



Report on the implementation of the European Geothermal Information Platform

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Table of Contents

List of Figures	4
Acknowledgements	4
Abstract	4
Executive summary	5
1 Introduction	6
2 EGIP pilot	8
2.1 <i>D4science e-infrastructure</i>	8
2.2 <i>EGIP VRE</i>	8
2.3 <i>Data</i>	13
2.4 <i>EGIP pilot consortium</i>	14
2.5 <i>Dissemination</i>	14
3 EGIP Joint Activity	15
3.1 <i>JA aims</i>	15
3.2 <i>Web-survey</i>	15
3.3 <i>Results</i>	15
4 EGIP Expert Group	18
4.1 <i>EGIP EG aims</i>	18
4.2 <i>Profiles of experts</i>	18
4.3 <i>EGIP EG document outcomes</i>	19
4.4 <i>Future scenario investigated</i>	20
5 Conclusions	22
References	24

List of Figures

Figure 1 Conceptual schema of the EGIP pilot	9
Figure 2 D4Science social networking facilities, the list of user events and news	9
Figure 3 D4Science file-system storage and sharing area, the Workspace	10
Figure 4 Data Catalog, it contains spatial data and documents	11
Figure 5 The GeoExplorer, used to visualize heterogeneous data in the EGIP data catalogue	12
Figure 6 The D4Science interface for data processing and experiments setup	12
Figure 7 Example of configuration of the 5-years energy distribution algorithm	13

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Abstract

This report describes the principle activities related to Work Package 3 of the Geothermal ERA-NET project performed in the last two years (mid 2014 – September 2016). All the tasks carried out in this timeframe are here summarized highlighting the main outcomes. The included sections are dedicated to the pilot of EGIP released in 2014, the survey on EGIP completed in 2015 and the overview document on EGIP implementation currently being finalized. The report is concluded with a final section which highlights the main outcomes, the open issues and sketch the next steps.

Executive summary

The Work Package 3, in the frame of Geothermal ERA-NET project, was aimed at studying the boundary conditions and to perform the preliminary work to pave the way for the implementation of the European Geothermal Information Platform, shortly EGIP. In the first two year of the project, two documents were delivered, D3.1 “Report on the state-of-the-art and needs in regarding geothermal data and existing tools to manage them” and D3.2 “Feasibility study for a European Geothermal Platform” focused on the-state-of-the-art in terms of data and databases on geothermal and on a description of a possible approach to implement such geothermal platform at European level respectively.

This report, D3.3, titled “Report on the implementation of the European Geothermal Information Platform” brings together the key tasks accomplished in the WP3 in the second half of the Geothermal ERA-NET project. In terms of time it covers a period ranging from spring 2014 up to Autumn 2016 (end of the project).

After the introduction, it is here described the EGIP pilot project carried out by 6 Geothermal ERA-NET volunteer partners in the summer 2014. The following section regards the analysis on the EGIP stakeholders performed in the summer 2015 by means of a web survey. Eventually, the main outcomes gathered by the EGIP Expert Group are reported, in particular the experience acquired during the Geothermal ERA-NET and its contribution toward EGIP implementation.

In the conclusions are described the main benefits having EGIP implemented, the concepts leading to EGIP, the recommendations, open issues and possible future scenarios for its implementation.

1 Introduction

The key activity within Work Package 3 of the Geothermal ERA-NET is complete the preliminary work required for the implementation of a European Geothermal Information Platform, which was also mentioned in the Commission Call [Topic ENERGY.2011.10.2-2, FP7-ERANET-2011-RTD] that led to the current Geothermal ERA-NET Project.

In Work Package 3 the tasks were dedicated: 1) to the scientific and technical preparation, 2) to survey the state of the arte and needs, 3) to prepare a feasibility study and 4) to follow-up the implementation.

Task 3.2 was carried out in 2013 and the related report D3.1 named “Report on the state-of-the-art and needs in regarding geothermal data and existing tools to manage them” was released in April 2013.

At completion on task 3.2, in the frame of task 3.3, a preliminary design for a European Geothermal Information Platform (EGIP) at European scale was proposed. The envisaged EGIP and a possible approach to its implementation were described in the D3.2 titled “Feasibility study for a European Geothermal Platform” and delivered in the last version on October 2013.

During the spring-summer 2014 a group of partners of the Geothermal ERA-NET participated in a first volunteer Joint Activity (JA), specially organized to demonstrate the feasibility, the effectiveness and the usefulness of EGIP. Such group, coordinated by CNR, implemented a pilot project of EGIP including a part of the information envisaged for EGIP. In 2015 a scientific paper on the methodology used to setup the EGIP pilot titled “Building a European geothermal information network using a distributed e-Infrastructure” was published in the International Journal of Digital Earth.

In 2015, the activity on EGIP continued in a second JA addressed to ‘Tuning EGIP for target user’. To such aim, national and trans-national stakeholders (SH) were engaged for answering a web-survey. The results are described in the report “Tuning EGIP for Target Users EGIP Web Survey Results”.

In the Geothermal ERA-NET meetings held in October 2015 and December 2015, EGIP was considered an eligible topic for a joint call for tenders. The object of the tenders was the design and the implementation of the EGIP web-based user friendly front end. However, the time limits and administrative issues on regard of fund management, made the call unfeasible. In February 2016 the call for tender on EGIP was abandoned.

