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<http://engine.brgm.fr>



by Gabriel Courrioux
with 3DGeoModeller

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Editorial - Potsdam workshop

Workshop 1 of the ENGINE project dealing with **"Defining, exploring, imaging and assessing reservoirs for potential heat exchange"** was hosted from **6th to 8th November 2006** in the conference rooms of the GeoForschungsZentrum Potsdam. 68 participants coming from 13 countries attended the workshop. 51 ENGINE representatives from 14 partner organisations (more than one third of the overall partners) were sent to present and debate with numerous external participants from 13 different organisations mostly from industry. The goal of the workshop was to discuss all parameters that should be known before drilling for exploitation of potential geothermal reservoirs.

The workshop was strongly focused on debates about the definition of targets, characterization of reservoirs and optimisation of investigation methodology for EGS. To achieve this focus, four thematic sessions were defined (Signatures of temperature field for defining and exploring potential geothermal reservoirs, Signatures of fluid transport in Earth's crust, State of the Art in the exploration of potential geothermal reservoirs, Processes in geothermal reservoirs). Each session was introduced by two invited speakers, followed by poster presentations (10-15) and plenty of time for discussion. The talks were mostly documented by PowerPoint presentations and Posters, which are already available on [the workshop Web page](#). The final contributions will be published by January 2007 on a CD-ROM.

The workshop was terminated on November 8 by an excursion to the Groß Schönebeck geothermal test site.



On the 8/11 morning before departing to Groß Schönebeck.

Definition of targets, characterization of reservoirs and optimisation of investigation methodology for EGS require, among other topics, a significant improvement of the imaging and modelling of fault and fracture systems, of the knowledge of the paleostress field as well as of the heat flow and temperature distribution at depth. Following the workshop, it is stated that heat, stress and pathways as well as the structural inventory of the subsurface are the key elements that could be considered as priority for research needs. Four main research targets were defined, and the main conclusions can be summarized as follows.

- **Structural Geology: imaging potential geothermal reservoirs**

Geothermal reservoirs are sections at drillable depths containing enough heat for geothermal utilisation. Geophysical methods are suitable to determine the architecture, geometry, and quality of target intervals. However improvement of existing methods and in particular reasonable combination of different, most sensitive techniques (passive and active seismic, MT, and others) are needed to meet the requirements of modern geophysical exploration. The interpretation of geophysical features must be supported and validated by petrophysical laboratory and borehole measurements, as well as modelling. Experiences made in hydrocarbon exploration must be modified for EGS. EGS requires usually more knowledge about fracture and fault systems with respect to their role as potential water conduits. The reservoir imaging strategy should include large scale approaches supplemented by high-resolution experiments. Further benefit should come from adapted processing techniques.



Posters...

- **Heat: finding heat at depth**

For large-wavelength anomalies of the surface heat flow, the accuracy of their extension at depth often is very limited due to improper knowledge of the causes of the heat-flow anomaly. For example, the existence of convective and advective cells, well characterized at Soultz and in the Rhine graben area, preclude a temperature extrapolation to greater depth and can lead to wrong evaluation of thermal gradients. Maps of the surface heat flow and of the depth and heat flow at the crust-mantle boundary provide far-field conditions for the definition of possible targets for EGS. However, such maps require a basic knowledge of the main lithologies and their thermal properties. To properly define

temperatures, an EGS database of the thermal conductivity and the radiogenic heat production are now feasible for better constrained modelling. Several physical parameters (density, wave velocity...) are coupled with temperature and can be imaged by different geophysical methods. Thus, the definition of possible targets for EGS could be improved by the use of a 3D modelling platform, in which all solutions from geological and geophysical modelling, direct and inverse, could be combined and analysed.

- **Stress: understanding and stimulating fluid circulation**

There is abundant evidence for the influence of the stress field on hydro fracturing (ref workshop Ittingen). The knowledge of spatial stress distribution (map and depth) on a local as well as on a regional scale is thus fundamental for any future experiment. Mechanisms of rupture and propagation of an existing fault system and related displacement remain debated, especially in connection with the circulation of fluids and success rate of improving sustainable permeability. The circulation and accumulation of fluids in the crust are fundamentally controlled by the geometry of the fault and fracture systems. The ability of these systems for the channeling of fluids is directly dependant on the stress field (orientation and intensity). Favourable and unfavourable conditions exist depending of the tectonic context and geological environment.



...and fruitful discussions at the Potsdam workshop.

