

SIXTH FRAMEWORK PROGRAMME

PRIORITY 1.6



Enhanced Geothermal Innovative
Network for Europe



Project no 019760

ENGINE

Enhanced Geothermal Innovative Network for Europe

Instrument: Coordination Action

Thematic Priority: 1.6 Sustainable energy systems

2nd Periodic activity report

Deliverable 2: six month and one year activity report

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Start date of project: 1st November 2005

Duration: 30 months

Project coordinator name: Patrick Ledru

Project coordinator organisation name: BRGM



Version 1: 15th January 2007

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1. Periodic activity report

1.1. PUBLISHABLE EXECUTIVE SUMMARY

1.1.1. Summary description of project objectives

The work programme of the FP6 priority thematic area 1.6, "Sustainable energy systems", defines a need for co-ordinating ongoing research and promoting the development and uptake of innovative methods and technologies to expand the exploitation of Unconventional Geothermal Resources, in particular Enhanced Geothermal Systems.

To summarise, by exploring Unconventional Geothermal Resources, research and development institutes face:

- a scientific challenge to understand the distribution of heat and permeability at depth in the uppermost crust. High amplitude and small wavelength anomalies, related to local high conductivity layers or highly radioactive sources, may develop on the large wavelength thermal anomalies and present a great interest for assessment of reservoirs for Hot Dry Rock energy systems.
- a technological and economic challenge to improve and render cost-efficient investigation and development technology in order to make these geothermal systems viable.
- communication challenges to rally the support of policy makers and investors and, in certain cases, increase the social acceptance of a broader community.
- a challenge to integrate the different, yet parallel, research paths that currently exist, namely one for investigation and resource assessment and another for sustainable exploitation schemes, one for Hot Dry Rocks and another for High Energy Systems.

The Co-ordination Action, called "Enhanced Geothermal Innovative Network for Europe" (ENGINE) has been proposed in this framework. Its main objectives are to motivate the scientific community to face up to the above-mentioned challenges, to capitalise the know-how acquired in the framework of the Hot Dry Rocks Soultz experiment but also from the exploration and exploitation of Italy, Bouillante and Iceland geothermal fields, to define new integrated projects that will federate the scientific community working in the "geothermal field", in partnership with industry, in order to achieve the strategic objectives of the European Community. It will provide (1) an updated framework of activities concerning geothermal energy in Europe, including the integration of scientific and technical know-how and practices, the evaluation of socio-economic and environmental impacts; (2) the definition of innovative concepts for investigation and use of Unconventional Geothermal Resources and Enhanced Geothermal Systems; groups of experts will present a "Best Practice Handbook"; (3) a scientific and technical "European Reference Manual" including the information and dissemination systems developed during the Co-ordination Action. The links established between research and development teams, national development programmes, industrial partners and international agencies will be used to promote the geothermal energy as a major renewable and sustainable source of energy and to propose innovative high-level medium- to longer-term research projects

The structure of the project is based on 9 workpackages (Figure 1). The *Project management* activities are gathered in the Workpackage 1. A special attention is paid to the *Information and dissemination system of the Co-ordination Action* (WP2) as the potential impact of the project will be related to the mobilisation of a large scientific and industrial community and to the establishment of a sustainable institutional and political support. It will provide (i) a working platform for exchanging general or specialised information, (ii) on-line exchange and dissemination of scientific and technical know-how and practices, (iii) access to a metadata base, specified database, open-source software and models, (iv) an interface with non-member institutes and the international geothermal community, (v) development and maintenance of a regular contact with the media's.

