



Report on common interests for joint activities and action plan

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Abstract

This report presents the final realization scheme for transnational cooperation within the Geothermal ERA-Net. Seven specific joint activities were developed including cooperation on financial and funding issues, RD&D knowledge exchange on operational issues, public relations, new concepts, reservoir sustainability, a working group on the implementation of a European Geothermal Information Platform (EGIP) and a working group on data consistency. The activities follow a bottom up-approach to point out the additional benefit of trans-national cooperation. All activities are presented including their structure, goals and an action-plan for the individual steps within the activities.

Executive summary

To create a scheme for the implementation of trans-European cooperation on geothermal energy, work package 4 “Development of joint activities” proposed a bottom up-approach for the realization of joint activities. This approach is based on the previous results of the Geothermal ERA-NET and wants to present the main benefits of a European cooperation scheme. The approach combines the following requirements (see also D 4.1.):

- Minor effort of financial and human resources
- Based on the input from the geothermal community to ensure the necessity of the results
- Integration of stakeholders from the different fields of geothermal energy
- Capable to produce high-quality results and solutions for non-technical and technical issues
- Capable to identify several topics for joint calls

In a second phase this scheme was further developed and combined with the thematic needs on RD&D knowledge and information exchange and solutions to overcome non-technical and regulatory barriers extracted from the results of work package 2 “Information exchange on national incentives and status of geothermal energy”. As a result seven joint activities on different topics were proposed:

- NWW – New ways of working: Financial Instruments and Funding of RD&D and Geothermal Projects
- OpERA – RD&D Knowledge Exchange on operational issues of geothermal installations in Europe
- PRGeo - RD&D Knowledge Exchange on public relations for geothermal energy
- New Concepts for geothermal energy production and usage
- ReSus - RD&D Knowledge Exchange on reservoir sustainability
- Tuning EGIP (European Geothermal Information Platform) for target users
- Geostat - Towards Consistency of geothermal data

The specific activities and working groups follow partly iterative and partly continuous approaches. The final structure and the working plans are presented in this report. In addition the different working groups, coordinated by a steering committee of two countries for each activity, have developed an action plan until the end of the Geothermal ERA-Net. These action plans, which describe the timing of the results and the dissemination ways, are presented in this report. The first major milestone in all of the actions is the autumn meeting of the Geothermal ERA-NET, where first results of all activities will be presented and future activities, including a possible joint call will be planned.

1. Introduction

To foster the trans-European cooperation in the field of geothermal energy, the work package 4, ‘Development of Joint Activities’, was implemented into the working plan of the geothermal ERA-NET. The key objectives of work package 4 are:

- The identification of joint activities
- The definition of possible schemes and barriers for the joint activities
- The preparation of an action plan for the implementation of joint activities in work package 7, ‘Implementation of joint activities’.

In 2014 WP4 has identified possible schemes and barriers for the joint activities based on the results of the first 18 month of the Geothermal ERA-Net (D4.1, Possible schemes and barriers for joint activities“) and has proposed a bottom-up approach for the implementation of joint activities.

The identification of schemes and barriers for the implementation of joint activities within the framework of the Geothermal ERA-Net was the first step in a 4-step workflow for the final realization of the specific actions.

The four steps are:

1. Definitions of possible schemes and barriers (D4.1)
2. Identification and proposal of possible topics
3. Definition of discrete actions to be implemented
4. Final decision on the implementation of discrete joint activities (Action plan).

With respect to the existing barriers, a possible scheme was identified and specific actions on different topics in several clusters were proposed on a project supervisory board meeting in Leiden (NL) in December 2014 (Step 2). The consortium decided to pursue the following topics:

- NWW – Operation and Steering of research funding
- NWW – Financial instruments for the enabling of private investment
- Knowledge Exchange on „Operational Issues“
- Knowledge Exchange on „Public relations“
- Knowledge Exchange on „New Concepts“
- Knowledge Exchange on „Reservoir – sustainability“
- Knowledge Exchange on „Interoperability of data“

- Knowledge Exchange on „European Geothermal Information Platform“

This report wants to present the definition and the structure of the selected joint activities which were formulated in the follow-up of the meeting (Step 3). In addition an action plan for the final implementation of the activities is presented (Step 4).

1. Identified Schemes and Topics

As presented in deliverable 4.1, ‘Possible schemes and barriers for joint activities’, a bottom-up approach for the implementation of joint activities was selected. The basic idea behind this approach is to implement first level of joint activities (JA1) with a minor effort on human resources and financial support to present the effectiveness of transnational cooperation and to smooth the way for more complex future joint activities (JA2 & JA3). Based on the results of work package 2 (D2.3, D2.4) the proposed scheme was combined with the topics for RD&D and actions to soften or overcome existing barriers. Figure 1 shows the concept of the bottom up approach presented in D4.1.

