



## REFLECT DELIVERABLE D3.1

# Report on the collection of data on geothermal fluids at a European level



Photo: Alper Baba, Izmir Institute of Technology

### *Summary:*

This deliverable summarises the methodology and results of the data collection for the European Fluid Atlas at a national level by the EFG's linked third parties.

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## 1 EXECUTIVE SUMMARY

This deliverable summarises the actions related to the collection of geothermal fluid data at a European level. National member associations, as linked third parties (LTPs) of the European Federation of Geologists (EFG) have participated in data collection covering 15 European countries. As in the proposal it was declared that data collection would take place from 20 countries, in the remaining five countries experts hired by EFG collected data.

The data were obtained by reviewing reports on past and recent research and applied work that produced public access geological and geothermal datasets. In addition to these data, scientific publications and studies were also reviewed at a national level.

Detailed guidelines and a template for the data collection were worked out by University of Miskolc (UNIM) and EFG. The template includes all kinds of information which will be presented in the European Fluid Atlas to be created by UNIM. EFG put together the datasets from the different countries and provided them to the WP leader UNIM.

The European Fluid Atlas will be presented by the end of the REFLECT project. It is planned that in the process of the creation of the Fluid Atlas the collected data so far will be completed or refined, and new additional data may be added to the formerly collected ones.

## 2 INTRODUCTION

Geothermal energy is a renewable resource that will help to reach the European Green Deal challenges. Companies and operators realised the need of having long-lasting facilities, which allow the technology to be more reliable for the final clients as well as spread out its advantages to the countries where it is less developed.

Processes like precipitation or corrosion can raise serious consequences for power plant operations and project economics. These processes are in close connection with the physical and chemical properties of the geothermal fluids, which are often poorly defined.

The REFLECT project addresses these challenges and redefines fluid properties by the acquisition of key new thermodynamic and kinetic reaction data. Formerly existing data are collected and re-evaluated, as well as new data are generated by field observations, lab measurements and modelling. These data will be inserted in predictive models to determine fluid reactions at extreme conditions and will also be visualised through the European Fluid Atlas. The Atlas will map variations in fluid properties with geography, geology, and depth, and thus will facilitate the selection of new potential geothermal locations.

The Fluid Atlas will be developed in the frame of Work Package 3. The focus will be on fluids used for electricity generation ( $> 100\text{ }^{\circ}\text{C}$ ), but it will have the potential to be extended over time to include data from historical and new heat projects. With the Atlas, operators can rapidly assess what kind of fluid might be expected at a certain location, and thus have an improved view of the associated risks when installing a geothermal power plant. It will combine and interpolate geographical, geological and fluid property data to obtain open access maps. Furthermore, an approach will be developed to transfer these compositional maps into risk maps for the different operational issues by combination with numerical modelling.









regulations of the data accessibility is different country by country. In *Table 1* the number of data groups (wells, fluid samples, rock samples and reservoirs) are summarised.

**Table 1:** Number of data groups collected by the EFG's LTPs and experts

| Country         | English name of the LTP/Expert                          | Number of wells | Number of fluid samples | Number of rock samples | Number of reservoirs |
|-----------------|---|-----------------|-------------------------|------------------------|----------------------|
| Belgium         | Belgo-Luxembourg Union of Geologists                    | 8               | 28                      | 27                     | 8                    |
| Bulgaria        | Bulgarian Geological Society                            | 14              | 0                       | 14                     | 14                   |
| Croatia         | Croatian Geological Society                             | 12              | 9                       | 0                      | 12                   |
| Czech Republic  | Czech Association of Economic Geologists                | 5               | 5                       | 5                      | 5                    |
| Greece          | Association of Greek Geologists                         | 566             | 566                     | 0                      | 0                    |
| Hungary         | Hungarian Geological Society                            | 167             | 493                     | 14                     | 16                   |
| Italy           | Italian National Council of Geologists                  | 948             | 0                       | 0                      | 948                  |
| Luxembourg      | Belgo-Luxembourg Union of Geologists                    | 4               | 4                       | 4                      | 4                    |
| Poland          | Polish Association of Minerals Asset Valuers            | 33              | 12                      | 30                     | 27                   |
| Portugal        | Portuguese Association of Geologists                    | 5               | 5                       | 0                      | 5                    |
| Romania         | National Assoc. of Professionals in Geology and Mining  | 29              | 26                      | 0                      | 0                    |
| Slovenia        | Slovenian Geological Society                            | 48              | 27                      | 14                     | 6                    |
| Spain           | Official Spanish Association of Professional Geologists | 42              | 42                      | 42                     | 42                   |
| Turkey          | Turkish Association of Economic Geologists              | 254             | 254                     | 0                      | 0                    |
| Ukraine         | Ukrainian Association of Geologists                     | 50              | 50                      | 0                      | 0                    |
| Denmark         | Expert  | 19              | 37                      | 20                     | 21                   |
| France          | Expert  | 23              | 24                      | 0                      | 23                   |
| Germany         | Expert  | 95              | 155                     | 25                     | 69                   |
| The Netherlands | Expert  | 78              | 47                      | 15                     | 15                   |
| UK              | Expert  | 291             | 0                       | 0                      | 0                    |
| Total:          |   | 2691            | 1784                    | 210                    | 1215                 |

## 4 CONCLUSIONS

In the frame of the REFLECT project, a European Fluid Atlas started to be developed at the end of 2020, which will visualise the data collected during the project implementation. Data collection is carried out in two steps:

- EFG's national member associations, as linked third parties, collect existing, publicly available data on national level from scientific publications, reports and manuscripts;
- REFLECT partners collect data during field work and laboratory examinations in the frame of the implementation of the project. They also provide data from their own publications.

The recent report summarises the process and the results of the data collection at national level by the EFG's LTPs.

In the REFLECT proposal it was declared that 20 countries would be covered by data collection. However, during the project implementation less LTPs joined the project than expected and they covered only 15 countries. From the missing 5 countries, experts hired by EFG, collected data.

Detailed guidelines and a complex data collection template were provided to the LTPs and the experts. All data were filled into the same type of template so that they can be assessed for the use in the Atlas. The collected data were divided into four groups: well data, fluid sample data, rock sample data and reservoir data.

Due to the different geothermal potential of the examined countries and the different regulations of the data accessibility, the number of collected data varies greatly in the different countries. The number of data groups from the 20 countries are summarised below:

- Data of 2691 wells,
- Data of 1784 fluid samples
- Data of 210 rock samples,
- Data of 1215 reservoirs.

Data collection by the LTPs hasn't been finished with the submission of the recent report. In the process of the development of the Fluid Atlas, the LTPs will be contacted and asked to refine the existing data or collect further data if needed. The Fluid Atlas, presenting all collected data will be provided by the end of the project.