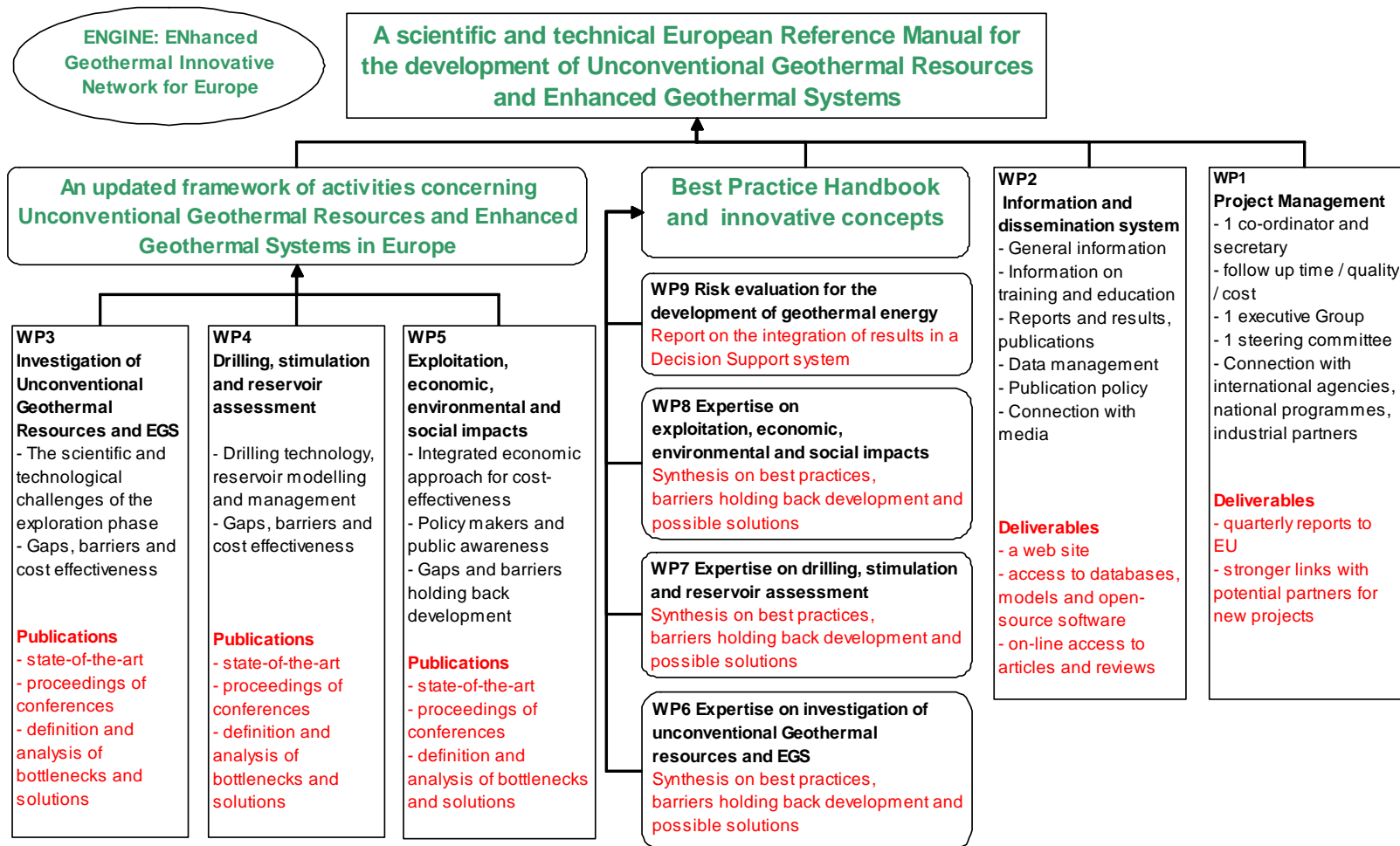


Figure 1. Breakdown structure of the ENGINE Coordination action

