European Energy Research Alliance

Joint Programme on Geothermal Energy

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Overall goal

Development of new cost-effective technologies suitable for a sustainable growth of geothermal energy in Europe and worldwide
## EERA – JPGE  List of Participants

### 2010

<table>
<thead>
<tr>
<th>Short Name</th>
<th>Country</th>
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<tbody>
<tr>
<td>BRGM</td>
<td>France</td>
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<tr>
<td>CEGL</td>
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<td>CNR</td>
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<td>CNRS</td>
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<td>ETH Zürich</td>
<td>Switzerland</td>
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<tr>
<td>GFZ Potsdam</td>
<td>Germany</td>
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<td>ISES</td>
<td>Netherlands</td>
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<td>ISOR</td>
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<td>TNO</td>
<td>Netherlands</td>
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12 participants  
7 countries  
~250 persons

### 2012

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<tr>
<td>Uni Neuchâtel</td>
<td>Switzerland</td>
</tr>
<tr>
<td>ENEA</td>
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<td>INGV</td>
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<td>LNEG</td>
<td>Portugal</td>
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<td>PT Milano</td>
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<td>BGS</td>
<td>UK</td>
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<td>RWTH Aachen</td>
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<td>U Torino</td>
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<td>VITO</td>
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<td>IFE</td>
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<td>U Bari</td>
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<td>U Trieste</td>
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<td>TU Darmstadt</td>
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25 participants  
11 countries  
~350 persons

### 2013

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<tr>
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<td>GZ Bochum</td>
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Current status:  
30 participants  
12 countries  
~400 persons
Overall goal
Development of new cost-effective technologies suitable for a sustainable growth of geothermal energy in Europe and worldwide
Examples for joint activities
Magmatic sites

Non-magmatic sites

July 2013 + 4 years
Budget: 13 Mio €, (incl. EC 10 Mio€)
19 partners
(6 from industry)

→ SP 1
Objectives

Develop reliable exploration methods for site characterization and well-siting

- **Understand processes and parameters** for prediction of the critical exploration parameters from continental to local scales
- **Develop exploration techniques** to improve assessment of critical exploration parameters by data-acquisition and processing in
  - Passive and Active seismic
  - Electro-Magnetic methods
  - Temperature measurement, geothermometers and tracers
  - Fieldwork and stress measurement
  - To test the developed exploration techniques on selected sites of the industry partners
- **Develop and demonstrate integrated sound methods for site characterisation and well-siting in field integration.**
Geothermal Engineering Integrating Mitigation of Induced Seismicity in Reservoirs

The European GEISER project
Project goals

• Understand processes and mechanics of induced seismicity in geothermal systems
• Develop mitigation strategies
• Provide legal and administrative guidelines for licensing of geothermal power generation

Funding period: 42 months, starting January 2010
Co-funded by the European Commission within FP7
13 partners from 7 countries, 2 industry

→ SP 2, 4, 5
Perspectives for Hazard Assessment of Induced Seismicity in a Regulatory Framework

Earthquake Catalogue

Zonation & Attenuation Relations (GMPE)

Seismic Hazard Map
Intensity or Peak Ground Acceleration (PGA)

10% Exceedence Probability in 50 a (T = 475 a)

Grüntthal et al. (2009)

→ SP 2, 5
In situ Geothermal Lab Groß Schönebeck

→ SP 2, 3, 4
Since 1904, Tuscany/Italy, today conventional geothermal power production. Since 2010 EGS plant in operation; Soultz Sous Forets, France. Icelandic deep drilling; magmatic conditions, testing 2011-2012, new well starting soon.
Topics for Horizon 2020

• Enhanced Geothermal Systems (EGS): Demonstration of reliability

• Zero-emission power plants: Total re-injection

• Development of reservoirs with supercritical fluids (fluids in the thermodynamic area above the critical temperature and pressure)
1) **EGS: Demonstration of reliability**

The EGS concept includes artificial improvement of the hydraulic performance of a reservoir with the goal to use it for an economical provision of heat or electric energy.

Issues to be addressed:

- Upscaling from small units to 10+ MWe => increase flow rate!
- Mitigation of induced seismicity
2) Conventional geothermal power plants – environmental requirements

At the beginning: power production with release of brine and steam
→ brine injection
→ steam injection
= ongoing development
→ next:
  zero-emission geothermal power plant
2) Zero-emission power plants / total re-injection

will increase

- Public acceptance
- Sustainability: environmental, reservoir performance
  => economics

requires

- Research across several disciplines
- Cooperation with key industry partners

**Topic goal**
short term increase of conventional geothermal power provision (from 2- >10 GW) fulfilling all environmental constraints
Main research topics: GEOTHERMAL ENERGY

3) Drilling to magma in Iceland

Surface Geophysics shows magma body at 4-5 km depth

All micro-earthquakes occur above magma body

Drilling hit magma at 2.1 km depth

Need for more accurate exploration methods ➔ IMAGE
3) Development of reservoirs with supercritical fluids
(fluids in the thermodynamic area above the critical temperature and pressure)

will increase
• Energy output per well
• Contribution of geothermal energy to total electricity production => economics

requires
• Major research (+funding) across several disciplines
• Cooperation with key industry partners