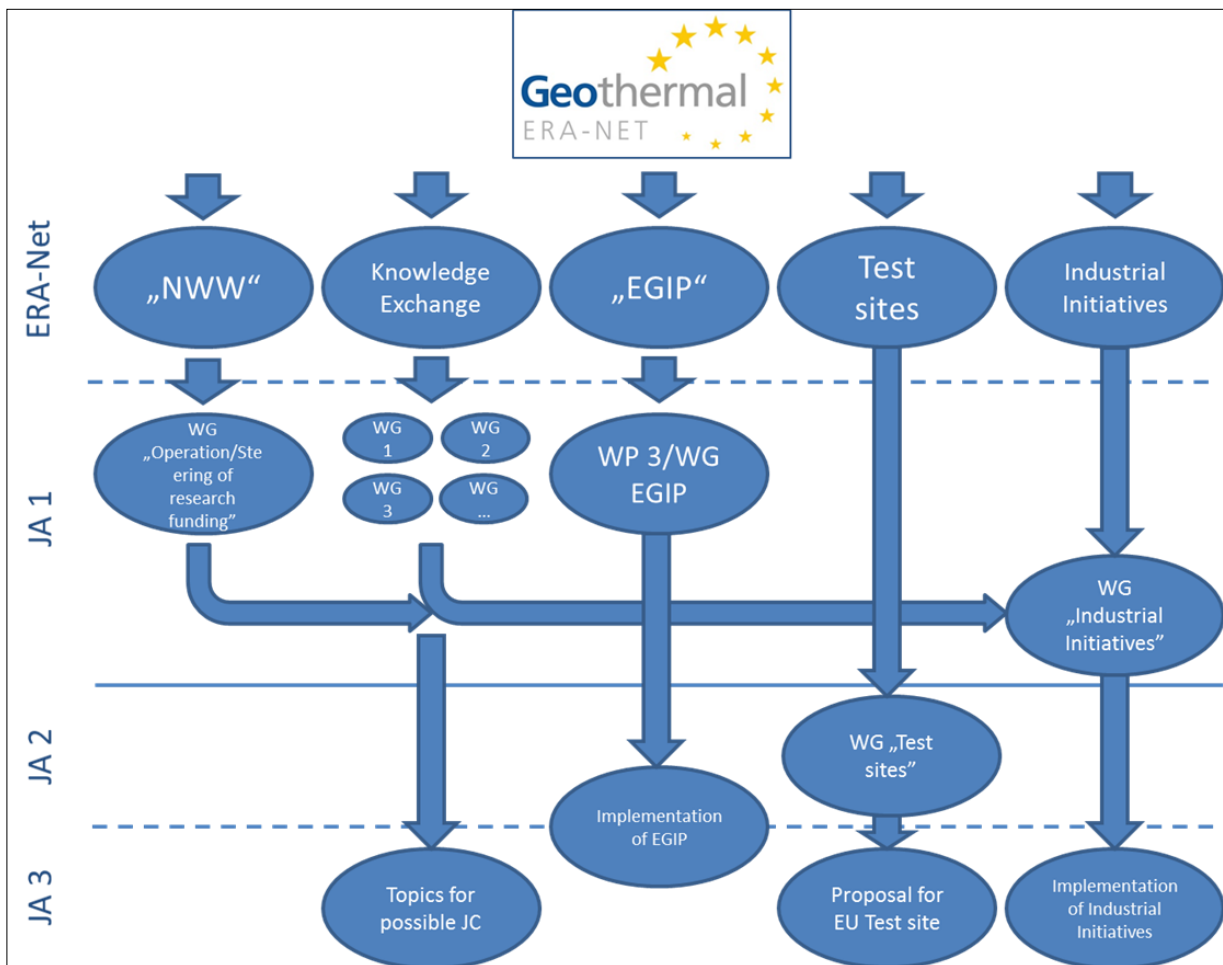


Figure 1 Bottom up approach for the implementation of joint activities within the Geothermal ERA-NET. First Level 1 JA are already developed and started.

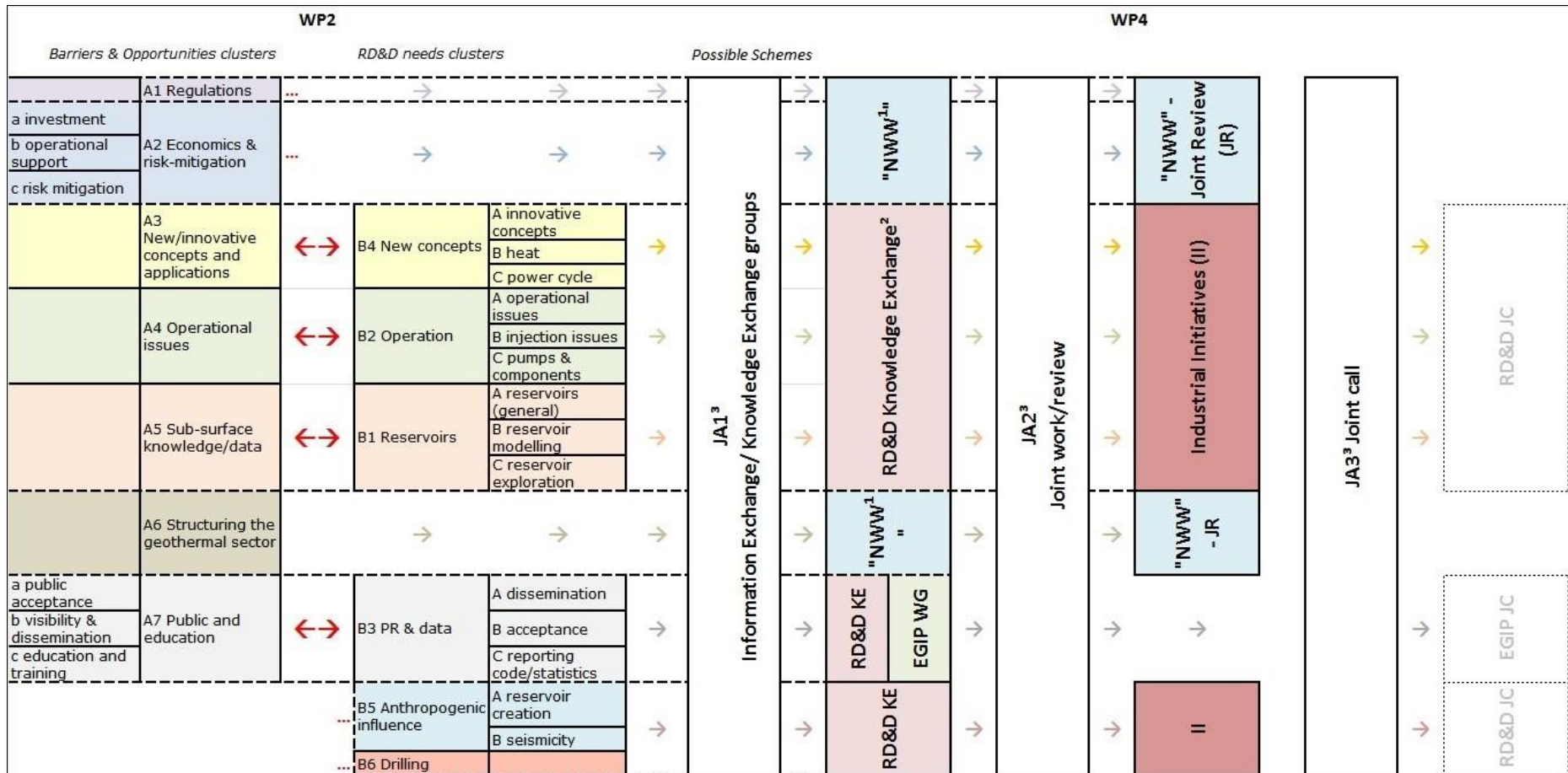


Figure 2 Transfer process from the identified topics (WP2) to the proposed joint activities (WP4).

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Figure 2, presents “NWW - New ways of working”. This thematic cluster focuses on the cooperation between the European funding institutions to overcome non-technical barriers. ²: “RD&D Knowledge exchange”. The proposed actions are working groups on operational issues, public relations, new concepts, reservoir sustainability and interoperability of data. ³: Levels of Joint activities (see also D2.5): JA1 Information Exchange/ Knowledge Exchange groups - low budget: Working groups to tackle issues through several means (dedicated meetings/workshops/visits/....). JA2 Joint work/review – limited budget: This could be a joint assignment, e.g. to have an expert company produce a status report on a specific issue, a detailed study to solve a specific issue etc. All interested countries could bring together budget for such an assignment, which is then of benefit to all. JA3 Joint Call – significant budget: A joint call allows stakeholders in the participating countries to work jointly on developing new insights and new systems, in contrast to the first two types of joint activities that essentially aim to improve availability of or analysis of existing information, where it is required.

To reduce the number of topics for the implementation of first level JA, a selection on the topics which were extracted from the results of WP2 was made due to the urgency estimations from the participating countries. The result was a list of 13 possible topics for joint actions in two clusters which were proposed. Figure 2 shows the process which leads from the results of WP2 to the selected joint activities.

