DESTRESS

Newsletter #10 / May 2020

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DESTRESS is nearing the end

After four exciting years, DESTRESS is in its final stage! Most research activities were successfully finalised early this year. Please read here about the last chemical stimulation conducted in Soultz-sous-Forêts (France) and test stimulation executed in Bedretto (Switzerland). Special attention is also paid to the latest best practice report published on responsible research and innovation (RRI) and to advertising the Final Conference of DESTRESS.

We would also like to share with you the insightful Results Pack report on geothermal energy in Europe released by the EU. The report showcases the latest innovative EU-funded research on both deep and shallow geothermal energy that will allow for a faster, wider and more efficient roll-out of this potentially game-changing alternative energy source. DESTRESS was proudly part of this initiative!

News and Progress

Chemical stimulation at Soultz-sous-Forêts

Dr. Albert Genter, Deputy General Manager, ÉS Géothermie

Together with the agreement of the power plant owner, És Géothermie (ESG) and the German Research Center for Geoscience (GFZ) supervised the chemical stimulation at the Soultz-sous-Forêts plant in Alsace (France). This plant is made of one production well, namely GPK-2, and two injections wells, GPK-3 and GPK-4, drilled at 5 km depth. This stimulation conducted in December 2019, was designed for improving the injectivity index of the well GPK-4, drilled in a deep, fractured granite reservoir. The aim was to dissolve hydrothermal minerals filling the natural fractures such as carbonates and silicates. The basic concept developed by ESG and GFZ was to inject innovative chemicals through a coiled tubing deployed at 4.7 km depth in the granite reservoir. The acids had been previously tested in a lab on hydrothermally altered granite samples.

This chemical stimulation was performed during geothermal exploitation of the power plant for the first time. So, the plant was continuously producing electricity from geothermal energy during five days of operations. Before conducting the soft chemical stimulation of the injection well GPK-4, various aspects of environmental and hydraulic monitoring were recorded from the concept to the operation phase:

- Environmental monitoring such as induced seismicity, geochemical monitoring of the geothermal fluid (salinity, pH, Redox, etc.)
- Hydraulic monitoring such as pressure, temperature and flow rate

In parallel, the well injectivity index was evaluated based on recorded hydraulic parameters before and after the operation. It varied between 0.54 kg/s/bar and 0.65 kg/s/bar from the early 2017 to February 2020.

Key observations and results

So far, no significant impact of the chemical stimulation of GPK-4 can be observed. Many reasons could explain the poor efficiency of the acid job. Indeed, two hydraulic and three chemical stimulations were done in GPK-4 after the drilling operations. Those past operations had probably already improved the near-wellbore permeability of the well. Consequently, the recent chemical stimulation could only have a limited effect on the already near well-stimulated zones.

Moreover, the near-wellbore targeted by the chemical stimulation is maybe not the limiting parameter of GPK-4 injectivity. The low reservoir permeability could explain the poor efficiency of the chemical treatment, as the radius of acid reaction is too small to enhance far field reservoir permeability. Other explanations may arise from chemical stimulation induced fines transport or partial pathways collapse. Both processes can also reduce previously increased permeability.

Two small micro-seismic events were detected one day after the stimulation. However, there is no evidence that those two events are directly related to the soft chemical stimulation, according to the observation of seismic rates such as peak ground velocity (PGV) and magnitude. They are not different in terms of number and energy compared to the observed induced micro-seismic activity baseline of the Soultz-sous-Forêts site. However, they might have been induced by the stop and the restart of the injection well, which was part of the stimulation procedure or even just related to the injection itself. This chemical stimulation was soft and done safely with no injured neither damage, by using the best practices developed in the frame of the DESTRESS project, such as risk assessment and management.

Image: *Soultz-sous-Forêts geothermal site by night during the chemical stimulation done in the framework of DESTRESS project. Source: és Géothermie.*

Hydraulic stimulation tests conducted in the Bedretto Underground Laboratory

GEO-Energie Suisse

In the frame of DESTRESS, the Bedretto demonstration site in Switzerland aims to show that the concept of a hydraulic stimulation with several stages is feasible in granitic rocks. The underground laboratory is located in granitic rocks at an approximated depth of 1.1 km below the surface in the middle of a 5.2 km long tunnel connecting the Bedretto Valley of the Canton of Ticino with the Furka tunnel. There is enough crystalline rock volume that can be accessed to create a reservoir of similar characteristics to the deep underground environment, except for the temperature that remains there constant and at 17°C.