In January 2016 the EGIP Expert Group (EG) was created to capitalize the work done for EGIP during the Geothermal ERA-NET. In particular, the EGIP EG was intended to help in the management of a call for tender for developing a web based user friendly front end for EGIP. Since the call for tender was given up, the EGIP EG decided to synthetize the experience acquired during the Geothermal ERA-NET into an overall document for offering an overview of EGIP to prepare its implementation. The document, released in October 2016, is named “European Geothermal Information Platform - EGIP - An overview to prepare the implementation” and includes also INSPIRE oriented guidelines to implement EGIP.

This report, related to the task 3.4 of the project, describes the principle activities performed after the release of the D3.2 (from mid 2014 up to September 2016) as principle preparatory steps for the EGIP implementation. Section 2 gives an overview of the work carried out to setup the Pilot, Section 3 describe the web-survey on EGIP and the results obtained and section 4 reports the EGIP EG activity. The conclusive section 5 highlights the main outcomes as well as the open issues to be solved and possible scenarios for future EGIP development.

2 EGIP pilot

The EGIP pilot is the result of a Join Activity carried out in the frame of the Geothermal ERA-NET project. The EGIP pilot is aimed to demonstrate the platform capabilities and usefulness to the main geothermal actors in Europe (i.e., scientists, politics and industrials).

The EGIP pilot offers an access point to a number of services, information and data specially set up in accordance with the provisions in Geo ERA-NET D3.2 “Feasibility study for EGIP implementation”.

EGIP pilot project exploits the services offered by the high performance e-Infrastructure made available by D4Science.org organization and the federation and integration of the resources provided by the participating volunteers (e.g., Catalogue of data, data, documents).

The pilot provides only the nucleus of the EGIP containing the most urgent information and some main functionality. The initial development of the pilot project involved setting up a geothermal common data model and the management and optimization of services EGIP designed to fully satisfy the end-user by providing easy and useful data retrieval and cost containment, in compliance with INSPIRE rules for building a (spatial) Data Infrastructure.

2.1 D4science e-infrastructure

D4Science.org is an organisation offering a Hybrid Data Infrastructure service and a number of Virtual Research Environments.

Such a Hybrid Data Infrastructure (HDI) service represents a new solution supporting scientists called to deal with data-intensive science. An HDI assumes that several technologies, including Grid, private and public Cloud, can be integrated to provide an elastic access and usage of data and data-management capabilities. D4Science.org relies on the gCube software system to realize and operate its HDI.

A Virtual Research Environment (VRE) is a system with the following distinguishing features: (i) it is a web-based working environment; (ii) it is tailored to serve the needs of a community of practice; (iii) it is expected to provide a community of practice with the whole array of commodities needed to accomplish the community’s goal(s); (iv) it is open and flexible with respect to the overall service offering and lifetime; and (v) it promotes fine-grained controlled sharing of both intermediate and final research results by guaranteeing ownership, provenance and attribution.

2.2 EGIP VRE

The EGIP capabilities are provided within EGIP Virtual Research Environment (VRE). The EGIP VRE deploys the services offered by the high performance e-Infrastructure D4Science and the federation and integration of the resources provided by the participating volunteers, Figure 1.

Up to now EGIP provides community members not only with different applications enabling metadata discovery function (spatial data view, query and download, statistical data analysis) but also facilities for collaboration, such as Collaboration Environments, Social Networking (Figure 2) and Shared Workspace (Figure 3).

