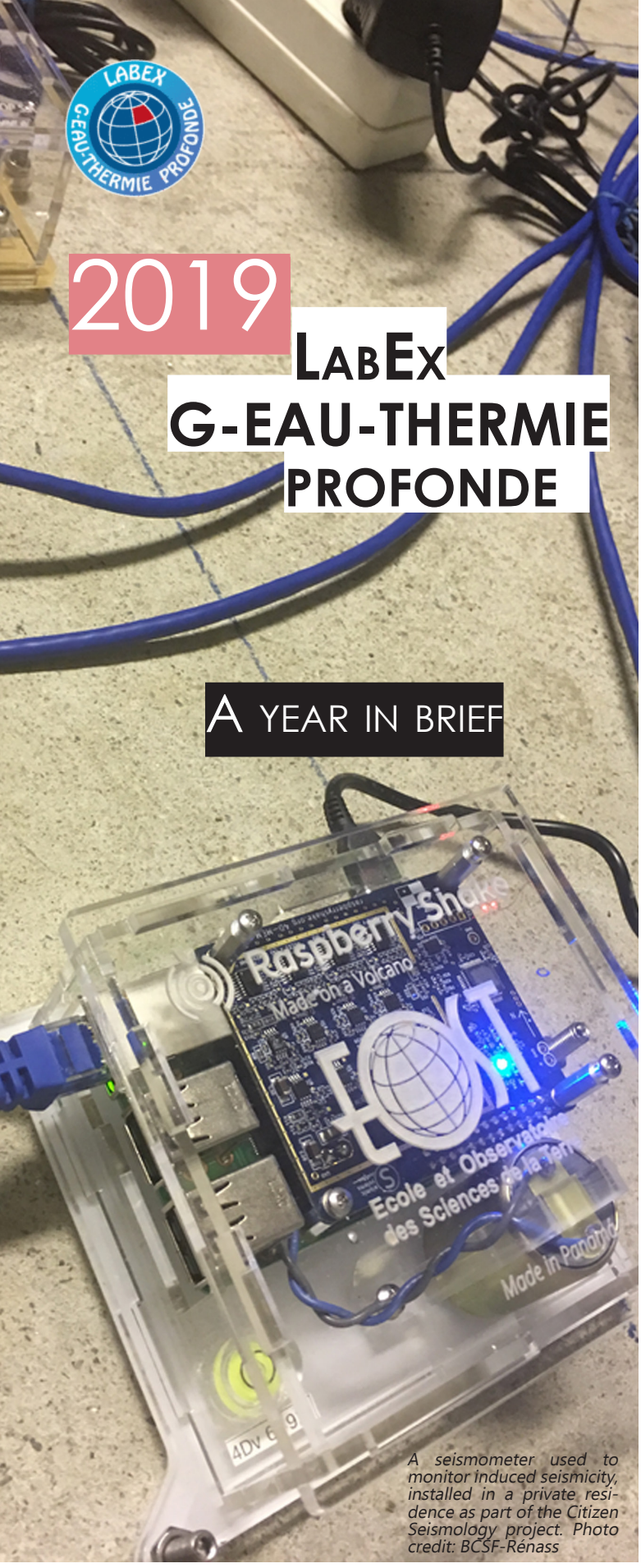


2019 LabEx G-EAU-THERMIE PROFONDE

A YEAR IN BRIEF

A seismometer used to monitor induced seismicity, installed in a private residence as part of the Citizen Seismology project. Photo credit: BCSF-Rénass

labex-geothermie.unistra.fr

École et observatoire des **sciences de la Terre** de l'Université de Strasbourg et du CNRS

Laboratory of Excellence
A university-industry partnership dedicated to deep geothermal research in Alsace

Created in 2012, the LabEx G-eau-thermie Profonde is coordinated by the University of Strasbourg, with support from the French National Centre for Scientific Research (CNRS).