Geo-Energie Suisse AG aims to demonstrate a multi-stage stimulation concept to increase energy production and to minimize induced seismicity. A hydraulic stimulation treatment was performed in the beginning of 2020 at the Underground Laboratory of Bedretto. The stimulation treatment consisted of the injection of up to a maximum of 5 m^3 of freshwater at two intervals of well CB1 (Fig. 1).

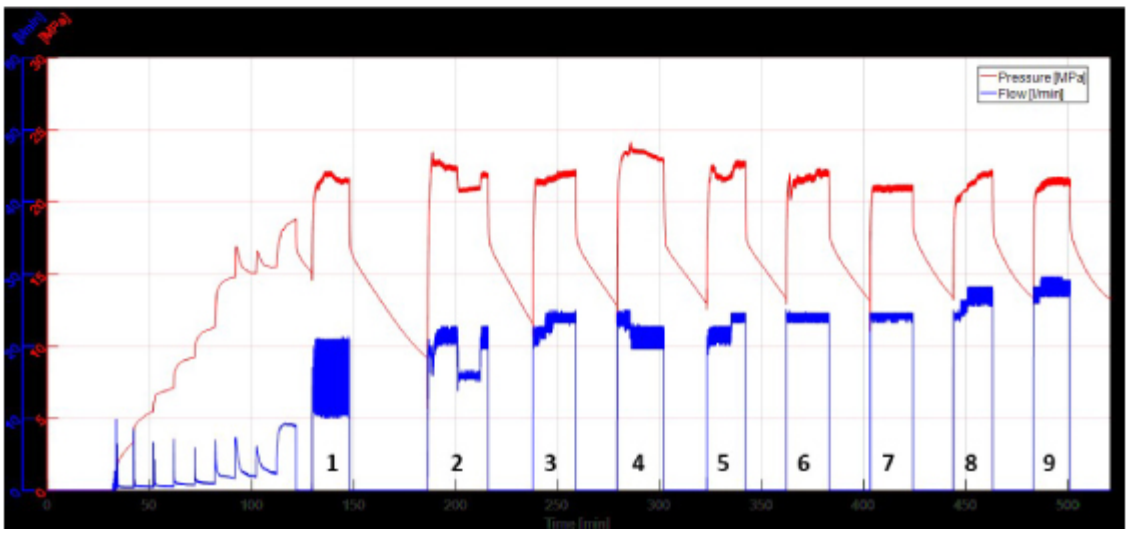

***Figure 1**: Injection protocol of the hydraulic stimulation tests of interval 274 m - 264 m, consisting of an initial injection test with a maximal injection flow rate of 9 l/min, followed by nine injection cycles and interrupted by shut-in phases. For each injection cycle, circa 500 litres were injected, so that the total injected volume was maximum 5 m^3 for this interval. The red curve shows the pressure inside the test interval measured uphole and the blue one the injection flow rate. The data are from CB1 at 267 m depth.*

However, as the rock was low permeable, it was necessary to fracture these two intervals hydraulically beforehand. Therefore, we set up a high resolution real-time seismic monitoring. It showed that these stimulations only induced a few seismic events with magnitudes between -3 and -2.6 (Fig. 2).

Based on a previously conducted risk study, the project team established a seismic risk protocol. The first results showed that the permeability of the rock could be increased so that it was easier to inject water into the rock after the stimulation (Fig 3). The hydraulic, seismological and borehole geophysical data gathered during the tests are now analyzed and will be used for planning the main stimulation scheduled for summer 2020.