1.1 Cluster: NWW - New ways of working

The target community for the joint activities in this cluster consists of the national funding institutions (program owners or managers). The aim is to foster the knowledge exchange on the different national systems for research funding. Collaboration between the institutions which are responsible for the selection and support of research projects and the design of new funding instruments can soften non-technical barriers for the development of geothermal energy due to the knowledge and information exchange. Within the cluster, the following subtopics were identified for joint activities:

Table 1 Operation and Steering of research funding

Subtask:	Operation and Steering of research funding
Organisation:	National funding institutions: - Steering committee (2 countries) & participating members
Possible actions:	<p><u>2-Day WS:</u> Day 1: “Handling of national research funding: Proposal, Review, Funding” Information Exchange on the different national workflows. Day 2: “Experiences in national research funding: Needs, Barriers, Opportunities”</p> <p><u>1-Day WS:</u> “Guarantee schemes for deep geothermal energy projects in Europe”.</p> <p><u>Joint Database:</u> “National research projects on deep geothermal energy of the last 10 years”. (Establishment of a database for the exchange on completed projects in the participating countries).</p>

Dissemination:	Report on the status of national research funding in the participating countries and recommendations to overcome barriers
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Table 2 Financial instruments for the enabling of private investment

Subtask:	Financial instruments for the enabling of private investment
Organisation:	National funding institutions: - Steering committee (2 countries) & participating members - invited experts (Industry, financial sector)
Possible actions:	Evaluation of existing instruments Evaluation of national markets Round table with stakeholders on necessary instruments (must-have & nice to have) <u>1-Day WS:</u> <i>“Feed-in Tariff for deep geothermal energy: Status quo, Experience, Needs”</i> . Information Exchange on the different national approaches. (poss. 2nd Part: <i>Insurance approaches</i>)
Dissemination:	Recommendations for financial instruments for the development of geothermal energy in Europe (country specific)

Table 3 Evaluation of the regulatory framework for geothermal installations

Subtask:	Evaluation of the regulatory framework for geothermal installations
Organisation:	National funding institutions: - Steering committee (2 countries) & participating members
Possible actions:	Communication Workshop: E.g. World Café on " <i>Regulatory barriers and ways to overcome these barriers</i> "
Dissemination:	Paper on a country specific analysis of the national regulatory frameworks and recommendations for a best-practice approach

1.2 Cluster: RD&D Knowledge exchange:

The cluster on RD&D knowledge exchange addresses the research community and representatives of the geothermal industry (e.g. plant owners, project developers) as well as the national funding institutions. With a knowledge exchange on technical topics, relevant for the further development of geothermal industry, research efforts can be merged and the technical barriers can be overcome on a transnational base. The working groups in this cluster will connect researchers and members of the geothermal industry. This can be the base for the realization of possible large scale research projects within the European programs. The following topics were proposed:

Table 4 Operational Issues

Subtask:	Operational Issues
Organisation:	National funding institutions: - Steering committee (2 countries) & participating members - invited experts (Industry, Research), EERA-JPGT
Possible actions:	Invited Roundtable discussions for the identification of common topics Invited Workshops for relevant stakeholders from the research community and industry: <u>1-Day WS:</u> <i>“Scaling Issues in Northern Central Europe: Experiences from NL and GER”</i> (Presentation of issues and solutions from both countries) <u>1-Day WS:</u> <i>“Corrosive thermal brines: Materials and ways to handle”</i> Development for expert exchange schemes (Possible start-up: NL-GER) Evaluation of possible topics for a joint call
Dissemination:	Workshop Proceedings Report on expert exchange

Table 5 Public relations

Subtask:	Public relations
Organisation:	National funding institutions: - Steering committee (2 countries) & participating members - invited experts (PR, media, project owners)
Possible actions:	<u>Invited Workshop:</u> <i>“Public relations for geothermal energy: Best practice from European countries”</i> <u>Public Workshops</u> (concept for participating countries to inform the public): <i>“Why geothermal energy is not so bad at all – Risks and Advantages”</i>
Dissemination:	Workshop Proceedings Recommendations for PR best-practice

Table 6 New concepts

Subtask:	New concepts
Organisation:	National funding institutions: - Steering committee (2 countries) & participating members - invited experts (Industry, NGO, Research)
Possible actions:	<u>Invited round table/World Café:</u> <i>“Geothermal Energy in Europe 2030: Concepts and Needs”</i>
Dissemination:	Position paper

Table 7 Anthropogenic influence

Subtask:	Anthropogenic influence
Organisation:	National funding institutions: - Steering committee (2 countries) & participating members - invited experts (Industry, Research), EERA-JPGT
Possible actions:	<u>Invited Workshop:</u> <i>“Reservoir creation: Methods and Experiences”</i> <u>Invited Workshop:</u> <i>"Influences of reservoir creation beyond the reservoir – Environment and Community"</i> <i>Evaluation of possible topics for a joint call</i>
Dissemination:	Workshop Proceedings

Table 8 Reservoirs

Subtask:	Reservoirs
Organisation:	National funding institutions: - Steering committee (2 countries) & participating members - EERA-JPGT
Possible actions:	<i>to be identified</i> <i>Evaluation of possible topics for a joint call</i>
Dissemination:	<i>to be identified</i>

Table 9 Drilling

Subtask:	Drilling
Organisation:	National funding institutions: - Steering committee (2 countries) & participating members - EERA-JPGT
Possible actions:	<i>to be identified</i> <i>Evaluation of possible topics for a joint call</i>
Dissemination:	<i>to be identified</i>

Table 10 Interoperability of Data

Subtask:	Interoperability of Data
Organisation:	National funding institutions: - Steering committee (2 countries) & participating members - International Data collectors and national data providers
Possible actions:	Development of a protocol for consistent measurements of the input and output parameters of deep geothermal energy installations (heat & electricity). (Cooperation with IEA-GIA?). Development of a protocol for a European-wide terminology for geothermal energy installations. Development of a unified way for data collection and providing (Follow Up of “International Collection of Geothermal Energy Statistics”)
Dissemination:	Publication of protocols

In addition to the joint activities included in the two big clusters, additional topics generated from the ERA-NET working plan and the results from WP2 were identified.

To extend the previous results from WP3 “Towards a EU Geothermal Data Platform” (D3.1, D3.2), the necessity of further collaboration on the implementation of the “European Geothermal Information platform – EGIP” was revealed. This action should respect the following points:

Table 11 European Geothermal Information Platform

Title:	European Geothermal Information Platform
Organisation:	National funding institutions: - Steering committee (2 countries)/WP3 & participating members
Possible actions:	Stakeholder analysis for a European Information Platform: Target Groups and need Preparation of joint call (proven need) or Translation of national information platforms and provide access via a central website (www.geothermaleranet.is?)

Dissemination:	Joint call or central website
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During the identification process, additional activities were revealed whose financial frame and the requirements on manpower cannot be covered by the Geothermal-ERA Net. Nevertheless, the importance of the topics was identified and these high-level joint activities can be realized in a second phase of the implementation of transnational collaboration (see chapter 4).

Table 12 Industrial Initiatives

Title:	Industrial Initiatives
Target Community:	National funding institutions, Industry, Research
Aim:	- Development of industrial initiatives to merge public and private funding
Organisation:	National funding institutions: - Steering committee (2 countries) & participating members - invited stakeholders from industry
Possible actions:	<i>to be established based on the knowledge exchange working groups</i> Evaluation of possible topics for a joint call
Dissemination:	to be identified

Table 13 Test site/laboratory

Title:	Test site/laboratory
Target Community:	National funding institutions, Industry, Research
Aim:	- Evaluation of possible types of test sites
Background:	RD&D needs from WP2
Timing:	Autumn 2015 - ∞
Organisation:	National funding institutions: - Steering committee (2 countries) & participating members - invited stakeholders from Research and Industry - EERA-JPGT
Possible actions:	<i>to be established based on the knowledge exchange working groups</i> Evaluation of possible topics for a joint call
Dissemination:	to be identified

In an interactive workshop at the project supervisory board meeting, all participating countries decided which activities are suitable for them and in which activities they want to participate. Also leaders and co-leaders were assigned to coordinate the further elaboration of the actions. The selected actions are:

- The whole cluster NWW-New ways of working

- RD&D Knowledge exchange on operational issues
- RD&D Knowledge exchange on public relations for geothermal energy
- RD&D Knowledge exchange on new concepts
- RD&D Knowledge exchange on reservoir sustainability
- RD&D Knowledge exchange on interoperability of data
- The further work on EGIP

A steering committee of two countries was assigned for the further formulation and discretization of the actions.