Academic partners :
EOST (School and Observatory of Earth Sciences)
And its two laboratories
IPGS (Institut de physique du globe de Strasbourg)
LHyGeS (Laboratory of Hydrology and Geochemistry of Strasbourg)
ICube (Laboratory for Engineering Science, Computer Science, and Imaging)
LISEC (Inter-university Laboratory for Education and Communication Sciences)

Founding industrial partners :
ÉS (Électricité de Strasbourg), and its affiliate ÉS Géothermie,
GEIE (European Economic Interest Grouping, EEIG) Exploitation Minière de la Chaleur at Soultz-sous-Forêts

Missions

Research and Development
Data management
Education
Outreach

Key figures

75 individuals, equivalent to **25 people employed full-time**
73% from the University of Strasbourg,
16% from the CNRS, 5% from ÉS
6% from other partners

10 working groups
seismology, geodesy,
magneto-tellurics and gravimetry,
rock physics, hydro-geochemistry,
geology, social sciences,
the deep geothermal data centre,
modelling, and education

4 governing committees
Executive Committee,
Includes the CNRS, University of Strasbourg, ÉS
Steering Committee,
Includes experts from EOST and ÉS
Chair Committee,
Includes all working group leaders
Scientific Committee,
Includes international scientists

3 industrial partners
ÉS
Storengy/Engie and Total, as of 2017

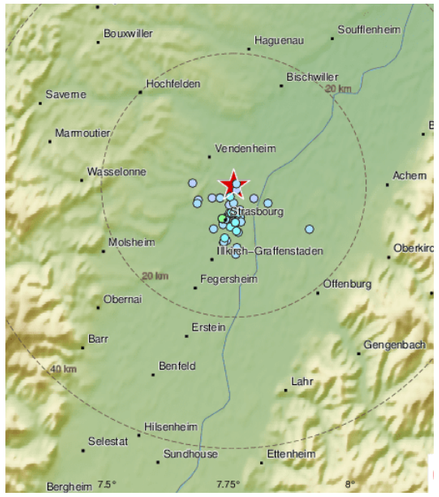
Research, education, and outreach

Observatory

Earthquakes near Strasbourg

On November 12, 2019, a magnitude Ml3 earthquake was felt in Strasbourg and recorded by the French Central Seismological Office and the National Seismic Monitoring Network (BCSF-RéNaSS, based at EOST). BCSF-RéNaSS rapidly classified the earthquake as induced, in connection with drilling and stimulation activities at the Fonroche-Géothermie Geoven geothermal site in Vendenheim.

The EOST and LabEx teams quickly set to work to understand the origin of this event. Their analyses show that this earthquake was part of a seismic swarm that started six days earlier. This swarm originated at a depth of 5 km on a fault zone linked to the well site. These analyses tend to confirm that this earthquake was triggered by the geothermal exploitation activities. Additional analyses are under way.



Organisation

A collective vision for the future: the ITI G-eau-TE

Over the course of 2019, researchers from EOST, LISEC, and ICube came together to construct a proposal for a new Interdisciplinary Thematic Institute (ITI): Geosciences for Energy Systems Transition (ITI G-eau-TE). This proposal was submitted in July 2019 to the «Beyond borders» Excellence Initiative call for projects, jointly led by the University of Strasbourg, the CNRS, and Inserm.

This collective initiative has borne fruit: The ITI G-eau-TE was one of 15 projects selected for funding on January 7, 2020. This exciting initiative will be funded for 8 years, between 2021 and 2028.

Research

Seismology and the social sciences

The citizen seismology project continues. Thanks to an initial investment from the CNRS, 22 sensors were installed in private residences around Mulhouse between December 2018 and February 2019. As part of the sociological study, two series of interviews with participants were conducted in 2019.

Rock physics

An initial laboratory-based study of chemical stimulation was conducted by IPGS' (Institut de Physique du Globe de Strasbourg) experimental geophysics team. This study has been published in Geothermal Energy (Farquharson et al., 2020).

Hydro-geo chemistry

The purchase of a new high performance liquid chromatography (HPLC) pump has made it possible to carry out continuous flow rock-fluid interaction experiments up to pressures of 130 bars. These experiments shed light on how trace cations are released through time as mineral dissolution reactions progress.

Magneto-tellurics and gravimetry

In 2019, gravity measurements (micro-gravimetry and absolute gravimetry) continued at the Theistareykir geothermal site in Iceland.

Using a combination of different types of gravimeters, gravity variations over space and time were studied to understand the natural and anthropogenic evolution of an active geothermal reservoir.

Education

Three PhD defences

Three LabEx-affiliated PhDs were defended in 2019:

- Bérénice Vallier, Thermohydromechanical modeling of the exploitation of a deep geothermal reservoir, defended on August 26, 2019
- Coralie Aichholzer, Complete stratigraphic log of the Rhine Graben, defended on October 10, 2019
- Eric Henrion, Monitoring of underground reservoirs (geothermal and natural gas storage) using spatial geodesy, defended on December 19, 2019

Since 2012, 10 LabEx-affiliated PhD theses have been defended.