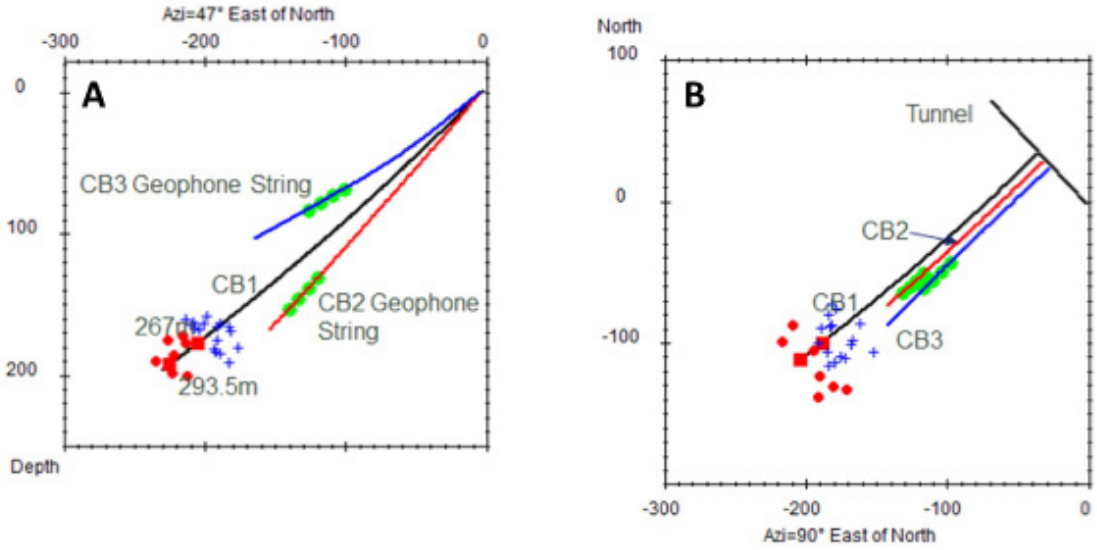

***Figure 2**: Microseismic events during the hydraulic stimulation tests of interval 298 m - 289 m (red dots) and 274 m - 264 m (blue crosses). A) The depth section is parallel to the borehole axes with an azimuth of 47° East of North i.e. perpendicular to the axe of the underground laboratory. B) The view from above has an azimuth of 90° East of North. The green dots symbolize the geophones localized in the boreholes CB2 and CB3. The distance and depth units are given in meters.*

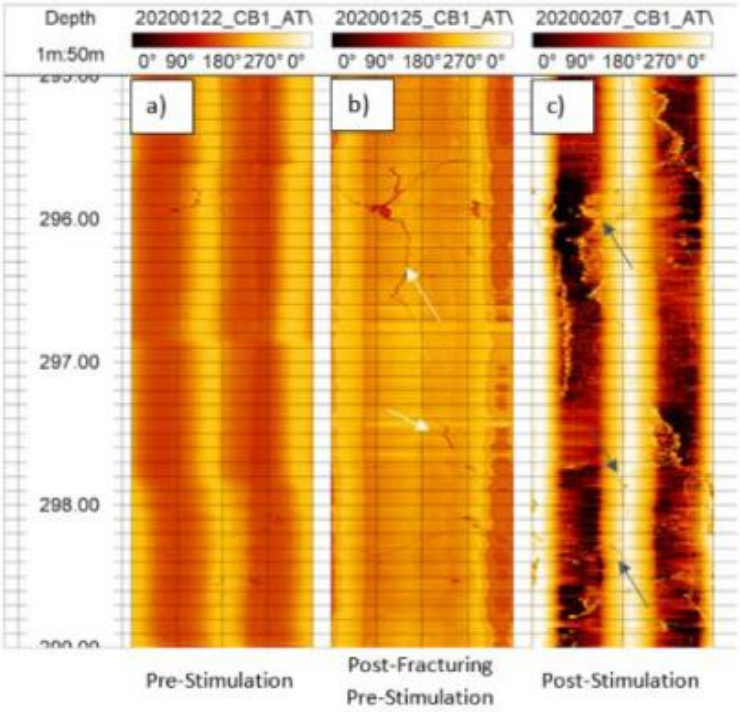

Figure 3: *Borehole interval at a depth between 295 m to 300 m in CB1 seen with the Acoustic Televiewer (ATV). a) The state of the interval before the stimulation. The rock is almost intact and low permeable. b) The state after the hydraulic fracturing treatment and before the stimulation treatment. The white arrows show axial fractures. c) The state of the interval after the stimulation. It is possible to see an increased complexity (black arrows) on pre-existing structures and new connections between pre-existing structures.*

Responsible research and innovation as a holistic approach to social acceptance

Dr. Philippe Chavot, University of Strasbourg

Responsible research and innovation is a key issue in the European Union's Framework programme Horizon 2020. In this framework, it is defined as "an approach that anticipates and assesses potential implications and societal expectations with regard to research and innovation, with the aim to foster the design of inclusive and sustainable research and innovation".