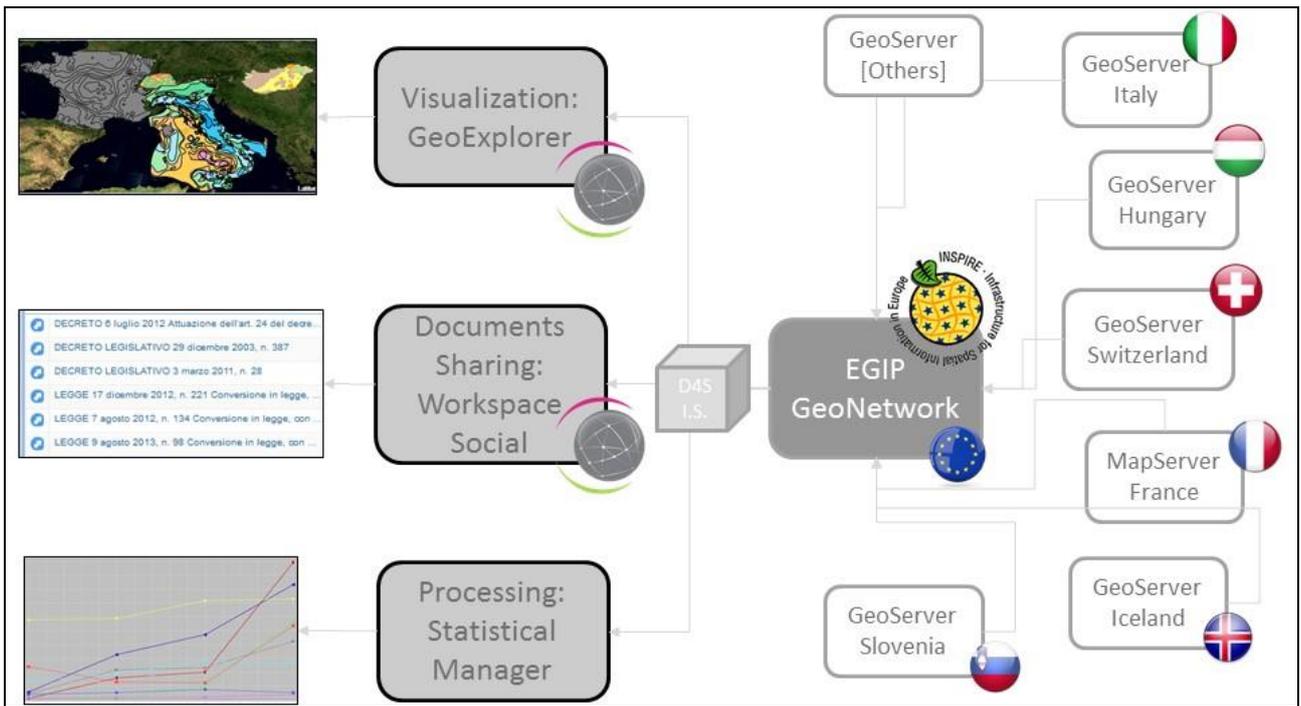


Figure 1 Conceptual schema of the EGIP pilot

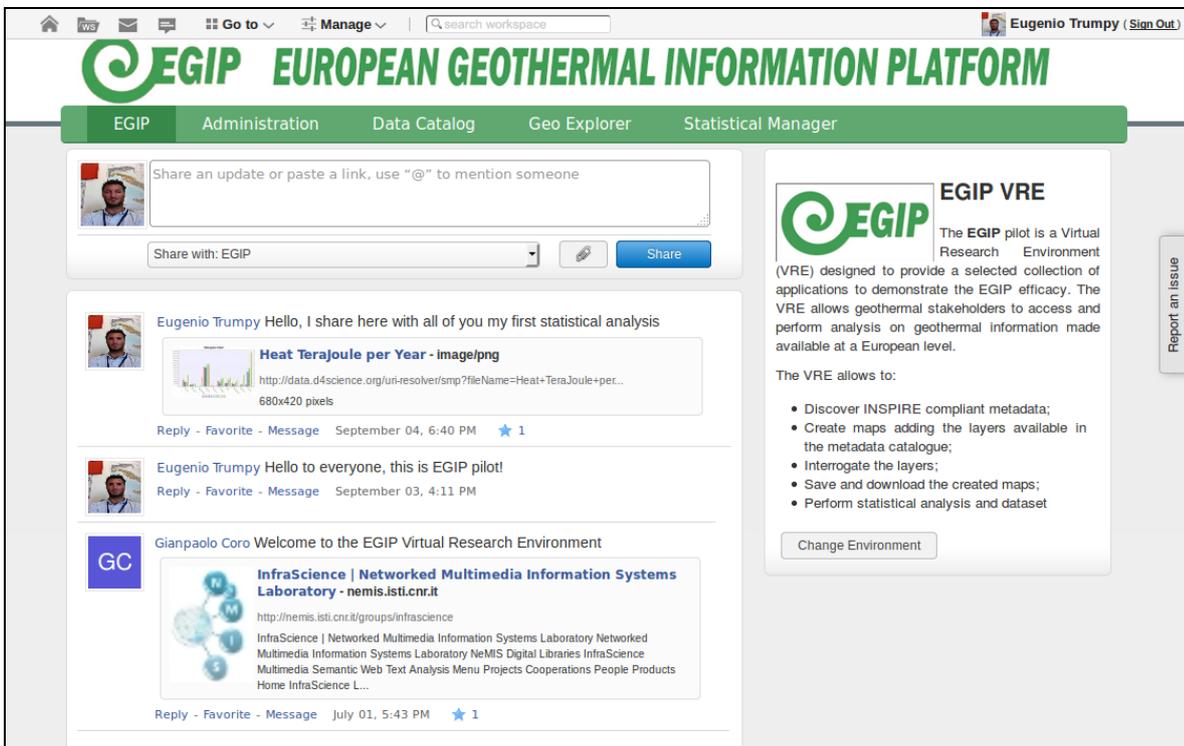


Figure 2 D4Science social networking facilities, the list of user events and news