- **Pathways: defining integrated conceptual models**

What starting conditions are needed to develop/stimulate an EGS? What are the conditions classifying a thermally well-suited area for the development of an EGS? There is

a need to refer to conceptual models of the main geothermal sites, from extended active geothermal sites to EGS for which heat distribution and permeability networks are available for modelling pathways for fluid circulation and heat exchange. The basis of such models should be the geometry of the regional geology. They could be built by integrating the most significant datasets and their interpretation on reference key areas, such as Larderello, Bouillante, Soultz, Groß Schönebeck. Such models must be updated as soon as new data or new experiences and results are available. A significant improvement of the knowledge is expected from natural analogues on which hypotheses could be tested about, for example, circulation of fluids in relation with seismicity and heterogeneity of the lithologies, thermal imprint of fluid circulation. The links with other investigation programmes such as nuclear waste storage,

capture and storage of CO₂ and oil and gas field development will be developed to take advantage of existing installations and experiences. Workflows encompassing fault interpretation from 3D seismics and geostatistic tools, 3D retro-deformation and fracture interpretation from well data should be further developed to give a base for possible pathway interpretation through time. To decide about open or closed fractures, palaeostress maps are needed. Technological platforms could be promoted to develop new methods and tools, test hypotheses in situ or the accuracy of conceptual models.

Investigation for EGS is of strategic importance for reduction of costs and increase of efficiency in the development of geothermal projects, and Workshop 1 of the ENGINE project has certainly made an important contribution.

News @ engine.brgm.fr

New items are now available on the ENGINE Web site:

- [Minutes of the Steering Committee and Executive Group meetings](#). An immediate access to the minutes.
- [Bibliography of the partners](#). The compilation of the partners' major references.
- [Search](#). For searching either in the main ENGINE Web site or in the

Conferences & Workshops Web pages.

- [Partners access](#). A space to share documents among ENGINE partners (restricted access).

The screenshot shows the ENGINE website interface. Callouts highlight the following sections:

- ENGINE bibliography:** A section for displaying the compilation of partner bibliographies.
- ENGINE search:** A search bar with options for 'main Web site' and 'conferences & workshops'.
- ENGINE partners access:** A restricted access space for partners to share documents.
- ENGINE minutes:** A table listing meetings, including Steering Committee and Executive Group meetings, with columns for Date, Place, Event, and Link.

ENGINE minutes			
Steering Committee meetings			
Date	Place	Event	Link
01/11/2006	Potsdam, Germany	Defining, exploring, imaging and assessing reservoirs for potential heat exchange, Workshop1	minutes
29/06/2006	Zurich, Switzerland	Stimulation of reservoir and induced microseismicity, Workshop3	minutes
27/04/2006	Potsdam, Germany	Special meeting (WP2, WP3)	minutes
15/02/2006	Orléans, France	Launching Conference	minutes
10/11/2005	Potsdam, Germany	Kick off meeting	minutes
Executive Group meetings			
Date	Place	Event	Link
13/02/2006	Orléans, France	Launching Conference	
11/11/2005	Potsdam, Germany	Kick off meeting	

Next ENGINE meetings

[Potsdam, Mid-Term Conference, 9-12/01/2007](#)

Deadline for registration: 2/01/2007



Babels park, Potsdam.

The ENGINE Midterm Conference will be held at the GeoForschungsZentrum Potsdam January 9th - 12th next year. This international conference offers the chance to get in contact with representatives from industry, policy makers and organizations from around the world, that have a shared interest in the progress of geothermal energy.

In addition, it will provide an outstanding forum for communication and information exchange on recent developments in the environmental friendly exploitation and use of geothermal resources. The conference will open access to an international network focusing on the promotion of geothermal energy in the future and will allow experts in this field to share already existing experience and know-how and to develop innovative concepts for future initiatives.

[Pisa, workshop 2, 2-4/04/2007](#)

Deadline for registration: 2/03/2007

The workshop on "Exploring high temperature reservoirs: new challenges for geothermal energy" will be held at SIAF (International High Formation School) in Volterra (Tuscany, Italy) on the 2nd and 3rd of April, 2007 followed by a field trip to Larderello, the first exploited geothermal field, on Wednesday the 4th. The workshop is planned as a forum for discussion, with mainly poster presentations and only few invited speakers on specific topics. These topics range from basic scientific questions on the signature of fluid circulation in high temperature systems to advanced research in exploring supercritical fluids.

A thematic session will be dedicated to simulation and modelling, with particular emphasis on high temperature systems.

Registration:

The online registration on the conference website is mandatory for the participation. Detailed information and the online registration form are provided at <http://engine.brgm.fr> following the link conferences&workshops. Please note that the number of participants is limited. Registration deadline: January 2, 2007.



