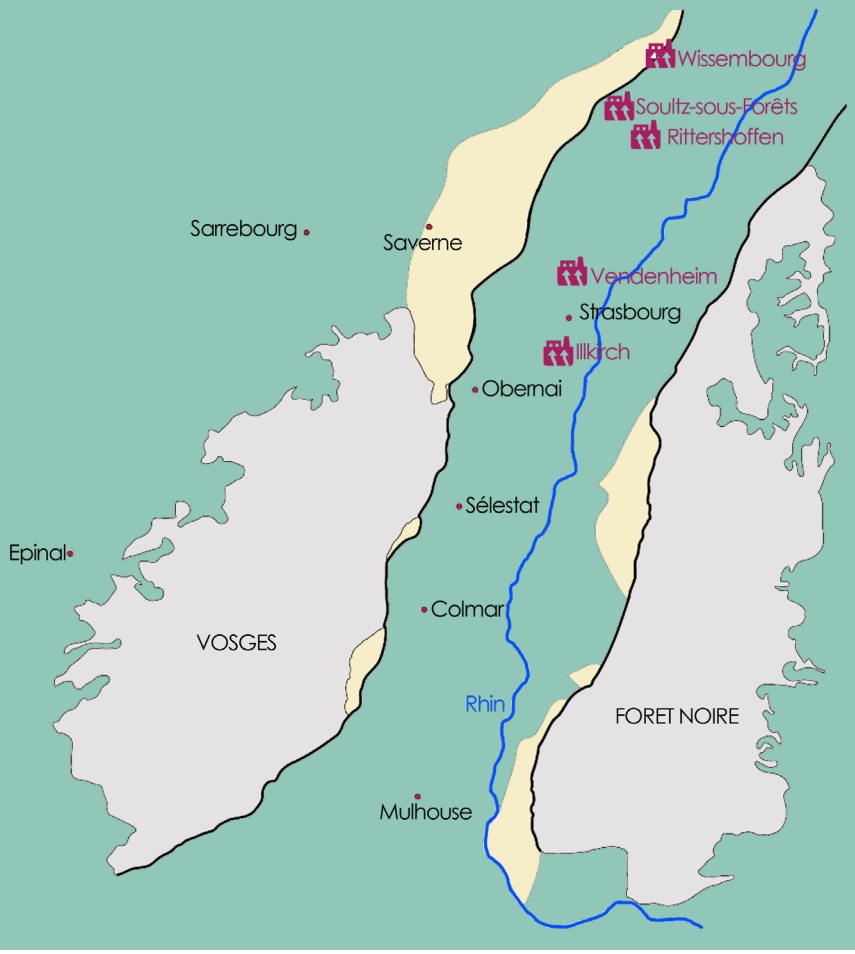
2018

LabEx G-EAU-THERMIE PROFONDE

A YEAR IN BRIEF

labex-geothermie.unistra.fr



Geothermal sites - active or under development - in the Rhine Valley. Grey - crystalline basement, beige - fracture zones. Map by Pauline Harlé, modified from Aichholzer et al., 2016.

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 (Laboratory for Education, Information, and Communication Sciences)

Founding industrial partners :

ÉS (Électricité de Strasbourg), and its subsidiary ÉS Géothermie,

GEIE (European Economic Interest Grouping, EEIG) Exploitation Minière de la Chaleur at Soultz-sous-Forêts

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

Missions

Research and Development
Education
Data management
Outreach

KEY FIGURES

92 individuals, equivalent to **29 people employed full-time**
- 69% from the University of Strasbourg,
- 15%from the CNRS, 11% from ÉS
- 5% from other partners

10 scientific 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 scientific working group leaders

Scientific Committee,
- Includes international scientists

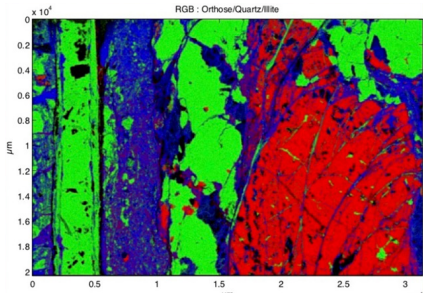
3 industrial partners
- ÉS
- Storengy/EPI and Total, as of 2017

Research, education, and outreach

Geology

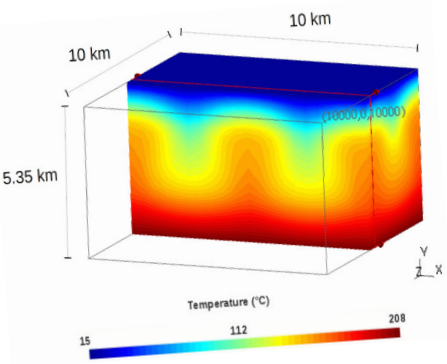
Installation of a new µXRF spectrometer

Thanks to the recent acquisition of a state-of-the-art µXRF spectrometer, EOST (IPGS) is now fully equipped to perform in-house measurements, **starting with the study of the impact of deep fluid circulation on rocks**. Delivered in November 2018, this new piece of analytical equipment was co-financed by Électricité de Strasbourg (via the Co-GéoS), IPGS, LabEx G-eau-thermie Profonde and EOST.