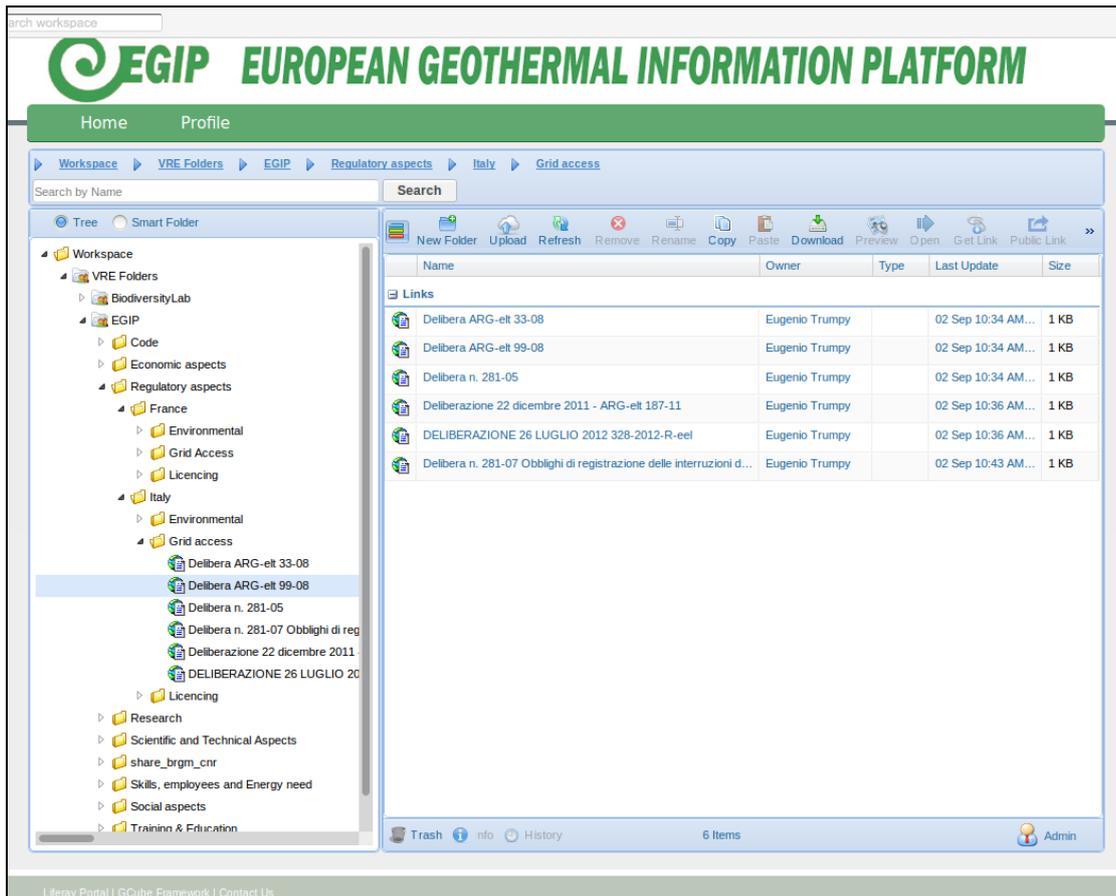


Figure 3 D4Science file-system storage and sharing area, the Workspace

The EGIP VRE main applications are:

Metadata Catalogue: harvests the geothermal data, via the OGC CSW protocol, from the EGIP pilot National volunteer partners. It shows the registered metadata according to the INSPIRE requirements. The catalogue allows the users to search and discovery the Geothermal information belongs to EGIP (Figure 4).



Figure 4 Data Catalog, it contains spatial data and documents

Geo Explorer: allows to insert all the spatial layers registered in the Metadata Catalogue in a map. Geo Explorer (Figure 5) has the main webGIS functionalities such as zoom in, zoom out, pan, data selection and data interrogation. For each layer the user can: i) adjust the opacity, ii) setup a data filter and iii) see the legend. Both the assembled map and each layer can be exported and download locally or save in the workspace available in the EGIP VRE to be share with other registered users.

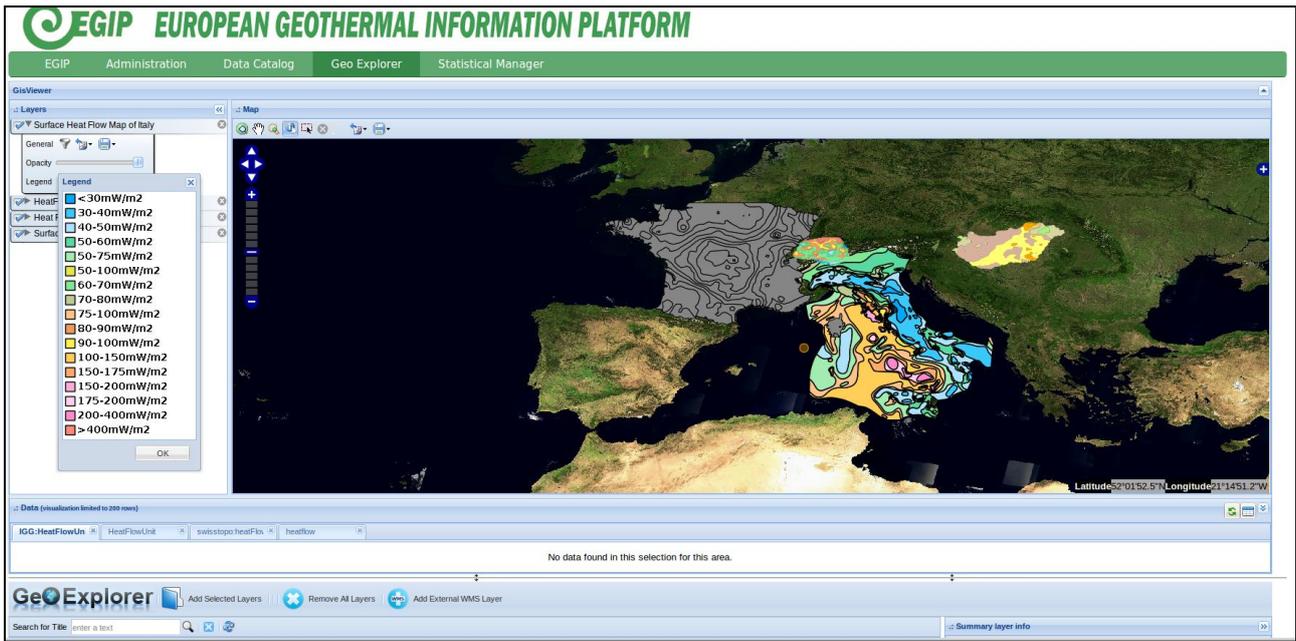


Figure 5 The GeoExplorer, used to visualize heterogeneous data in the EGIP data catalogue

Statistical manager: makes available a large number of tools to analyse the datasets provided. In EGIP VRE, to demonstrate the powerful of this tool, only a few and simple algorithms has been implemented, to examine the Geothermal Energy production trend in the Geothermal ERA-NET partner countries (Figure 6 and 7).