→ IMAGE

Topic goal
development of > 1 magnitude higher productive geothermal systems per well
Strategic activities

Geothermal Energy under-represented in SET Plan

Contribution to SET-Plan documents

JPGE input in the


• *Exercise on Education and Training for the SET Plan* (2012/13). Rapporteur: Prof. Eva Schill (formerly Univ. Neuchâtel/CH)

Workshop with EU Commissioner Oettinger (DG Energy)

Brussels 15\(^{\text{th}}\) of November 2012

“Geothermal Energy for Urban Areas”
Education and dissemination

European geothermal PhD day

1. 12th of February 2010, Potsdam / Germany
2. 1st/2nd of March 2011, Reykjavík / Iceland
3. 29th/30th of March 2012, Pisa / Italy
4. 6th/7th of May 2013, Szeged / Hungary

60 to 100 PhD students (incl. from overseas)
Supported by industry
Summary and Conclusions

Until 2012: focus of joint activities on defining the JPGE and on developing governance structure within the general EERA framework

New developments: Definition of main topics for Horizon 2020 Research goals amended accordingly. First steps in joint project proposal within FP7 (2012/13)

JPGE very successful: Continues to grow Milestones reached New goals provide basis for further jointly planned activities Visibility increased
Thank you for your attention

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Presentation of the reviewer

Ruggero Bertani, Italy
Douglas Hollett, USA
Greg Bignall, New Zealand

Questions?

MAXIMUM COMMON DIVISOR

minimum common multiplum
Is the governance set up in line with EERA rules? Is it relevant to achieve EERA JPGE objectives as well as the overall objectives of EERA?

• The governance system of the JPGE is quite complex and deeply structured, with clear definition of responsibilities and interfaces. It looks well in line with the overall EERA guidelines, and it suitable to guarantee a satisfactory level of management.

• The **aim** is to **align strategies** of Europe’s leading energy research institutions to tackle key research questions. The **objective** is to **streamline and coordinate** national R&D geothermal research, **accelerate development** of geothermal technologies, and provide industry with tools and information to **undertake future large-scale, cost-effective geothermal development at reduced risk**. The JPGE is well structured to tackle the issues facing future efficient utilization of Europe’s geothermal resources.
ASSESSMENT OF THE OPERATION OF THE JP:

Is the governance set up in line with EERA rules? Is it relevant to achieve EERA JPGE objectives as well as the overall objectives of EERA?

• Representation: The large group of players (30 participants from 20 countries, 400 persons) is sparsely represented as “Sub Programme Coordinator” and “Work Package Coordinator” roles. A few partners are leading several WP and SP - only 8 partners have a specific role in the entire 5+17 positions.

• The interaction between EERA-JPGE and other active entities, as EGEC, RHC-TP and EIT/KC should be stressed and enforced.
ASSESSMENT OF THE OPERATION OF THE JP:

Are the most relevant topics covered? Are the key players included? Effectiveness and efficiency of the description of work?

- The program is rich and ambitious, and basically it covers ALL the future needs for geothermal energy developments in short, medium and long term in Europe. It is hard to find some relevant points which are not described in the items covered by the five SP. The multidisciplinary research topics are integrated, well planned, collaborative.

- The sub-programme activities are comprehensive, and many are very challenging – it would be reasonable to ask if all the research themes can be completed in the timeframes proposed but constitute geoscience and technical challenges that need to addressed.
ASSESSMENT OF THE OPERATION OF THE JP:

Are the most relevant topics covered? Are the key players included? Effectiveness and efficiency of the description of work?

- The consortium of European energy research institutions working in the JP-Geothermal programme is impressive, and the successful coordination of the work being undertaken (and proposed) is a credit to the programme management.

- Concerns: what mechanism is in place to ensure new topics, themes or research areas are discovered, researched or implemented in a timely fashion?

- The budget is not under control of EERA JPGE management: it can create a trouble in matching timing, costs and results. How will budgetary issues be managed that might limit new initiatives to be undertaken?
Are the programme deliverable relevant & realistic? Is the current approach appropriate for achieving the deliverables?

• Some of the research activities are extremely ambitious, and it is unknown how the management team coordinates budgetary issues.

• It is uncertain if all goals will be achieved in the proposed timeframes, however, as some tasks will not be straight-forward to resolve or, indeed, even able to be achieved. It is necessary to keep a strict follow-up of each WP timing, being the project very ambitious and with a tight schedule, mainly for the short term objectives.

• The level of success is not expected to be uniform across the programme.
Are the programme deliverable relevant & realistic? Is the current approach appropriate for achieving the deliverables?

- The description of milestones is not clearly identified in the WP, but only in the SP: it is assumable that each milestone could be associated at one deliverable, but its nature is not identified in the document.

- Does the program review on an annual basis for appropriateness, and how does the program ever determine that some topics can be now dropped since critical milestones have been achieved? In other words is there a central governing body, which in essence grades all the projects and research?
ASSESSMENT OF THE OPERATION OF THE JP:

What – in your opinion – is the role EERA-Geothermal play in relation the Geothermal industry? (EII, KIC, ETP, Industry grouping at national/European/ international level)? And is the current setup of the programme adequate to fulfill that role? How an EERA be of added value to the European Geothermal industry? What are the requirements for EERA JPGE to be a good partner in this relationship?