Modelling

Modelling geothermal reservoirs



In 2018, a thermo-hydro-mechanical model of the Soultz-sous-Forêts and Rittershoffen geothermal reservoirs was completed. This new model shows that natural fluid circulation is **more extensive and shallower than expected.**

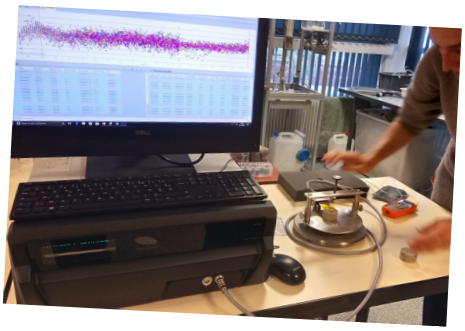
The effect of thermoelastic deformation of a reservoir on the coda of seismic waves has been demonstrated for the first time. This paves the way for **new reservoir monitoring tools.**

A new **formation mechanism for native hydrogen** in granitic geothermal reservoirs has also been modelled.

Rock Physics

LabEx's first laboratory measurements of the thermal properties of rocks

These new measurements will help to **constrain the thermal conductivity gradient** of the sedimentary layers above the Wissembourg geothermal reservoir, which will be used to **refine thermo-hydro-mechanical models of hydrothermal convection** in the Upper Rhine Graben.



Hydro-geochemistry

Modelling reservoir stimulation at Soultz-sous-Forêts

Recent modelling has shown that **chemical stimulation could significantly increase the porosity and permeability of the Soultz-sous-Forêts reservoir** around the GPK4 injection well. However, reservoir improvement is **limited to within a few meters** of the injection well.

Silicate dissolution

Results from albite dissolution experiments show **preferential leaching of minor and trace elements**, which raises questions about their heterogeneous distribution in albite minerals and the conditions governing their selective transport.

Data Centre

New Soultz-sous-Forêts datasets now online

Data from the 1988, 1991, 2000, 2003, 2004, and 2005 stimulation episodes at Soultz-sous-Forêts have been **collected, described, and are now available to the scientific community** through the Deep Geothermal Data Centre.

https://cdgp.u-strasbg.fr.

Outreach

The 6th European Geothermal Workshop : 140 participants from 17 countries descend on Strasbourg

Organised by the LabEx G-eau-thermie Profonde, in partnership with the Karlsruhe Institute of Technology and the European Energy Research Alliance, the 6th EGW took place at the Hôtel du Département in Strasbourg on the 10th and 11th of October.

This scientific conference brought together **140 participants from 17 countries around the world**: France, Germany, Norway, the Czech Republic, Switzerland, the Netherlands, Belgium, Denmark, Iceland, Italy, Spain, the United Kingdom, Turkey, Canada, Mexico, Chile, and Saudi Arabia.

A selection of the work presented at the 6th EGW is currently being edited for a **special issue** of the Springer Open Access journal Geothermal Energy.

Education

Two PhD defences

The **6th and 7th** LabEx PhD theses were defended in 2018: «Thermal cracking in rocks» by **Luke Griffiths** in February and «Analog modelling of slip on a fault» by **Camille Jestin** in November.

Research

11 research projects

1. Hybrid gravimetric monitoring of a geothermal reservoir
2. Magneto-telluric monitoring of a geothermal reservoir
3. Extrapolation of thermal conductivity gradients to estimate geothermal fluid temperature
4. Study of silicate dissolution processes through a combination of microstructural, elemental, and isotopic approaches
5. Purchase of a µXRF spectrometer
6. Stratigraphic, sedimentary, and structural study of the sedimentary-to-basement transition in the Rhine Graben
7. Study of rock thermal properties in the Rhine Graben
8. Continued operation of the Deep Geothermal Data Center (CDGP)
9. Friction along faults in EGS reservoirs: The effect of thermal perturbations
10. Seismic events triggered on regional faults: Can an EGS site play a role?
11. Production of abiotic hydrogen from a biotite-rich granite

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 (2015-2018) *BRGM, EOST, 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 minimising environmental risks