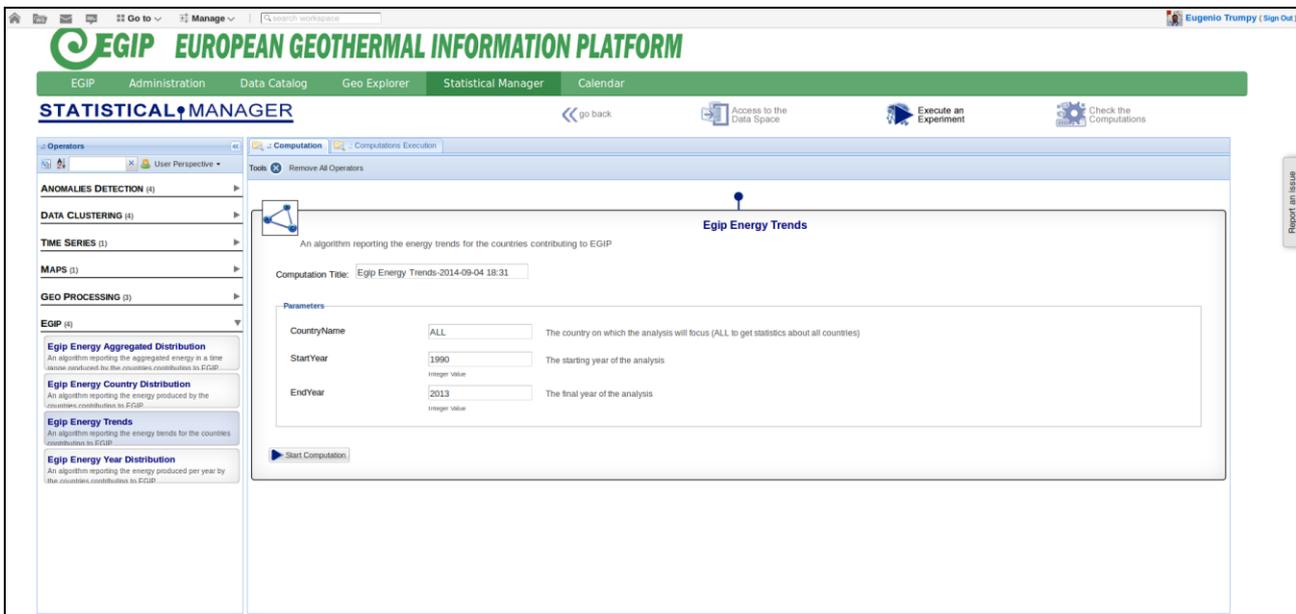


Figure 6 The D4Science interface for data processing and experiments setup

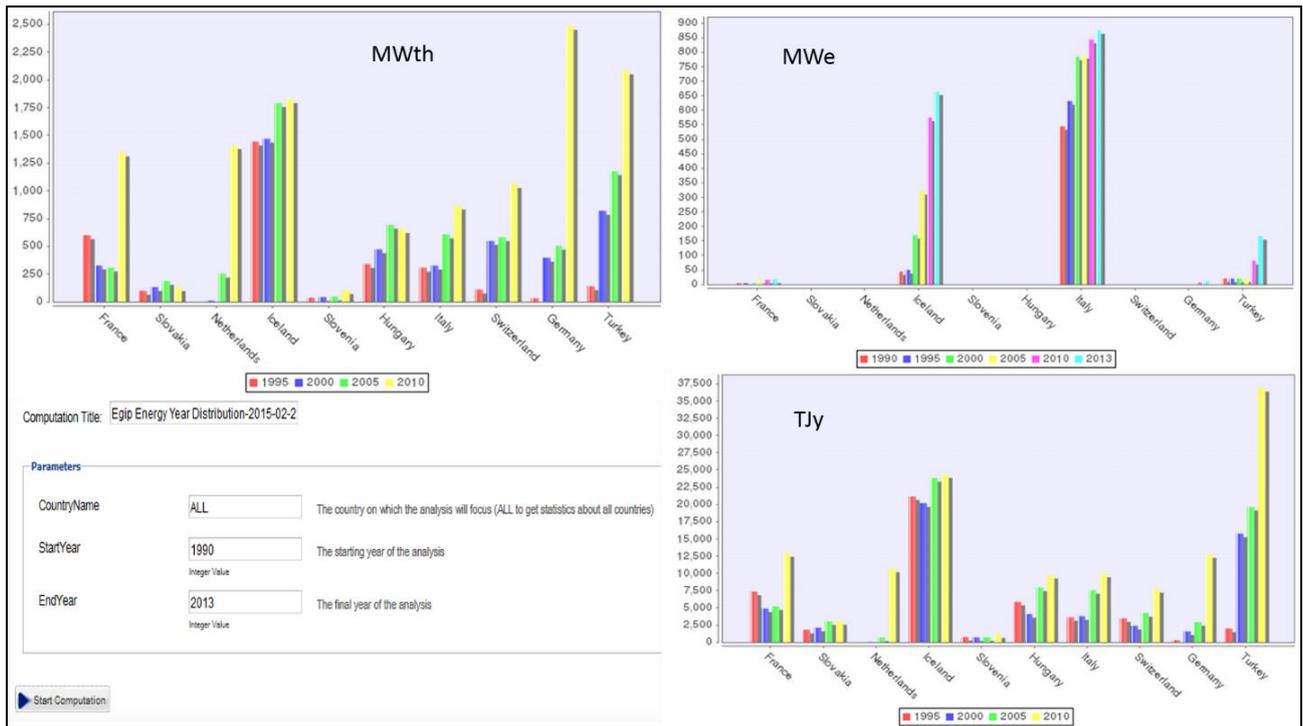


Figure 7 Example of configuration of the 5-years energy distribution algorithm

2.3 Data

EGIP follows the principles of a distributed architecture, so that at national level each partner decided the data and documents to be shared through the EGIP portal, according to common rules adopted by the EGIP (i.e., EGIP Games rules, EGIP data model and egip.xsd file provided in the EGIP pilot portal) that are compliant with INSPIRE principles. Each partner remains the owner of its national data. The EGIP Pilot organized just a minimum number of data, as listed:

1. Temperature maps
2. Surface Heat Flow
3. Exploration and production licenses and (projected) power production
4. Laws
 - Environmental impact
 - Licencing regulations (exploration/exploitation)
 - Legal conditions for grid access
5. Geothermal roadmaps
6. Insurance
7. Royalties & taxes, support scheme (feed-in tariffs, grants, ...)
8. List of education & research institutes

9. List of Industries

2.4 EGIP pilot consortium

The volunteer participating partners and relate country in EGIP pilot were:

- CNR – Italy
- BRGM – France
- SFOE (with Swiss Geological survey) – Switzerland
- MFGI – Hungary
- GeoZS – Slovenia
- OS – Iceland

2.5 Dissemination

The idea of EGIP, described in the report on the Feasibility study (D3.2), was presented at the INSPIRE conference held in Florence in June 2013.

The EGIP Pilot was unveiled at the Geothermal ERA-NET meeting held in Trieste in September 2014. In the same occasion it was presented also to EERA-JPGE consortium in a join meeting.

The methodology adopted for the pilot has been published in the International Journal of Digital Earth as scientific paper titled “Building a European geothermal information network using a distributed e-Infrastructure” by Trumpy et al. (2015) and as proceedings at the European Geothermal Congress (EGC) in the 2016.

3 EGIP Joint Activity

Late 2014, the Geo ERA-NET project consortium and the Supervisory Board decided that a further step of EGIP evaluation was necessary. Consequently, the “Tuning EGIP for target users” Joint Activity was launched, with the aim to performing an analysis of the boundary conditions for such Geothermal Information Platform at European level. A Web survey was conducted to share the EGIP Pilot with European stakeholders (SH) and to collect their feedback on effective needs, impacts and benefits that EGIP must have. The results and conclusions of this survey, described in the Tuning EGIP for target users JA report (2016), are here synthetized.

3.1 JA aims

The main aims of EGIP JA are as follows: i) to define the principal groups of stakeholder (SH) interested in the implementation of a European Geothermal Information Platform (EGIP), ii) to identify where will EGIP add the most value –or meet requirements of SHs, iii) to assess the EGIP interest and necessity, and rank priorities of implementation of EGIP, iv) to strengthen the shared understanding or awareness of SHs on some available portals. Having these points covered was an important part of the requirement gathering for EGIP.

3.2 Web-survey

The survey, for a total of 26 questions, was designed in 3 sections each with its own target in order to achieve the goals of the survey.

Part 1 was dedicated to retrieve information on the respondent institution (i.e., institution activities, institution interests, institution belonging group) in 5 questions. This part was important since it provided the necessary information about the type of SH.

Part 2 was dedicated to assess the feeling of the respondent institution to some general concept regarding EGIP. This was aimed to check whether the concept of EGIP was understood or rather considered too business oriented or too technical, in order to achieve an increased shared understanding.

Part 3, which was optional, was intended for the analysis of the EGIP pilot experience, and to get the opinion and feedback of the respondents mainly on the EGIP pilot functionalities, data/information provided and usability of the web platform set up.

3.3 Results

Altogether 385 SH were invited to complete the questionnaire of the web survey. The origin of the SH laid in the six geothermal ERA-NET nations participating in this JA plus a few trans-national organisations. 130 SH answered to this invitation by completing the survey, which corresponds to 34% of the invited stakeholders. The web survey showed a good general perception of the EGIP concepts by the SHs.

The results of the survey allowed a prioritization of the contents that should be implemented in an EGIP. Some of the identified SH priorities clearly fell within the vicinity of national platforms and responsibilities. This allowed a further focus on the topics that had to be treated on a trans-national level like EGIP. This was important to prevent that a future EGIP just duplicates national platforms.

There was a good general perception of the EGIP concepts among different kind of stakeholders, indicating a valuable interest on the possibility to have such platform. An easy and quick way to access (visualisation and where possible download) raw data, interpreted data, documents, was considered crucial for many users. A detailed inventory of the available information including the contact reference for those not available should be considered for the implementation of EGIP.

Main achievements are listed below:

- ❖ The majority of respondents who took part in survey believe that improved access on the Internet to specific geothermal data and documents as in EGIP Pilot (or similar web application) is important. It is for both spatial datasets and other data.
- ❖ The main interested groups are Academia/Research centres, public authorities and industry (the latter consisting of upstream, midstream and downstream industry and consulting enterprise)
- ❖ Geothermal potential assessment, geothermal energy from hydrothermal as well as research and innovation are the topics of most interest for those who answered. Against expectation, the interviewees showed significantly more interest in hydrothermal than in petrothermal (EGS) systems.
- ❖ The suggested contents (in terms of raw data, interpreted data and documents) met expectations of those who answered.
- ❖ Easy and quick access/visual access to data, documents, specialist information were seen as the most important added values to today's situation.
- ❖ All three raw data types (well data, geophysical surveys, and production data) were considered very valuable.
- ❖ Temperature and heat flow maps, geological maps, cross-section and 3D Models, interpreted seismic lines were the most valuable interpreted spatial datasets.
- ❖ Best practices and guidelines were the document type mostly required.