GFZ, Potsdam.

Organisation Committee:

Patrick Ledru, BRGM, France; Ernst Huenges, GFZ Potsdam, Germany

Scientific Committee:

Philippe Calcagno, BRGM, France; Albert Genter, BRGM, France; Martin Kaltschmitt, IE, Germany; Costas Karytsas, CRES, Greece; Thomas Kohl, Geowatt, Switzerland; Ad Lokhorst, TNO, Netherlands; Adele Manzella, IGG, Italy; Sverrir Thorhallsson, ISOR, Iceland.

Experts from academia and industry will contribute both through talks and posters.

Important dates and logistics information:

- Call for abstract: 16/02/2007

- Registration deadline: 2/03/2007. Registration is mandatory to attend the workshop. Online registration will be available on the workshop pages starting on 20/01/2007.

- The accommodation will be at SIAF facilities. The details of the accommodation characteristics and prices will be given with proper advance time.

The programme of the Volterra workshop will appear on the [Web pages](#) and will be circulated on February 2007. A First Announcement is foreseen on January 2007, after the Mid-Term Conference.

The focus of the conference

is to bring together European partners active for the environmentally friendly exploitation and use of geothermal resources. The conference represents an outstanding forum for communication and knowledge exchange on recent developments in this field. It offers the chance to get in contact with representatives from science, industry, policy makers and organizations from around the world, who have a shared interest in the progress of geothermal energy. The conference programme covers the broad spectrum of geothermal technology development in a variety of themes.

The ENGINE project

is a joint initiative of 35 partners from 16 European and 3 non-European countries supported by the 6th Framework Programme of the EU.

Its main objective is the coordination of current R&D activities with respect to Unconventional Geothermal Resources and Enhanced Geothermal Systems. For more information please visit the website <http://engine.brgm.fr>.

The conference is organised by



Supported by



Location

GeoForschungsZentrum Potsdam
14473 Potsdam, Telegrafenberg, Germany
Conference: Building H, Auditorium
Meetings: Building H, Conference Rooms 1-3

Registration

Registration at the conference website <http://engine.brgm.fr> following the link *conferences&workshops Mid-Term conference* is mandatory for your participation.
Registration deadline: January 2, 2007.

Organisation Committee

Patrick Ledru, BRGM, France; Ernst Huenges, GFZ Potsdam, Germany

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ENGINE

Enhanced Geothermal Innovative Network for Europe

Mid-Term Conference
9-12 January, 2007
GFZ Potsdam, Germany



Preliminary Programme

January 9, 2007

19:00 Icebreaker at GFZ campus

January 10, 2007

8:30-10:30

Meeting of the Work packages

8:30-10:00

Meeting of the Executive Group

11:00

Conference Opening

R. Emmermann, GFZ Potsdam

C. Fouillac, BRGM

J. Schuppers, European Commission

Lunch

13:30

Session I: Global developments

- The future of geothermal energy: Impact of Enhanced Geothermal Systems on the United States in the 21. Century
- The economics of developing Enhanced Geothermal Systems
- Application of EGS concepts in Latin America and Asia
- International Continental Scientific Drilling Programme

16:30-18:00

Meeting of the Executive Group and Steering Committee with Stakeholder Committee

20:00

Dinner

January 11, 2007

8:30

Session II: Exploitation, economic, environmental and social impacts

- Political frame conditions for promoting geothermal energy
- Geothermal electricity generation from low enthalpy systems
- Economic approach of geothermal energy generation
- Non technical barriers

Lunch

14:00

Session III: Drilling, stimulation and reservoir assessment

- Developments in geothermal drilling
- Drilling of geothermal wells in granitic, volcanic and sedimentary reservoirs
- Hydraulic stimulation and microseismic fracture monitoring
 - in the hydrocarbon industry
 - in geothermal wells
- Development of conceptual and numerical reservoir models

January 12, 2007

8:30

Session IV: Investigation of Unconventional Geothermal Resources and in particular Enhanced Geothermal Systems

- Structural Geology: imaging potential geothermal reservoirs
- Heat: finding heat at depth
- Stress: understanding and stimulating fluid circulation
- Geophysical methods for EGS investigation
- Geochemical methods in geothermal exploration and exploitation

12:00

Session IV: Dissemination and information

- Capacity building through training by research in geothermal activity
- Dissemination of geothermal knowledge
- Geothermal education in Europe and other continents

13:30

Conclusion

14:30-16:00 Meeting of the Work packages

16:30-18:00 Meeting of the Steering Committee