Français.

Conference program

The conference was organized by TNO Netherlands Organization for Applied Scientific Research as web-conference using MS Teams as conference tool. The program was subdivided into a morning and afternoon session with three and four presentations, respectively.

TIME	TITLE	SPEAKER
10.00 – 10.15	Welcome, program & conference rules	Martin Salamon (GD NRW, coord. DGE-Rollout); Holger Cremer (TNO, organizer)
10.15 – 10.45	Key-note: What thrives an energy company in a big city like Munich to develop geothermal	Thomas Jahrfeld (Stadtwerke München)
10.50 – 11.20	Low enthalpy heat and building deep borehole thermal energy storage	Ingo Sass (TU Darmstadt)
11.25 – 11.55	Experiences with the deep geothermal project in Mol, Belgium	Ben Laenen (VITO)
12.00 – 12.45	**LUNCH BREAK**	
12.45 – 13.15	Key-note: Deep geothermal – state-of-the-art and opportunities & challenges	Jan-Diederik van Wees (Utrecht Univ.)
13.20 – 13.50	Uncertainties in geothermal potential calculation	Hans Veldkamp (TNO)
13.55 – 14.25	Dinantian Carbonates – Target for Ultradeep geothermal in the Netherlands	Bastiaan Jaarsma (EBN)
14.30 – 15.00	Exploring the geothermal potential of the Dinantian in Northwest Europe: novelties from DGE-ROLLOUT	Martin Arndt (GD NRW)
15.00 – 15.10	Closing words and end of conference	Martin Salamon (GD NRW)

Participants

A total of 129 participants participated in the web-conference. Both the morning and afternoon sessions saw a stable number of 115-120 attendants each, representing a total of 22 countries.

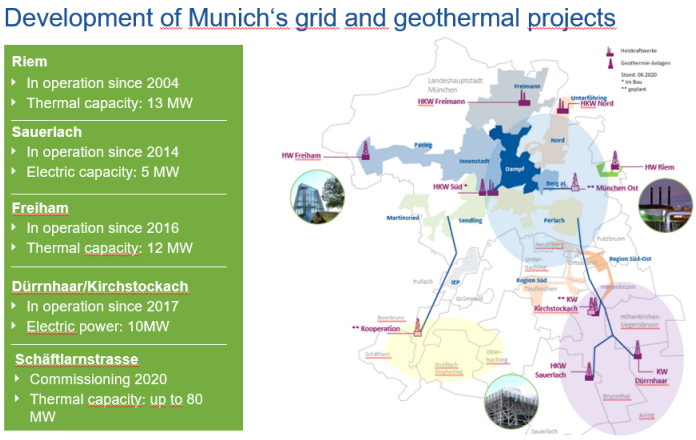
Most attendants came from Germany (39), followed by the Netherlands (18), Belgium (13) and France (12) with a significantly lower number of participants.

Country	No. of participants	Country	No. of participants
Germany	39	Poland	2
The Netherlands	18	Slovenia	2
Belgium	13	Bosnia and Herzegovina	1
France	12	Ethiopia	1
United Kingdom	9	Finland	1
Ireland	8	Hungary	1
Spain	5	Luxemburg	1
Austria	4	Malta	1
Italy	3	Romania	1
Switzerland	3	Sweden	1
Czech Republic	2	Tunisia	1

Conference report

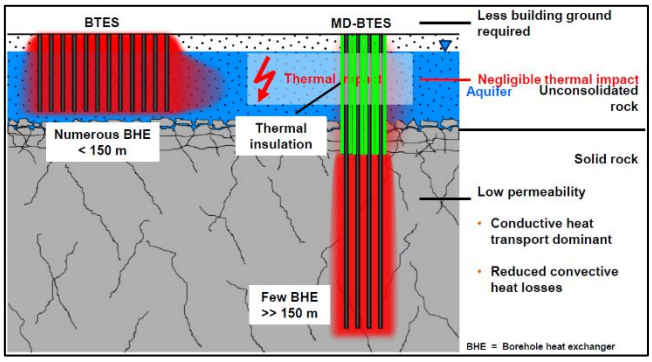
The web-conference was opened by Holger Cremer from organizing institution TNO Netherlands Organization for Applied Scientific Research and Martin Salamon, Geological Survey of North Rhine-Westphalia, coordinator of the Interreg DGE-ROLLOUT project. Both emphasized in their welcome words the potential importance of deep geothermal in future energy mixes. Martin Salamon also gave a short overview of the DGE-ROLLOUT project.