The INSPIRE perception remains still not clear, as more than half respondents were from Switzerland, where the INSPIRE regulation does not apply. Moreover, in each country there is a key institute controlling the INSPIRE implementation, in most cases it is the National Land Survey of each country, and those institutes usually have no connection with Geothermal energy related issues, and answers to the web survey did not come from them.

The EGEN and IGA web sites, which provide different kind of information (multi-purpose/multi-information), were the most known and used, highlighting how the users usually look for more than one information typology.

The results of the survey allow a prioritisation of the various kinds of raw data, interpreted data and documents and also allows focusing on the most important applications of geothermal energy for an

eventual realisation of EGIP. Complete survey analysis is available in the report titled “Tuning EGIP for target user”.

4 EGIP Expert Group

Late 2015, the Geo ERA-NET project consortium and the Supervisory Board gathered in Leiden where two tasks were introduced on EGIP:

1. To form a group of 3-4 experts (or more if needed) to extend the INSPIRE oriented technical guideline for geothermal data. (no competition – not suitable for tender)
2. Development of a user friendly web based front-end to access, view, download, share and analyse data and information of the gradually developing EGIP (tendered out)

Early 2016, the EGIP Expert Group was created and supported by an Extended Expert Group gathering technical skills especially regarding the INSPIRE European Directive and geothermal databases.

4.1 EGIP EG aims

The EGIP Expert Group was aimed to:

- a. **Write an INSPIRE oriented guideline for geothermal data harmonization**, starting from the works already performed in the context of the feasibility study D3.2 and the EGIP pilot project and adding the most priority information indicated by the principles EU Stakeholders in the survey on EGIP carried out in September.
- b. **Write the technical specifications for a call for tender** for the development of a user friendly web based front-end for a European Geothermal Data Platform (EGIP) with a minimal content of INSPIRE compatible data to demonstrate its functionality. The front-end and minimum data content should build up on the existing EGIP pilot database.
- c. **Assist the steering committee** of the call in writing the call for tender up to the end of Geothermal ERA-NET in April 2016.

Unfortunately, the ideas for a formal joint call for tender to design and develop a front end has been cancelled, since on EU level it was legally complicated and time consuming. Moreover, for some country (e.g., Italy, France) the funds could not be used for a Call for Tenders. Consequently, the expert group decided to focus mainly on the task related to “Write an INSPIRE oriented guideline for geothermal data harmonization” and reduce the task “Write the technical specifications for a call for tender”, whereas task “Assist the steering committee” with the writing of the call was abandoned.

Considering the close end of the Geothermal ERA-NET project, the Expert Group also seeks??? for opportunities to find a framework where EGIP could be realized.

4.2 Profiles of experts

The profiles of expert had to have experience in one or several of the following fields:

- ✓ INSPIRE guidelines: People having worked before with INSPIRE guidelines (not the legal part, but technical parts: metadata, services, implementing technical rules, data models) were considered an essential asset for this expert group.

- ✓ **Geothermal data:** It was essential to have people on the team that are familiar with geothermal information. This includes geothermal data (e.g. geological data, well data, ...) as well as other relevant information.
- ✓ **EGIP pilot:** the front-end may build upon the existing EGIP pilot database and shall also incorporate the data the latter contains. At least one person in the expert group should have been involved in the development of EGIP pilot or otherwise be very familiar with it. As the EGIP pilot was developed by the Italian National Research Council CNR, this expertise resided in CNR.

4.3 EGIP EG document outcomes

During the final course of Geo ERA-NET the Expert Group produced a document entitled “European Geothermal Information Platform - EGIP - An overview to prepare the implementation”. Such a document is dedicated to whom will take care of the development of the Information Platform.

This document offers an overview of EGIP to prepare its implementation. After a presentation of the EGIP concept, it proposes a vision for its intended architecture and implementation. This vision is completed at the end of the document by some open issues and recommendations, plus, as an annex, a detailed list of relevant geothermal data themes linked with related INSPIRE guidelines and previous Geothermal ERA-NET works.

EGIP has not been implemented so far but a pilot has been set up. The document is dedicated to whom such implementation may concern. It is not a ready-to-use procedure but contains the main insights identified by the EGIP Expert Group to be considered and adapted to the context where EGIP will be implemented.

The EGIP Expert Group recommended to pay attention to the following considerations related to the intended EGIP implementation:

❑ Recommended geothermal data themes and relevant INSPIRE guidelines

Recommended geothermal data themes and relevant INSPIRE guidelines are presented as catalog in the annex of the document along with the related INSPIRE.

❑ European harmonization

EGIP deals with geodata that are spatial data (e.g. subsurface temperature), and non-geodata (e.g. national incentives for geothermal energy). Knowing the (estimated) subsurface temperature is crucial for the development of a geothermal project but knowing the country incentives for geothermal energy is as much crucial for the developer. Consequently, the EGIP Expert Group strongly recommends to consider at the same level geodata and non-geodata in the EGIP implementation.

❑ European harmonization

The EGIP Expert Group estimates that the geothermal sector suffers of a lack of harmonization at the European level. Common and coherent initiatives are needed to gather

experts for the coordination of the geothermal actors and the definition of shared ways of working.

Two main aspects of such a harmonization are related on one hand to a European code for reporting geothermal resources and reserves, and on the other hand to the harmonization of geothermal data in the scope of the INSPIRE directive. In that sense, implementing EGIP is an opportunity to assist the harmonization the geothermal European sector at the European level.