2 Definition and structure of JA to be implemented

For the final set-up of the selected joint activities, a template was created to fix the topical/financial framework, the final structure and the working plan coordinated by the steering committees. During this process the subtopics of the “NWW” cluster were merged into one action. The knowledge exchange on the interoperability of data was transferred into a working group to solve the existing issues. The following subchapters describe the results and therefore the final shape of the joint activities which will be part of the action plan. All descriptions are taken from the templates delivered by the steering committees.

2.1 Financial Instruments and Funding of RD&D and Geothermal Projects (NWW-New ways of working)

Steering committee: Iceland, Switzerland

Participants: Azores, France, Germany, Hungary, Italy, Netherlands, Slovakia, Slovenia, Turkey

The overall objective of this activity is to improve the synergies between different players in the field of geothermal utilization, to improve funding processes in R&D and the possibilities for project financing with the goal to strengthen European geothermal development for economic opportunities, energy security and mitigate climate change.

A better understanding of this financial landscape is beneficial to all stakeholders in defining the barriers and recommend practical solutions, e.g. to prioritize in future joint calls, increase investments and growth of geothermal projects in Europe.

The Joint Activity "New Ways of Working" goals are to improve in the working practice of national funding institutions and the collaboration with their European counterparts.

The main process focus of this activity is to

- a) Analyse the financial instruments that are available and how they operate – and map the operational structure of the different national funding bodies, including policy and funding rules in R&D and industrial projects.
- b) Highlight the main barriers and opportunities, and how these instruments can more easily work together.

2.2 OpERA – RD&D Knowledge Exchange on operational issues of geothermal installations in Europe

Steering committee: Germany, Netherlands

Participants: Hungary, Iceland, Italy, Slovenia

The major advantage of geothermal energy over other renewable energy sources is the time and site independent availability of the geothermal resource. To use this advantage, the operational availability of geothermal energy installations has to be stable on a high level. Scalings and material corrosion for instance, are issues in many geothermal areas in Europe (e. g. boiling point scaling in production wells (calcium carbonate; metal sulfides)), scaling in surface equipment (mostly amorphous silica; calcium carbonate and sulfides to a lesser degree), scaling in reinjection wells (amorphous silica). All these issues lead to breakdown times due to necessary repair or service works. Also other issues like high gas content of the thermal brine or pressure related issues have to be discussed. A working group on operational issues can help to provide an overview of potential solutions, like adapted materials in the

geothermal installation, the use of inhibitors (e. g. scale inhibitors like phosphonates, polyphosphates and polycarboxylates) or optimized pipe geometries or well design. Therefore the group has to identify the main issues and the experts in this field in the participating countries and bring them together for a multi-lateral knowledge exchange. Due to the broadness of the topic, the different issues have to be divided into groups and discussed one by one.

2.3 PRGeo - RD&D Knowledge Exchange on public relations for geothermal energy

Steering committee: Hungary, Germany

Participants: Italy, Switzerland

Geothermal energy is an important component of the future energy supply in Europe which can offer a wide range of possible applications in the field electricity, heating and cooling (H&C) and has a great potential of development in many European countries. However, the advantages of using geothermal energy are little known, and media reports often spread information on its disadvantages (e.g. high upfront costs, drilling risks, environmental threats such as induced seismicity, ground swelling, pollution of ecosystems by the surface inlet of deep geothermal brines, etc.). The lack of public acceptance for geothermal energy installations hampers the further development of this green energy source in many countries. The origin of the skeptical view on geothermal energy varies from the lack of information about the technology to wrong conflict management from project owners in case of e.g. induced earthquakes. As a result, political decision makers and potential investors have concerns about possible risks in implementing geothermal projects, and social resistance often results in significant slowdowns of the projects.

To make sure that geothermal energy can play its optimal role in Europe's future energy supply, it is essential to address strategic groups of political decision makers, potential investors and the public to mitigate the possible concerns that may block the increased use of geothermal technologies.

This joint activity aims on fostering the social acceptance of all geothermal energy technologies in Europe. It spreads to a wider public the benefits, as well as limits of the different technologies by providing reliable and objective information. Furthermore, it increases local awareness and encourages participation in the planning of geothermal projects, thus reducing their implementation times. To reduce the negative attitude and to promote the use of geothermal energy different approaches are successful in different countries. A knowledge exchange on these approaches can be useful for project owners to adapt new ideas. In addition an expert group can summarize the successful approaches in a best-practice recommendation.

2.4 New Concepts - RD&D Knowledge Exchange on new concepts for geothermal energy generation and use

Steering committee: Iceland, Netherlands

Participants: Azores, France, Hungary, Italy, Slovenia, Switzerland

The Working Group/JA "New Concepts" should stimulate creative new directions/concepts related to geothermal (in utilization and technology) and showcase successfully and innovative (demo/pilot) projects in the geothermal field. For instance, opportunities can be the direct utilizing of low enthalpy geothermal resources, ranging from innovative solutions in district heating to drying of food, the cultivation of algae and fish for production in biotechnology processes. Crucial in this JA is showing and stimulating new opportunities.

2.5 ReSus - RD&D Knowledge Exchange on reservoir sustainability

Steering committee: Italy, France

Participants: Germany, Hungary, Iceland, Switzerland, Turkey

To foster sustainable and safe use of geothermal reservoirs as well as increase the lifetime of the resource, boreholes and system components, it is very important to understand the physical properties of the reservoir rocks and fluids and their interaction during the exploitation process. The Joint Activity (JA) "ReSus" will set up a platform to study geothermal reservoir sustainability taking into account, as starting point, the tasks which have been addressed in Annex I by IEA-GIA and the results of an international workshop on sustainability modelling held in late 2008 in Taupo (NZ). Comparing the current practice used by the operators, highlighting the best solutions and studying the unsuccessful cases, we will animate a fruitful debate to capture the current state-of-the-art and explore possible scenarios for future economic and sustainable exploitations. Beyond the scientific community, the topic of such a JA clearly interests regulatory authorities and operators who seek to implement sustainable development strategies. Consequently, it will be very important to involve, along with the Geo ERA-NET community, regulatory authorities, the EERA-JPGE as well as the European geothermal operators.