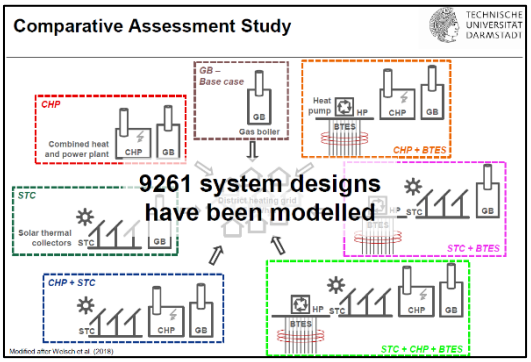
The first key note was presented by **Thomas Jahrfeld from Stadtwerke München** (SWM, Munich City Utilities) who gave a detailed overview about **Stadtwerke München's activities in geothermal development**. SWM's vision of district heating builds on geothermal energy. SWM currently has 5 geothermal plants in operation, feeding a heating grid of ca. 900 km. The system consists of 16 boreholes with lengths between 2.500 and 5.500 meters, flow rates of 80-130 L/s and temperatures of 90-140 °C.



To improve and optimize geothermal systems, considerable research activities are necessary covering the fields energy (heat flow optimization, efficiency), reservoir (indiced seismicity), hydrochemistry (scaling, materials), well drilling (well design, noise) and geothermal techniques (pumps, monitoring). In his conclusion Thomas Jahrfeld pledges for a German Geothermal Masterplan as a strategic instrument to develop Germany's geothermal capacities in the coming decades.

In the second presentation, **Ingo Sass, Chair of Geothermal Science and Technology at Technical University Darmstadt**, gave an overview on **energy storage using MD-BTES concepts** (Medium Deep-Borehole Thermal Energy Storage) compared to regular, shallow BTES solutions. Energy storage is regarded an important future technology to significantly contribute to a reduction of greenhouse gas emissions by storing heat in summer when the production potential usually exceeds the demand, and extracting heat in winter when the demand exceeds the production potential.



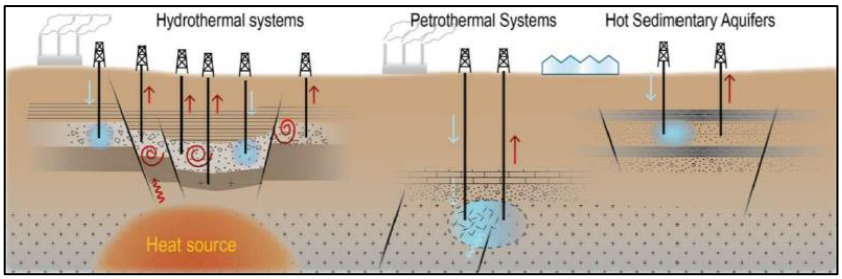


The team has modelled and compared several thousand system designs for heat supply (MD-BTES combined with GB, CHP, STC) under different economic and environmental circumstances. This study shows under which scenario's MD-BTES would be most suitable, cost-effective and environmentally valuable in terms of GHG emission reduction.

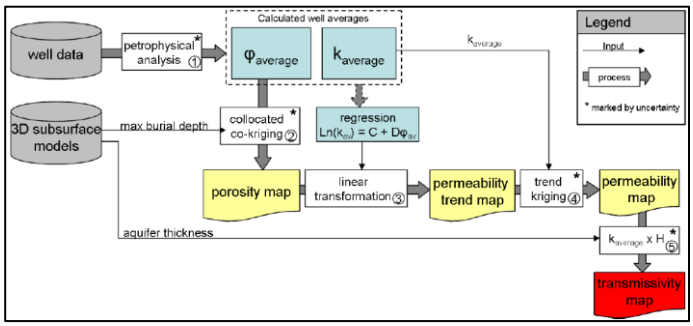
The session was continued with a presentation by **Ben Laenen (VITO)** who shared experiences with the **deep geothermal project in Mol, Belgium**. The reservoir was expected to be located at 2.800-3.600 m depth in the Lower Carboniferous limestone group but in fact lies at 3.200-3.800 m depth. It is a complex reservoir with a considerable geological uncertainty even after three completed wells. This project is a good example that the development of deep geothermal projects is not trivial but faces a number of technical challenges related to corrosion and scaling, induced seismicity, and emissions. Special interest has the estimation of the risk to induce seismicity as there was a sensible earthquake in the region in June 2019. Geothermal activities in the region are, therefore, accompanied by a seismic monitoring network and an implemented traffic light system. The Mol project further shows that good understanding of complex geological processes is essential in order to better predict subsurface conditions and the potential of the target reservoir for heat production.

After lunch break the web-conference was continued with four presentations by Jan-Diederik van Wees (Utrecht University), Hans Veldkamp (TNO), Bastiaan Jaarsma (EBN) and Martin Arndt (Geological Survey of North Rhine-Westphalia).