Hence, adopting the RRI principle makes it necessary to consider research and innovation not only from a science-centered perspective or through economic interests or political considerations, but also from environmental and societal perspectives. In this frame, several facets of RRI overlap. RRI is inclusive and encourages the involvement of different categories of actors, from scientists, industrialists and politicians to NGOs, associations and educators. It gives new dimensions to the notions of transparency, open access, ethics, social desirability and sustainable development.

This raises the questions on how to best include different perspectives of various stakeholders and why RRI is really needed? Find answers here in our latest best practice report!

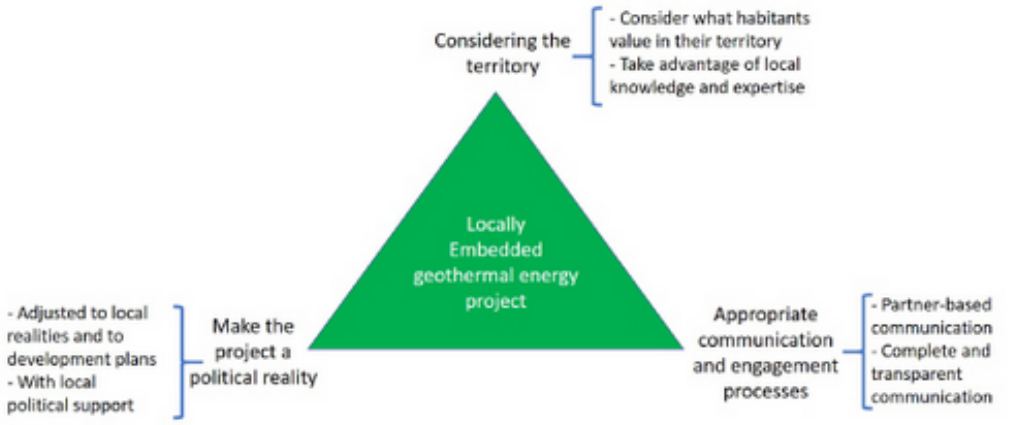

Figure 1: *An RRI approach to the social dimension of geothermal energy projects.*

Did you know...

... how many countries are using geothermal energy?

Geothermal resources have been identified in around 90 countries, 79 of those have quantified records of geothermal utilization. However, electricity is produced from geothermal sources in only 24 countries, of which nine obtain 5–26 percent of their national electricity from geothermal such as Iceland. *(Source: United Nations University)*

Miscellaneous

SAVE THE DATE:
Public final DESTRESS conference

The final public conference of DESTRESS takes place from **24 - 26 November 2020**, hosted by GFZ in Potsdam. Further details and information will be sent soon. We are looking forward to meeting you there!

The DESTRESS project released in CORDIS Results Packed on geothermal energy

The Community Research and Development Information Service (CORDIS) is the European Commission's primary source of results from the projects such as DESTRESS funded by the EU's framework programmes for research and innovation. CORDIS released a report about geothermal energy and a collection of innovative EU-funded research results in this field to which also DESTRESS and eleven other projects are contributing. They cover the full spectrum of geothermal energy research and provide a holistic overview of what the key priorities are for further development and investment in these technologies, so they become a vital source of alternative energy for Europe. The DESTRESS project has been developed and tested new stimulation methods for enhanced geothermal systems. Those efforts should lead to reduced costs and increased environmental safety.

Would you like to read more about the projects developing a new and viable alternative energy source to help achieve Europe's climate ambitions? Find here the full report available online and to download as PDF or read more about it on the DESTRESS website!

Services

Talking about DESTRESS

CORDIS Results Pack on geothermal energy

Geothermal Energy: A new and viable alternative energy source to help achieve Europe's climate ambitions.

Full report here

Conferences

24. - 26.11.2020 Potsdam, Germany
More details coming soon

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Demonstration of soft stimulation treatments of geothermal reservoirs

DESTRESS demonstrates methods of enhanced geothermal systems (EGS). The aim is to expand knowledge and to provide solutions for a more economical, sustainable and environmentally responsible exploitation of underground heat.

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No. 691728