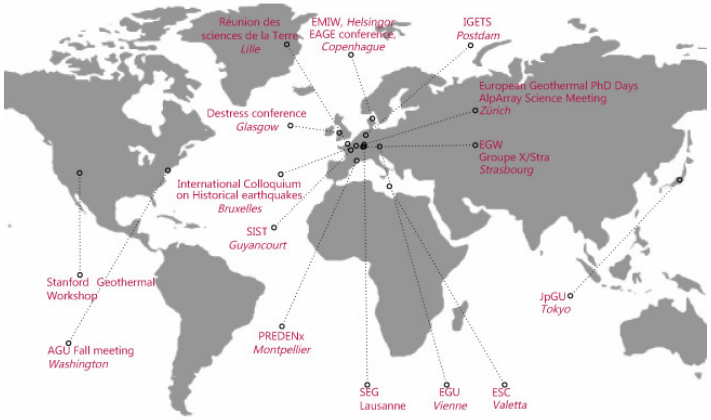
H2020 EPOS-AH (2014-2019) *250 international partners*
Data management, archiving, and dissemination

Training

11 PhD theses and 7 post-doctoral projects
1 MSc course in deep geothermal energy
taught at EOST (Master 2)
2 PhD theses defended

Outreach

22 articles in scientific journals
47 abstracts presented at
19 workshops and conferences around the world



A positive assessment from the LabEx Scientific Committee

The scientific committee - composed of international experts - meets annually to evaluate the LabEx's scientific output and proposed research initiatives. In 2018, the committee performed an in-depth evaluation of all LabEx activities and issued a very positive assessment:

«The amount of work and publications is very high both in number and quality at a global level.» «The Scientific Committee would like to congratulate the creation of Working Groups. This structure clarifies the activities of the LabEx, and care was always taken to keep links strong and tight between the Working Groups.»
«It is clear that the existence and the organisation of the LabEx is a strong "plus" for the University of Strasbourg and has provided an increase in strength and recognition for EOST at the national and international levels.»

BUDGET

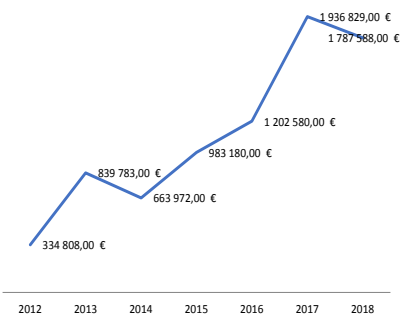
1 787 588 € in funding and endowments were allocated in 2018

Of which **769 508 €** was provided by the original LabEx endowment (Investissement d'avenir and ÉS)

And **1 018 080 €** came from French and European research projects (ANR Cantare, ADEME EGS Alsace, H2020 EPOS-AH, H2020 DESTRESS) and industry partnerships (Storengy/EPI, Total, CoGéoS contracts)

LabEx IA	364 525 €
CoGéoS LabEx ÉS	282 000 €
Fondation	50 000 €
CoGéoS contracts	72 983 €
ADEME EGS Alsace	303 855 €
ANR Cantare	185 869 €
H2020 EPOS	15 962 €
H2020 Destress	267 134 €
Storengy/ EPI	66 000 €
Total	180 073 €
TOTAL	**1 787 588 €**

7 500 000€ in endowments and funding received since 2012



LOOKING TO THE FUTURE

Geosciences for the energy systems transition

Evolving toward a dedicated research and training institute

The LabEx G-eau-thermie Profonde, which comes to an end in 2020, **has made significant scientific advances in deep geothermal energy research that can be applied to other renewable energy sectors.**

With this in mind, the LabEx has started looking to the future through the collective construction of a proposal for a Thematic Interdisciplinary Research-Training Institute (ITI), entitled **Geosciences for the energy systems transition: Exploiting Deep Groundwater (G-eau-TE).**

In late 2018, the University of Strasbourg officially opened its call for ITI initiatives. This new call for projects is, at once, **an opportunity for the renewal of the university's 11 LabEx projects** and a call for new initiatives, all in the spirit of strengthening the link between training and research.

Geothermal energy, hydrogen, lithium, energy storage...

This ambitious G-eau-TE initiative **goes beyond deep geothermal energy** research and will expand its research activities to include **the role of deep groundwater as a tool for the energy systems transition,** including the role of deep groundwater in hydrogen and lithium production and heat/ CO_2 storage.

This **new multidisciplinary initiative** will tackle challenges in resource characterisation (exploration and evaluation), access to the reservoir and reservoir development (drilling and stimulation), monitoring during reservoir exploitation, as well as social science approaches to evaluating community perception of renewable energies.

The project will also address technological challenges related to reservoir instrumentation and monitoring (e.g. fiber optics, ambient seismic noise), as well as key issues surrounding effective environmental risk management.

Toward a decarbonised economy

This new G-eau-TE initiative will build on the rich legacy of the LabEx G-eau-thermie Profonde in response to one of the critical challenges of the 21st century: a transition to **a low-carbon economy.**