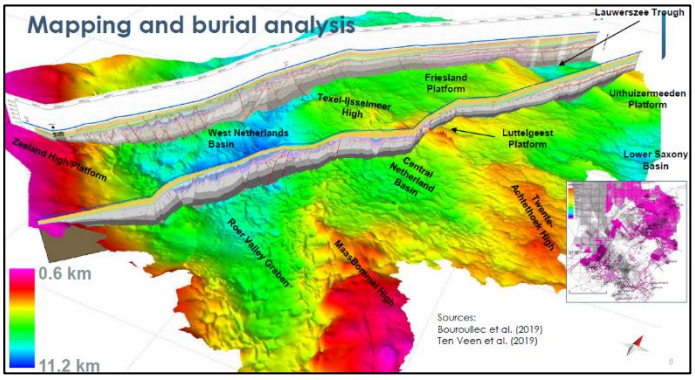
Jan-Diederik van Wees (Utrecht University) started the session with an overview of the **state-of-the-art of deep geothermal**. He emphasized in his talk chances to establish deep geothermal as important contributor to future energy mixes, urban heating in particular, on the one hand, but also clearly designated risks as for example induced seismicity that may hinder the development of deep geothermal on the other hand. Crucial methods to develop safe and impactful deep geothermal projects include the development of powerful modelling applications, the optimal use of existing and generation of new geological data for reservoir characterization, and a play-based portfolio approach. Basis of a subsurface play-based approach is the deployment of the value of information for the portfolio of the play rather than to single, stand-alone doublets. This approach enables considerable reduction of geological risks by optimal use learned knowledge and will increase the success rate of new doublets.

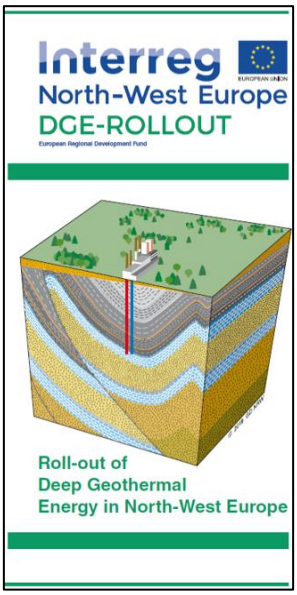


In the second presentation **Hans Veldkamp (TNO)** gave a detailed overview of uncertainties with the **calculation of the potential of geothermal reservoirs**. Questions like 'What is geothermal potential' or 'How to calculate transmissivity maps' and 'Can we calculate the geothermal potential of deep Dinantian carbonates' were discussed in the presentation. With the TNO-made regional geothermal prospectivity assessment tool ThermoGIS, Hans Veldkamp explained the necessary input data and the various workflow steps to obtain economic potential maps of different probability classes. In the second part of the talk, the difficulties with calculating rock permeability and consequently, reliable geothermal potential calculations for deep karstified and fractured Dinantian carbonates were exemplarily demonstrated for the situation in the Netherlands. Despite all geological uncertainties, first estimates of the geothermal potential of these rocks are possible.



This presentation was followed by an overview on the **potential of Dinantian carbonates for the development of ultradeep geothermal (UDG) in the Netherlands**, given by **Bastiaan Jaarsma from EBN**. The government-supported Green Deal UDG program, active since 2017, focuses on the assessment of the feasibility of UDG for heat generation in the Netherlands. UDG in this program means Dinantian carbonates at >4 km depth and >120 °C temperature. In several subprojects research questions about reservoir quality, mapping, burial history analysis, productivity and injectivity, and risks related to induced seismicity were studied. All results were made public under https://scanaardwarmte.nl/english/.





The last presentation of the web-conference was given by **Martin Arndt from the Geological Survey of North Rhine-Westphalia** who introduced **goals, activities and results of the four-year Interreg DGE-ROLLOUT project**. DGE-ROLLOUT was started in 2018 with 20 partners from 6 countries to study the geothermal potential of the Dinantian (Lower Carboniferous) in North-West Europe. Research activities in 2019 and 2020 focused on transnational mapping of the Dinantian in North-West Europe, the evaluation of reservoir properties at the Balmatt test site in Belgium, development of a 3D-heat flow model of the Weisweiler site in Germany as well as the feasibility of geothermal heat storage. Within DGE-ROLLOUT also a number of drilling campaigns have been set up and are currently in execution. Important part of the project is the organisation of national and international workshops and seminars in order to share knowledge about deep geothermal and concrete DGE-ROLLOUT achievements with relevant stakeholder groups.

The web-conference was concluded with close-out words by organizer Holger Cremer and DGE-ROLLOUT coordinator Martin Salamon.

PROJECT PARTNERS

Geologischer Dienst NRW

Fraunhofer IEG

vito

ebn

Géosciences pour une Terre durable brgm

DMT

Geological Survey of Belgium

TECHNISCHE UNIVERSITÄT DARMSTADT

TNO innovation for life

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