Outreach

EGW 2019 in Karlsruhe

The 7th European Geothermal Workshop (EGW), hosted by the Karlsruhe Institute of Technology (KIT), was held on October 9 and 10, 2019. It brought together 152 participants from 21 countries, including 55 students. 9 LabEx researchers presented their work (5 posters and 4 oral presentations).
Because of the Covid-19 pandemic, the 8th EGW, organized by LabEx, will be held entirely online on October 7 and 8, 2020.

Research

Fiber optics and seismology

EOST researchers have tested an innovative observational approach at the Illkirch geothermal site: using optical fibers as seismic sensors. A 1 km long optical fiber was buried around the geothermal platform and installed down a 180 m deep borehole. The first measurements were made in April and May 2019. While the results show that this Digital Acoustic Sensing (DAS) technology is still emerging and that many challenges still need to be overcome, DAS is currently revolutionizing seismic observation.

Organisation

Projects that came to an end in 2019

2019 saw the end of the CoGéoS (the Strasbourg Deep Geothermal Energy Consortium, established in 2012 by the University of Strasbourg, the CNRS and ÉS), the ADEME EGS Alsace project (2015-2019), and the Horizon 2020 EPOS project (2014-2019). The ANR Cantare project (2015-2018) has been extended until 2021.

EGS ALSACE

EPOS EUROPEANPLATEOBSERVINGSYSTEM

Cantare

Research

11 research projects

1. Seismic measurements using fiber optics at Illkirch
2. Citizen seismology: Installing a seismograph network in private residences
3. The Deep Geothermal Data Centre (CDGP)
4. Friction along faults in geothermal reservoirs: An experimental approach
5. Temporal hybrid gravimetric monitoring of a geothermal reservoir
6. Acquisition of electrical induction logging modeling software
7. Extrapolating geothermal gradients in northern Alsace for temperature estimations of the geothermal convection zone
8. Study of the dissolution processes of silicates using microstructural, elemental, and isotopic approaches
9. The Rhine sedimentary cover: Stratigraphy and heat flow
10. Social representations of deep geothermal energy: the role of popular science
11. Triggered seismicity on regional faults: Can an EGS site play a role?

4 large research projects

funded by the French Environment and Energy Management Agency (ADEME), the French National Research Agency (ANR), and the European Union

EGS Alsace (2015-2019) *ADEME, ÉS*
Industrialisation of geothermal energy in Alsace

ANR Cantare (2015-2021) *BRGM, EOST et ÉS Géothermie*
Studying the development of high temperature geothermal resources in Alsace

H2020 DESTRESS (2016-2020) *16 international partners*
Developing stimulation techniques to enhance reservoir productivity, while minimizing environmental risks

H2020 EPOS-AH (2014-2019) *250 international partners*
Data dissemination and conservation

Education

Ongoing: **12 PhD projects** and **3 post-doctoral projects**

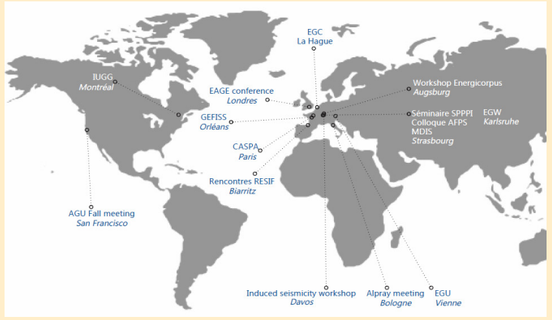
1 Master course in deep geothermal energy taught at EOST (Master 2)