❑ Stakeholders' involvement

It seems important to the EGIP Expert Group to involve a representative group of users since the beginning of the EGIP implementation. Scientists, investors, developers, decision makers dealing with geothermal energy should be taken on board as soon as possible to ensure that the propositions fit their needs. This would also facilitate progressive appropriation of EGIP by the identified stakeholders.

❑ Sustainable governance

The Information Platform needs sustainable governance operating even after the end of the EGIP implementation project to guarantee the accessibility and the update of the data, and to allow the evolution of the platform for fitting the user's demand.

❑ Border harmonization, cross border discontinuity and interpolation issue

Creating fully harmonized European level cross border coverages requires transnational cooperation and great effort as demonstrated by the rare international projects dedicated to harmonization issues.

Sharing data through the EGIP platform can help in solving such problems. Common transnational datasets are required to create 2D surfaces that are free of interpolation errors at state borders. Interpolations carried out with combined datasets will be free of border zone discontinuities.

Publishing background data as “Renewable And Waste Resource Coverage” with multipoint geometry is fully in line with the INSPIRE directives and provide exactly the kind of information that is needed to solve such issues.

4.4 Future scenario investigated

The EGIP Expert Group analysed the possibilities to fund EGIP implementation in the future. Two ways were investigated: a) in the frame of GEOTHERMICA CoFund Action and b) in the frame of GeoERA CoFund Action (both project proposals are awaiting approval).

- a. Initially feedbacks from GEOTHERMICA consortium let understand that there would have been limited possibilities for EGIP to be tackled in that framework. However, non-geodata (not in the scope of GeoERA, see below) could be covered by GEOTHERMICA.

- b. During the spring 2016 a contact with the coordinator of the Geoenergy theme of GeoERA consortium was established. The feedbacks were positive, EGIP could have a good opportunity for its implementation within the Geoscience Information Platform that GeoERA consortium is planning. However, some issues were raised:
- GeoERA will deal only with geodata, whereas non-geodata are important information for EGIP.
 - Not all EGIP partners participate in GeoERA and would require to be inserted as third parties
 - The maintenance of EGIP platform both at central, European level and at national level, is not planned and guaranteed

5 Conclusions

The work already done on EGIP in the framework of the Geothermal ERA-NET is the ‘launching pad’ for a major project allowing its implementation. Along all the performed tasks, it is now more clear what would be the benefit to have EGIP implemented:

- ✓ Guaranteed data interoperability, which will simplify data provision (e.g., retrieval, viewing and access of information from partners)
- ✓ Harmonized geothermal domain at a European level, which will reduce geothermal data fragmentation
- ✓ Guaranteed ownership: data **belong** to and **stay** in the country they are related to
- ✓ Data availability will increase the focus on and investments in geothermal energy inducing a reduction of project risks
- ✓ Raised awareness about geothermal energy
- ✓ European coverage thanks to the multiplicity of data sources, the latter being directly related to national databases

The main interested groups of stakeholders are Academia/Research centres, public authorities and industry, which have to be involved since the beginning of the implementation. Scientists, investors, developers, decision makers dealing with geothermal energy should be taken on board as soon as possible to ensure that the propositions fit their needs.

EGIP must act as web portal and shall allow an easy and quick access to datasets and documents.

The information included in the EGIP has to cover all the aspects related to geothermal energy, not only underground data but also information on the economics, regulations, national energy policies, energy production, energy demand, market requests, and social issues.

EGIP should have a catalogue providing and disseminating information regarding what geothermal data are available, how to access and who is maintaining them, and their access level. The information search has to be accessible in two main ways: i) as catalogue allowing alphanumeric search operation which relies on (metadata) attributes (e.g., keywords, countries and categories) and ii) as Web-map allowing spatial search of information/datasets. Furthermore, EGIP should allow to visualize, browse, and query interpreted datasets in the form of maps (e.g., subsurface temperatures for the whole of Europe or for the chosen areas) covering the areas of the participating countries.

EGIP intends to upscale national data and information at European level. Compliant with the INSPIRE directive (INSPIRE, 2007), EGIP has to be connected with the national data providers through Web services. European products will be obtained by accessing, sharing, and processing the national geothermal information. A data model, metadata description and web services are the key elements to implement an EGIP INSPIRE compliant.

The Information Platform needs sustainable governance operating even after the end of the EGIP implementation project to guarantee the accessibility and the update of the data, and to allow the evolution of the platform for fitting the user's demand.

Possible future scenario for EGIP implementation were surveyed. Currently the most suitable occasion would be the call could be launched in the frame of the GeoERA (Applied Geosciences ERA-NET Cofund Action), which answered to the Call H2020 LCE-26-2016. Such activity, if funded, will cover only geodata (to be defined what part of those of interest to the geothermal sector. Complementarily GEOTHERMICA, the geothermal Co-fund Action recently approved by EC, could provide the occasion to collect other geothermal, non-geodata, information at European level.

Finally, the open stakeholder group 'Geothermal Technological and Innovation Platform' (Geothermal ETIP), recognized by European Commission on July 2016 and which includes representatives from industry, academia, research centres, and sectorial associations, can be considered another suitable and strategic place for preparing the EGIP platform implementation.

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Tuning EGIP Joint Action report (01/2016)

Report: Tuning EGIP for target user. ISBN 978-9979-68-389-6

Link: <http://www.geothermaleranet.is/media/publications/Geothermal-ERA-NET-JA-REPORT-EGIP.pdf>

European Geothermal Information Platform EGIP - An overview to prepare the implementation report (09/2016)

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Link: http://www.geothermalera.net.is/media/publications/Geothermal-ERA-NET-REPORT-EGIP-implementation_final.pdf



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