2.6 Tuning EGIP for target users

Steering committee: Italy, Switzerland

Participants: France, Hungary, Iceland, Slovenia

The core of the European Geothermal Information Platform (EGIP) is running since last September (2014) thanks to the first completed Joint Activity performed by some of Geo ERA-NET partners (The EGIP pilot project). However the Geo ERA-NET project consortium firstly (September 2014) and the Supervisory Board secondly (December 2014) decided that a further step of EGIP evaluation would be necessary. This Joint Activity (JA) is aimed to perform a final analysis of the boundary conditions for the complete implementation of such Geothermal Information Platform at European level, including the evaluation of possible join calls for its complete realization. The JA will be based on the experience learned from the Pilot Project, which will be used to focus on effective needs, impacts and benefits that EGIP must have, in order to propose its complete implementation by a Join Call (JC). To this aim the JA we propose will set up a working group of experts and stakeholders who have to clearly identify the interest and need for data sharing. Seven actions are planned in this JA: 1- Every EGIP JA member identifies their national stakeholders (plus suggest international stakeholders, as maybe EU or IEA bodies); 2- The EGIP JA members will put together the detected stakeholders and will identify their representative key stakeholders to invite at a workshop/roundtable; 3- EGIP JA members will organize a common and shared survey (web survey); 4- Every EGIP JA member will present EGIP, its pilot and the survey to their identified stakeholders and gets back feedback (e.g. physical meeting, a telephone conference with online presentation, or an e-mail with explanations and link to EGIP Pilot); 5- The EGIP JA will organize a workshop/roundtable (including invited key stakeholders and trans-European experts) to present, comment and analyze the results of the survey; 6- Update of the feasibility study (D3.2) based on the workshop/roundtable feedbacks; 7- Write a possible joint call on EGIP implementation.

2.7 Geostat - Towards Consistency

Steering committee: Iceland, Hungary

Participants: Germany, Italy

Data on geothermal energy is collected by various international organizations. These collections are based on questionnaires which are different although the objective is to collect the same data. Due to these differences the same data can be misunderstood, misinterpreted and give wrong signals. Therefore a common ground is needed to enable use and comparison of energy statistics, increase reliability, security and decrease fragmentation in line with the aim of these organizations, motions and regulations.

Here are proposed objectives with measurable indicators and how GeoStat can achieve these:

1. Participating countries to aim at reducing the difference between industry and official statistics below a defined benchmark for year 2020. The following indicators are proposed on a national level annually:
 - Total Net Maximum Electrical Capacity
 - Total Electricity Generation
 - Total Geothermal Direct Use and Heat in Final Use

GeoStat could facilitate by aiming at identifying the source of error in each case with dissemination and discussions on terminology and definitions and direct comparison of statistics for each nation.

2. Participating countries to aim at reducing duplication of efforts domestically. Measureable indicators suggested:
 - Number of months until Joint Questionnaires to IEA and Eurostat on Renewables and Electricity and Heat are made available.

GeoStat could assist in making the files accessible electronically on a website with other sources accessible on a national basis.

3. Collaboration between entities on a domestic level having the following indicator:
 - The respective experts responsible for each data submission for both official and industry statistics know about each other.

GeoStat can make the connections between experts on a domestic level.

4. Simplified process across organizations and reducing duplication of efforts with the following indicators:
 - Associations and lobby groups should peer review official statistics.
 - Terminology of industry should be adapted to official statistics when possible.
 - Terminology of official statistics should be clear and understandable.

The intention of GeoStat is to make the connections and starting the review process in cooperation with the partners and to make the terminology clearer. GeoStat will write a short manual with terminology and definition already identified in this report, in particular for thermal capacity.

The seven presented joint actions are the base for the trans-European collaboration in the most relevant fields of geothermal energy. Topics identified in earlier steps of the implementation process can be addressed in a second phase of joint activities in the future. The selected actions are capable to enable and to foster a multinational cooperation for the development of geothermal energy. This can also be the starting point for more complex (JA2&3) activities in the future, if the benefit of multinational collaboration can be shown on the selected level with minor financial effort. The planned steps of each joint activity will be presented in chapter 3. Possible further steps and activities are presented in chapter 4.

3 Action plan (Phase 1)

This action plan is based on the input from the steering committees of each planned joint activity following the implementation meetings in late 2014 and 2015. The first actions already started at the beginning of April 2015, the others will follow soon. The aim of all working groups is to provide first results in autumn 2015. At least identified topics for possible joint calls will be named. Further results, especially publications and guidelines will be delivered until the end of the geothermal ERA-Net in April 2016. The following subchapters summarize the planned activities within the working groups.

3.1 Financial Instruments and Funding of RD&D and Geothermal Projects (NWW-New ways of working)

The “NWW” joint activity is based on two major outcomes. Firstly, the knowledge, cooperation, utilization and effectiveness of geothermal funding for R & D activities should be increased. To reach this goal, the highest priority of the work has the mapping of funding policies and the regulatory framework for geothermal R&D activities followed by highlighting barriers and policy opportunities of geothermal R&D activities. In a second step, the knowledge, cooperation and financing possibilities for geothermal projects should be increased. This step includes the mapping of geothermal financial and funding project policy and the highlighting of barriers and opportunities of geothermal project funding instruments. The results will be disseminated by a publication on recommendations for financial instruments for the development of geothermal R&D and for the development of geothermal projects in Europe. For the working plan of the activity the steering committee identified the following possible actions:

- Coordinated desk research, meeting with experts and collection of data from countries.
- Evaluation of existing instruments and national markets
- Working meetings e.g. with stakeholders on necessary instruments and topics.
- Conclusion Seminar - Barriers & Opportunities and Policy recommendation.
 - National research funding:
 - Needs – Barriers – Opportunities and Policy recommendation.
 - Financial funding for geothermal projects.
 - Needs – Barriers – Opportunities and Policy recommendation.

The time plan for the realization of the specific steps is shown in table 14. Figure 3 summarizes the structure of the NWW joint activity.

Table 14 Time plan NWW

	04/ 15	05/ 15	06/ 15	07/ 15	08/ 15	09/ 15	10/ 15	11/ 15	12/ 15	01/ 16	02/ 16	03/ 16	04/ 16
Preparation/Planning													
Desk research													
Working process													
Group meetings													
Stakeholder-meetings													