3 PhD defences in 2019

Dissemination

23 articles in scientific journals

37 abstracts presented at **16 workshops and conferences** around the world

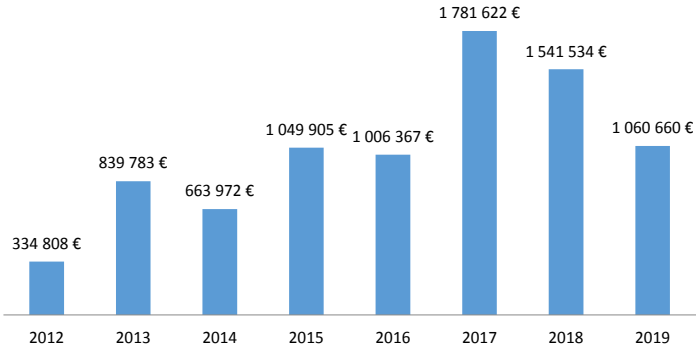


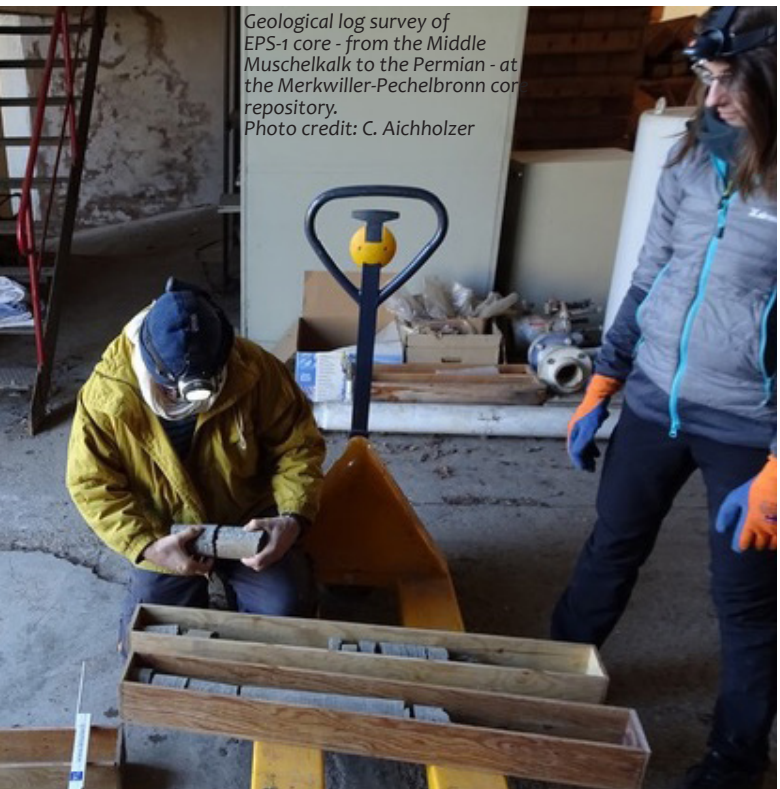
BUDGET

1 060 661 €
in funding and endowments were allocated in 2019

LabEx Investissement d'avenir	364 525 €
CoGéoS LabEx ÉS	214 762 €
CoGéoS Contracts	58 740 €
ADEME EGS Alsace	83 155 €
ANR Cantare	46 338 €
H2020 Destress	138 313 €
Storengy/EPI	70 010 €
Total	84 817 €
TOTAL	**1 060 661 €**

8 600 000€ in endowments and funding since 2012




Geological log survey of EPS-1 core - from the Middle Muschelkalk to the Permian - at the Merkwiller-Pechelbronn cor repository.
Photo credit: C. Aichholzer

PERSPECTIVES

The ITI G-eau-TE: Geosciences for the Energy Systems Transition

An Interdisciplinary Thematic Institute for Research and Training

The LabEx G-eau-thermie Profonde will come to an end in 2020. This initiative has enabled real scientific progress in the development of deep geothermal energy. The ITI G-eau-TE (Geosciences for the Energy Systems Transition: Exploiting Deep Groundwater) is a natural evolution of the LabEx and will build on this acquired scientific expertise.

The ITI is hosted by EOST, and its research laboratories IPGS and LHyGeS. This new initiative also includes the ICube laboratory, with its expertise in engineering, and the Lisec, Crem and Sage laboratories, which provide their expertise in the field of social sciences.

Deep groundwater: A key tool in the energy systems transition

The ITI G-eau-TE will centre its research and training activities around an innovative subject: the role of deep groundwater in the development of carbon-free energy resources, including geothermal energy, hydrogen and lithium production, and heat and CO_2 storage. The possible co-exploitation of these georesources makes these deep crustal reservoirs important targets for the energy transition.

At the heart of this initiative is its multidisciplinary approach to resource characterisation (e.g. exploration and assessment), reservoir access (e.g. drilling), reservoir development (e.g. stimulation), and risk monitoring, and understanding public perception.

The project will also address technological challenges in instrumentation (e.g. optical fiber, ambient seismic noise), as well as key questions for optimising operations to mitigate environmental risk.

A new international Master specialisation

The ITI G-eau-TE also includes a new international Master specialisation at EOST: «Geosciences for the Energy Systems Transition». This new research-focused program, created in partnership with the IFP School, will be offered to students starting in autumn 2021.

This new specialisation is an exciting opportunity for EOST to train the next generation of engineers and geoscientists for a decarbonated future.

Despite the Covid-19 health crisis, 2020 is dedicated to the construction of this new institute, which will launch in early 2021.