• A strong relationship between the EERA JPGE and European (and international) geothermal industry is essential, and JPGE already have effective industry involvement in the programme and collaborative engagement through attendance at meetings, workshops and conferences.

• The relationship is a ‘win-win’ partnership, and that success is more likely when the two entities are working together.
ASSESSMENT OF THE OPERATION OF THE JP:

What – in your opinion – is the role EERA-Geothermal play in relation the Geothermal industry? (EII, KIC, ETP, Industry grouping at national/European/ international level)? And is the current setup of the programme adequate to fulfill that role? How an EERA be of added value to the European Geothermal industry? What are the requirements for EERA JPGE to be a good partner in this relationship?

• Industry should recognise, that by accommodating and supporting fundamental research, that there may unexpected benefits or results of value to development and sustainable field management.

• EERA JPGE can be of demonstrated value, by having firm metrics for success of the supported R&D. That is not entirely clear through the documentation. That is the measurement by which the R&D must be judged and weighed. Does the private sector itself, feel that R&D within the JPG is the best utilization of the available funds and skills?
Please provide an synthesis of your evaluation of the JPs performance, taking into account its framework conditions and timeframe

• The objective of JPGE is to coordinate, optimize and prioritize geothermal research, and it is effective at this goal.

• Some research themes in the JP-Geothermal programme are extremely ambitious. Whilst all themes are forward-looking and commended, it will be necessary for the JP management team to monitor progress and timelines of some that are particularly challenging or dependent on results from other sub-programmes, and realistically amend milestones.

• The number of publications (about 50 to date) is relevant, and also the effort in organizing workshops is really appreciable.
Please provide a synthesis of your evaluation of the JPs performance, taking into account its framework conditions and timeframe.

- From the initial working plan, **three milestones are missed** and a better effort should be coordinated in order to fulfill the timing: three milestones not achieved till now are a first important warning, being **six critical activities** practically near to their expiration date.

  - M3.2 “Research power plant Groß Schönebeck establishment”
  - M5.4 “Methodology for the economic evaluation”
  - M5.5 “Identification and quantification of the impacts of the options considered, including costs, benefits and distributional effects”
ASSESSMENT OF THE OPERATION OF THE JP:

What would you consider the greatest challenges for the programme? What advice would you like to give to the programme? Validity of the programme to achieve the ERA (European Research Area) objectives? To achieve the SET Plan goals? To achieve Energy 2020? Energy 2050?

- The research themes being undertaken are challenging, but are well conceived, and realistic in their approach, timelines and generally in their expectations.

- Linkages with the US by EERA JPGE is noted, There is expertise elsewhere (e.g. in New Zealand, Japan, Korea and Australia) with collaborative value to the JP programme, that may not have received the same level of consultation and engagement. Although not partners in EERA initiatives, their experience and knowledge could be invaluable. Closer engagement with the European and international geothermal industry is recommend.

www.eera-set.eu
ASSESSMENT OF THE OPERATION OF THE JP:

What would you consider the greatest challenges for the programme? What advice would you like to give to the programme? Validity of the programme to achieve the ERA (European Research Area) objectives? To achieve the SET Plan goals? To achieve Energy 2020? Energy 2050?

- The program can be a flagship of European geothermal community for reaching the H2020 targets, if its coordination role could be enforced through the active participation of the most important players, without unnecessary duplications of activities and documents (realized in some cases by the same persons with two different hats). It may be important to ensure R&D successes and developments are well communicated to a variety of external parties and audiences, including decision makers, to allow the most rapid adoption of new geothermal energy development.

- To maintain industry and scientific relevance in light of increased commercial activity elsewhere in the world and strong connectivity between R&D and industry communities; ensure that there is a clear connection between the program and industry adoption and outcomes.
# SWOT Analysis of the JP:

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<tr>
<th>Strengths</th>
<th>Weaknesses</th>
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<tbody>
<tr>
<td>• Wide expertise</td>
<td>• Dimension =&gt; active participation</td>
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<tr>
<td>• Coordination structure</td>
<td>• Weak Budget control mechanism</td>
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<tr>
<td>• Critical mass</td>
<td>• Under-representation of geology</td>
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<tr>
<td>• Quality of the program</td>
<td>• Reallocation process and monitoring</td>
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<td></td>
<td>• Some country missing in consortium</td>
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<thead>
<tr>
<th>Opportunities</th>
<th>Threats</th>
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<tr>
<td>• Acting as a « qualified geothermal speaker » toward EU</td>
<td>• Loss of national support</td>
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<tr>
<td>• Promoting geothermal development</td>
<td>• Standard technical risks for any research activity</td>
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<tr>
<td>• Pursuing international co-operation</td>
<td>• Decrease of commitment from partner</td>
</tr>
<tr>
<td>• Help source of additional funding and personnel</td>
<td>• Unneeded duplication of effort</td>
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