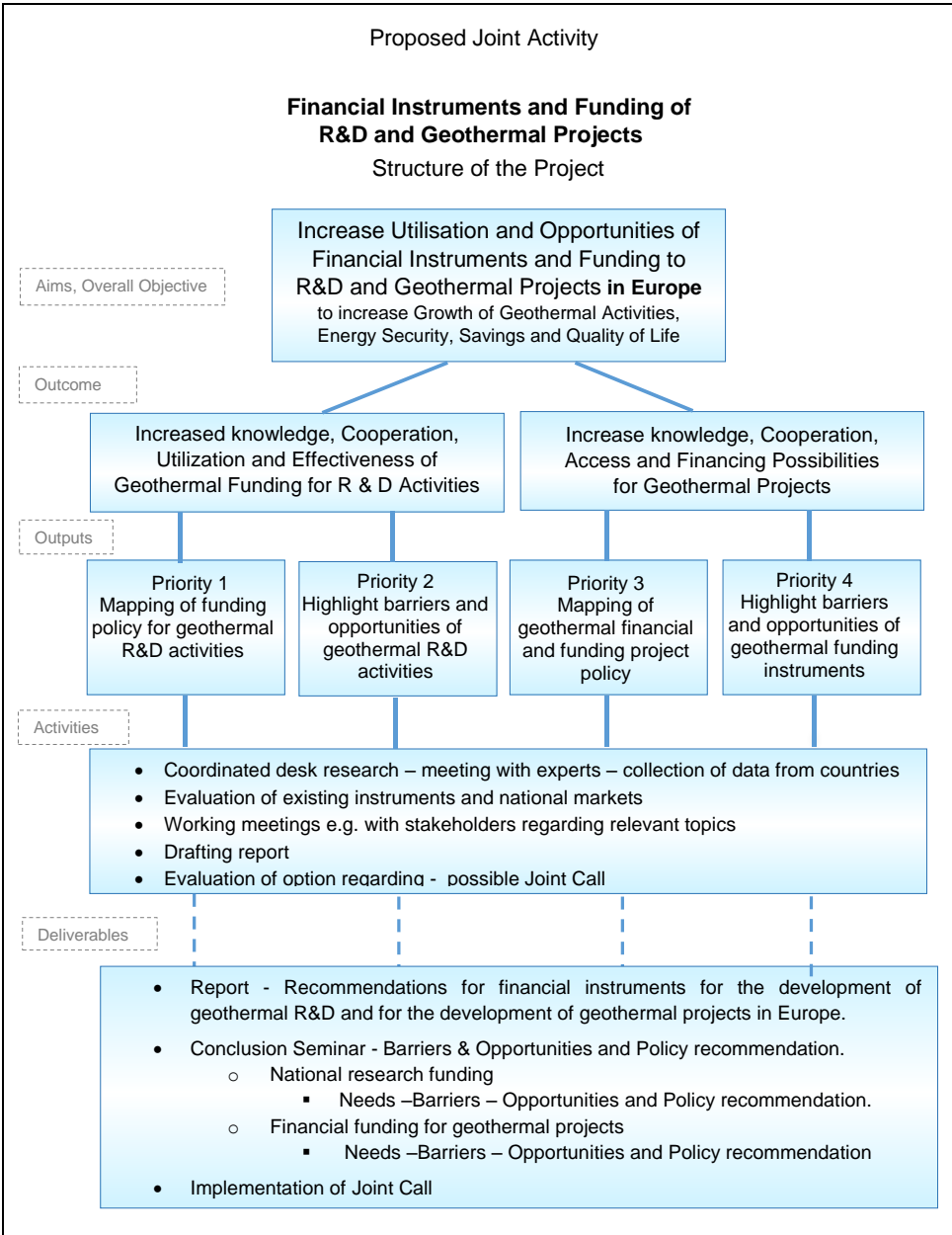


Figure 3 Structure of the NWW JA

3.2 OpERA – RD&D Knowledge Exchange on operational issues of geothermal installations in Europe

The OpERA working group with its more technical character aims on the development of a transnational cooperation between the different national stakeholders from industry and research. OpERA wants to provide a platform for technical knowledge exchange to solve technical issues on a European base. In addition the information exchange on different approaches to overcome technical barriers should be enhanced.

To reach these goals, in a first phase, OpERA wants to identify the main technical issues in the operation of geothermal installations, affected plant owners in the participating countries and the leading experts in this field. Based on this data collection, a specific topic for the first working cycle will be selected. It is planned to organize a first workshop on the selected

topic, to bring the experts from the different countries together. In a second phase, experts from all countries are nominated for a round table discussion and the formulation of best-practice recommendations.

The working group addresses the clusters A4 (Barriers) and B4 (RD&D Needs), identified in WP2 (see D2.3, D2.4). The stated urgency of the subtopics "Operational Issues", "Injection" and "Pumps & Components" was relatively high (1,6/2). Due to the volume of the individual subtopics, these should be handled separately. Therefore it is proposed to start with the more general topic "Operational Issues" which also covers parts of the other subtopics ("Injection" and "Pumps & Components").

The dissemination concept includes the publication of workshop proceedings and the best practice recommendations.

The time plan for the realization of the specific steps is shown in table 15.

Table 15 Time plan OpERA

	04/ 15	05/ 15	06/ 15	07/ 15	08/ 15	09/ 15	10/ 15	11/ 15	12/ 15	01/ 16	02/ 16	03/ 16	04/ 16
Phase I:													
Kick-off													
WS organization													
1 st WS													
WS Proceedings													
Phase II:													
Nomination of experts													
Round table													
Expert WG													
Final Publication													

3.3 PRGeo - RD&D Knowledge Exchange on public relations for geothermal energy

The lack of public acceptance and support is a problem for several geothermal projects across Europe. The PRGeo working group aims on bringing together the experts for communication concepts and public relations from the participating countries and therefore enhances the information and knowledge exchange between the different projects.

The PRGeo working group will organize a workshop on PR concepts for geothermal energy installations in Europe (with invited experts), where best case studies and best practices, in terms of communication and the fostering of social acceptance of geothermal energy installations will be presented. On the other hand (partial) failures, negative impacts of geothermal projects have never been highlighted, although many lessons could be learned from their objective analyses without putting a shade on geothermal energy utilization. The workshop also aims to present some of these case studies.

In a second step, identified experts from all countries will be invited to form an expert working group to summarize the main outcomes

The working group addresses the clusters A7 (Barriers, Public and education) and B3 (RD&D needs, PR&Data), identified in WP2 (see D2.3, D2.4). The stated urgency of the RD&D subtopics "Dissemination" and "Acceptance" was relatively high (1,75/2). The support of the public is indispensable for a significant development of the geothermal sector

in many countries. All successful concepts which help to win the public for geothermal energy have to be made available for future installations.

The dissemination concept includes the publication of workshop proceedings and the best practice recommendations from the expert working group.

The time plan for the realization of the specific steps is shown in table 16.

Table 16 Time plan PRGeo

	04/ 15	05/ 15	06/ 15	07/ 15	08/ 15	09/ 15	10/ 15	11/ 15	12/ 15	01/ 16	02/ 16	03/ 16	04/ 16
Phase I:													
Kick-off													
WS organization													
WS													
WS Proceedings													
Phase II:													
Nomination of experts													
Expert WG													
Publication Summary													

3.4 New Concepts - RD&D Knowledge Exchange on new concepts for geothermal energy generation and use

Geothermal energy can be used directly for heating and cooling purposes as well as power production. There are countless opportunities for using direct heat (20°C-150°C) originated from geothermal energy, such as heating homes, offices, and greenhouses; in aquaculture and food processing plants; and a variety of other applications. Iceland is well known to be a world leader in the use of geothermal district heating. After the Second World War, Orkustofnun carried out research and development, which has led to the use of geothermal resources for heating of households. Today, almost 90% of Iceland's houses and buildings are heated by natural hot water.

There is a huge potential in Europe for direct use of geothermal energy, especially low enthalpy ones. According to data presented by John W. Lund, at World Geothermal Congress 2010, Europe is the world leader in geothermal direct use. Geothermal energy is directly used in 32 European countries, accounting for over 40% of world's direct utilization.

The working group wants to stimulate creative new directions and concepts for the generation and/or the use of geothermal energy. Therefore, two types of events will be organized:

Event 1: A Showcase or Brokerage Event focusing on bringing together existing (demo/pilot) projects within the field of "Geothermal New Concepts", thus showing opportunities and enhancing cooperation and knowledge exchange.

Event 2: An "Idea Factory" or a "World Café" that would focus on generating new ideas on Geothermal Utilization (with emphasis on low enthalpy geothermal) or Technology and stimulate growth of the geothermal industry in Europe.

Both of these events would be on invite only where the teams are carefully selected, bringing in creative and multidisciplinary thinkers as well as people with experience in innovative

direct utilization of geothermal energy and/or a good overview of innovation in geothermal on European level.

The Working Group will be an umbrella for joint activities in the field of "New Concepts". On the bases of the results the events the Geothermal ERA NET could support further stimulation of new concepts. Apart from the mentioned events more activities can be organised in future.

The results of the working group will be disseminated widely, amongst others through the Geothermal ERA NET website and newsletter.

The time plan for the realization of the specific steps is shown in table 17.

Table 17 Time plan New concepts (exact timing to be defined after kick-off)

	04/ 15	05/ 15	06/ 15	07/ 15	08/ 15	09/ 15	10/ 15	11/ 15	12/ 15	01/ 16	02/ 16	03/ 16	04/ 16
Kick-off													
Brokerage Event						tbd							
Idea Factory						tbd							
Publication Results													

3.5 ReSus - RD&D Knowledge Exchange on reservoir sustainability

Delivering energy from the geothermal system to the wellhead is mainly related to specific reservoir properties. Geological conditions, pressure, temperature and chemical properties are quite unique to each reservoir. Accordingly, reliable dynamic reservoir models together with operational and reservoir management schemes, the specific arrangement of surface installations and overall system integration are the key drivers for a sustainable utilization of the resource balancing commercial viability, environmental impact and impact on people.

It is planned to organize one event to foster the knowledge and information exchange on this topic. A workshop/round table will bring together selected experts from all participating countries and is focusing on bringing together existing practices used in various geothermal systems. As an outcome of the event a final summary will be prepared, containing the state-of-the-art with regards to the sustainability of the reservoirs and identification of a possible topic for a future research project call.

The time plan for the realization of the specific steps is shown in table 18.

Table 18 Time plan ReSus

	04/ 15	05/ 15	06/ 15	07/ 15	08/ 15	09/ 15	10/ 15	11/ 15	12/ 15	01/ 16	02/ 16	03/ 16	04/ 16
Kick-off													
Identification issues													
Conference Call													
Workshop													

3.6 Tuning EGIP for target users

The organization and sharing of geothermal data was identified by the Geothermal ERA-NET partner countries to play an important role in order to facilitate the development of geothermal energy in Europe. This was specifically mentioned in the EU Commission Call [Topic ENERGY.2011.10.2-2, FP7-ERANET-2011-RTD] which led to the current Geothermal ERA-NET Project.

The work package 3 is dedicated to the preliminary work for implementing a European Geothermal Information Platform (EGIP). The tasks 3.2 and 3.3 were aimed to analyze the state-of-the-art and the needs regarding geothermal information and existing IT-Tools to manage a geothermal information system, (see D3.1) and study the feasibility for the realization of an EGIP, (see D3.2). Afterwards a joint activity has been proposed and recently started to prove the effectiveness and efficiency of EGIP.

The first part of the action will include a survey to collect information about the necessity of EGIP, the added value and the identification of possible users. Every EGIP JA member will present EGIP, its Pilot application and a questionnaire to their identified stakeholders on a national level. After the collection of the survey results, a workshop/roundtable will be organized to present, comment and analyze the results of the survey together with national and international experts. Based on the outcome of this event, the feasibility study will be updated and if the necessity and the added value of EGIP is proven, a joint call will be prepared.

The time plan for the realization of the specific steps is shown in table 19.

Table 19 Time plan Tuning EGIP

	04/ 15	05/ 15	06/ 15	07/ 15	08/ 15	09/ 15	10/ 15	11/ 15	12/ 15	01/ 16	02/ 16	03/ 16	04/ 16
Kick-off													
Questionnaire													
Conference Call													
National presentations													
Workshop			tbd			tbd							
First results (Brus.)													

3.7 Geostat - Towards Consistency

The ERA-Net report “International Collection of Geothermal Energy Statistics” (2015) gives an overview of the international collection of geothermal energy statistics, actual data is compared between official and industry driven organizations. The comparison of reported national statistics of industry and official statistics show drastic differences beyond acceptable levels.

The proposed GeoStat Joint Activity aims at defining clear and measurable indicators for each objective identifying how GeoStat could contribute. Objectives being; 1) annual benchmarking of maximum statistical differences until year 2020, 2) reduction of duplication

of effort on domestic level and 3) increasing collaboration on domestic level, 4) simplifying the process across organizations.

This Joint activity is not only to be worked within the Geothermal ERA-NET but also in cooperation with Eurostat, IEA, IGA, IEA-GIA and EGEC. The idea is that each agency gets an invitation to be a part of the project coordination group.

In the beginning phase of the GeoStat Project two venues will be used to kick-start the work. For dissemination to the industry the World Geothermal Congress (WGC) will be used since it brings together the main organizations responsible. At WGC a special Workshop will be held with representatives of EU countries that are responsible for statistics reporting to IGA and IEA Geothermal. For dissemination to responsible entities for official statistics a meeting in Paris with national agencies will be held.

The final time schedule of the action will be fixed after the starting events.

4 Proposed future Joint Activities (Phase 2)

The presented joint activities are capable to demonstrate the additional benefit of a multinational approach for geothermal energy. The actions OpERA, PRGeo, ReSuS, New Concepts and Tuning EGIP have a structured approach based on several phases. The NWW action and the Geostat joint activity follow a more continuously approach. However, a milestone of all activities will be the next Geothermal ERA-NET meeting in Brussels in September 2015. Until then, all eight activities will have produced first results and the main tasks are underway. During the finalization process of the specific joint activities the capability of some actions to bear possible topics for a joint call emerges. Especially the actions in the RD&D knowledge exchange area OpERA, ReSUS and Tuning EGIP can present or prove urgent topics for the geothermal community in Europe. Dependent on these first results a decision can be made in September if a joint call is possible and reasonable in the final phase of the Geothermal ERA-NET. However, even if a joint call cannot be realized within the framework of the ongoing ERA-Net, topics for possible follow-up actions are identified. Together with the final results of the specific working groups this can be a major outcome at the end of the Geothermal ERA-Net. Based on expert knowledge, intensive inquiry and administrative knowledge, the main demand on RD&D is mapped in all participating countries.

In addition especially the knowledge exchange groups had to make a selection within the thematically fields because in many cases the complete research area could not be covered in just one phase. If the usefulness of a trans-European knowledge exchange can be shown and disseminated, these actions will produce additional follow-ups independently from the Geothermal-ERA Net, most realistic in the beginning only on the JA1 level with minor financial requirements. Other actions, especially the NWW cooperation can form a specific follow-up for this Geothermal-ERA Net. The additional benefit of the cooperation of the different funding authorities is already proven to all partners.

The final outcome cannot be estimated until the first results of the running joint activities are presented by the specific working groups, but the first step towards a sustainable European cooperation for geothermal energy has been taken.

5 Identified existing cooperation schemes

Parallel to the development of the proposed schemes and topics for the presented joint activities, a survey was carried out to summarize all existing bi- /multinational cooperation schemes and regional support schemes, especially on renewable energy technologies, between the participating countries. The aim was to use these existing schemes to smooth the way for possible joint activities. Also European programs which support especially regional cross-border activities were listed. Table 20 summarizes the existing support schemes:

Table 20 Overview of identified existing support schemes in the participating countries. Blue indicates cooperation between Geothermal ERA-NET countries.

Partners	Title	Focus
NL-DE	Declaration on Energy Cooperation, 25-7-2014	Energy policy in a broad perspective
NL-Various (KZ, CN, IL, RU...)	Collaboration on energy	Energy policy in a broad perspective
NL-DE (Border region)	Interreg IV-A/V- NL-DE program	Enhance strength of the regions across the borders
NL-BE (Flanders)	Interreg IV-A/V Flanders-NL program	Stimulate development in border regions
NL-DE-BE (Border region)	Interreg IV-A SME programme	Stimulate development in border regions
NL-BE-UK-FR	Interreg IV-A/V 2 Mers Seas Zeeën program	Stimulate development in border regions
NL-UK-DK-NO-SE-DE	Interreg IV-B/V-B North Sea Region program	Regional development
NL-IE-UK-BE-LU-DE-CH-FR	Interreg IV-B/V-B NW Europe program	Regional development
IT-AL	Executive program for scientific and technological cooperation between the Italian Republic and the Republic of Albania 2012-2014	Agriculture, food sciences, Environmental and Energy, Earth sciences, Life sciences and health, basic sciences, Information and communication technologies, technologies applied to cultural heritage
IT-PL	Executive program for scientific and technological cooperation between the Italian Republic and the Republic of Poland for the years 2013-2015	Agriculture, food sciences, Environmental and Energy, Medicine and health, Basic sciences, Nanoscience and advanced materials, Information and communication technologies, technologies applied to cultural heritage
IT-RO	Executive program for scientific and technological co-operation between the Italian Republic and Romania for the years 2013-2014	Environmental and Energy, Basic sciences, Bio technologies, Nano technologies and new materials, Information and communication technologies, technologies applied to cultural heritage

IT-RS	Executive program for scientific and technological cooperation between the Italian Republic and the Republic of Serbia for the years 2013-2015	Biomedicine and Biotechnologies, Agriculture and Food technologies, Environmental protection and Energy, Mathematics, Physic, Chemistry and Biology, Nano technologies and new materials, Information and communication technologies, technologies applied to cultural heritage
IT-TR	Second executive program of the agreement between the Government of the Italian Republic and the Government of the Republic of Turkey on scientific and technological cooperation for years 2012-2014	Agriculture, Environmental and Energy, Health, Information and communication technologies, Nanoscience, technologies applied to cultural heritage, Prevention and Mitigation of natural disasters, automotive, textile
IT-BG	Agreement on scientific Cooperation between the Bulgarian Academy of Sciences (BAS) - and the Consiglio Nazionale delle Ricerche (CNR)	Strengthen cooperation in scientific research between Bulgaria and Italy
IT-PL	Agreement on scientific cooperation between the National Research Council of Italy and the Polish Academy of Sciences	Promoting the development and deepening the scientific collaboration and therefore strengthening the traditional links between Italy and Poland
IT-TR	General protocol on scientific and technological cooperation between the National Research Council of Italy and the Scientific and Technical Research Council of Turkey	Scientific and technological cooperation
IT-CY	Memorandum of Understanding	renewable energy, in particular concentrating solar and its applications
IT-FR	Implementing agreement and framework agreement	renewable energy, nuclear, materials, supercomputing
IT-DE	Agreement for scientific cooperation between the Deutsche Forschungsgemeinschaft, Federal republic of Germany and the National Research Council of Italy	all basic research, human sciences included
IT-DE	Collaboration framework agreement between the Italian National Research Council (CNR) and the Institute for Advanced Sustainability Studies concerning collaboration in areas of mutual interest	areas of mutual interest
IT-SE	Framework agreement for scientific cooperation between the National Research Council of Italy and RISE, Research Institutes of Sweden	advanced scientific research

IT-SI	Frame program agreement between National Research Council (Italy) and Univerza V Ljubljani (Slovenia)	biomedical sciences; physical sciences and material technologies; earth sciences and environmental technologies; chemical and material sciences; engineering, ICT and energy and transport technologies; bio-agro food sciences and human and social sciences, cultural heritage
IT-BA	Memorandum of Understanding	Cultural heritage, Humanities sciences, Mathematics, technological sciences, Biologic and Medical sciences
IT-MK	Memorandum of Understanding	Cultural heritage, Humanities sciences, Mathematics, technological sciences, Biologic and Medical sciences
PT-IS	“Renewable Energy Programme Area” within the priority area “Climate Change and Renewable Energy” of the EEA Financial Mechanism for the period 2009-2014, EEA Grants.	Geothermal
DE-CH-AT	German-Swiss innovations-forum, D-A-CH Declaration on cooperation and cross-border research , D-A-CH Lead Agency-procedure, equivalence declaration: CH-DE University	Research depending on current calls, University Education
DE-NL	Declaration on Energy Cooperation, Regional Networks (NL-NRW), BMBF calls for bilateral projects	Biotechnology, Climate, Environment, Sustainability, ICT
DE-FR	German-French Agenda 2020	Specific Agreements and Focus on Net development, Accumulator, H2, Solar
DE-IT	German-Italian Technology Transfer	Networking for Research Cooperation and SME Technology Transfer
DE-TR	Call for Scientific-technical cooperation with Turkey	Energy, Environment, Climate etc.

The information shown above cannot be seen as a full collection of all existing cooperation schemes but gives a first idea of the manifold possibilities for transnational cooperation. However in the development phase of the proposed joint activities none of the external programs has to be used due to the embedment in the Geothermal ERA-NET. In addition, the national research funding programs have to be consistent with the regulatory framework of the European Commission. This opens all national programs for cooperation projects within the European Union. Besides the cooperation of research institutes and universities, transnational research consortia with participating SME and other companies are supported. This industrial cooperation was simplified due to the omission of national regulations for the utilization of research results within the borders of the specific countries.

6 Conclusions

Based on the requirements of the European geothermal community, the work package 4 “Development of joint activities” of the Geothermal ERA-NET identified and developed a scheme for the realization of joint activities to foster the European cooperation in the field of geothermal energy. The scheme followed a bottom-up approach to show the additional benefit of cooperation with a minor effort on financial and human resources. This approach is capable to set the corner stone for more complex future joint activities, also with the possibility of a higher financial input.

In a first phase, seven different joint activities were developed and initiated, covering cooperation of the European research funding institutions on non-technical barriers, a RD&D knowledge exchange on operational issues, public relations, new concepts, reservoir sustainability, the implementation of a European Geothermal Information Platform and a working group on the consistency of geothermal data.

All activities were started in the first five month of 2015 and will deliver first results until the end of the year. Besides the organization of multilateral cooperation on the different topics, several events are planned, including expert round table discussions and workshops. In addition all compiled results of the specific working groups will be disseminated widely.

The implementation of the presented activities and working groups is the first step towards an extensive knowledge and information exchange on geothermal energy in Europe. This exchange is initiated by the Geothermal ERA-Net consortium and therefore based on the decisions of the national research program owners and managers. The consortium is technology focused but independent from the industry and national research communities.

7 References

- Lund, J. W., Freeston, D. H., Boyd, T. L. (2010). *Direct Utilization of Geothermal Energy 2010 Worldwide Review*, Proceedings World Geothermal Congress, Bali, Indonesia, 25-29 April 2010.

Geothermal ERA-NET:

- WP 2, D2.3: *Technical and non-technical barriers & opportunities*
- WP2, D2.4: *RD&D needs*
- WP2, D2.5: *Actions to bridge gaps, overcome barriers and promote the use of geothermal energy in Europe*
- WP3, D3.1 *Report on the state of the art and needs in regarding geothermal data and existing tools to manage them*
- WP3, D3.2: *Feasibility study for a European Geothermal Information Platform*
- WP4, D4.1: *Possible schemes and barriers for joint activities*

All deliverables are accessible via www.geothermaleranet.is



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