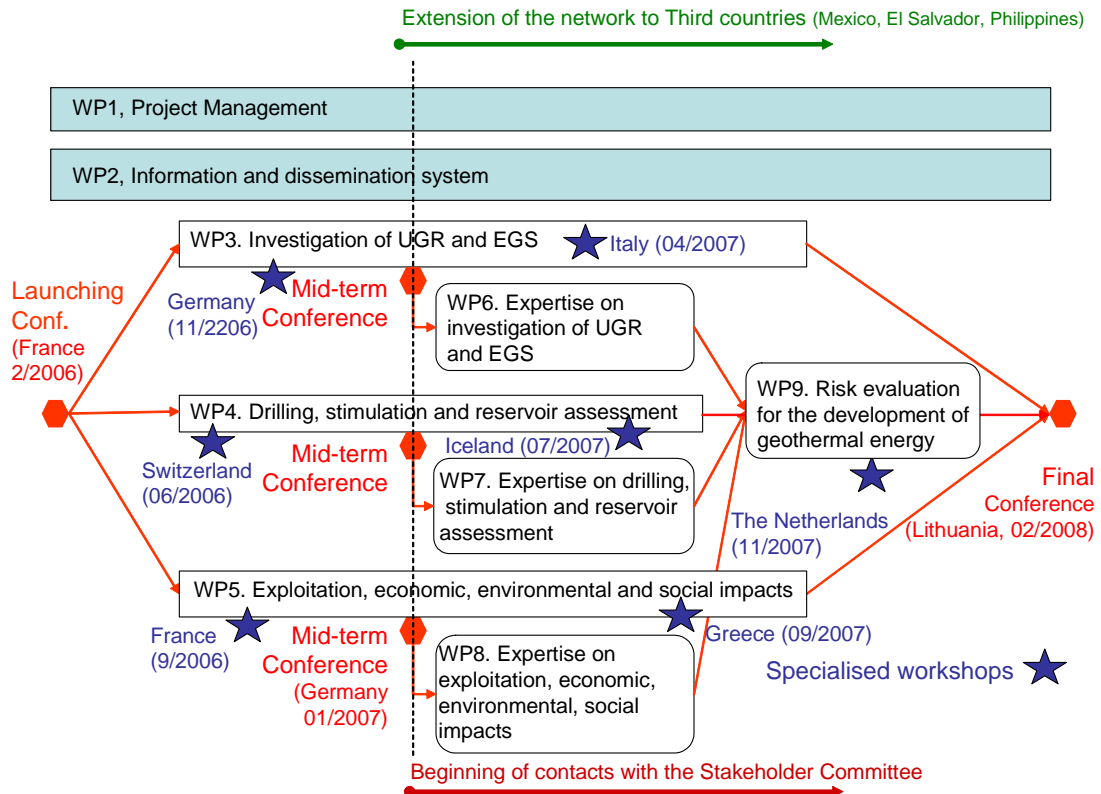


Figure 2: Project network of activity

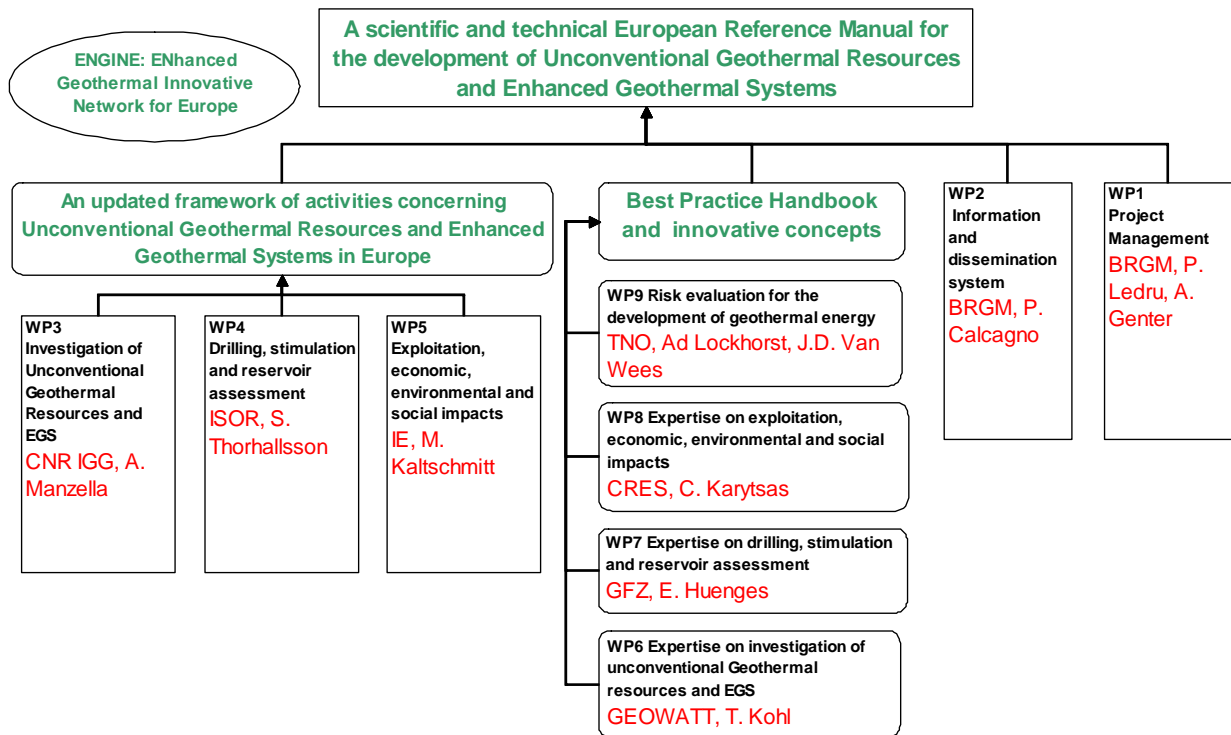


Figure 3: Breakdown of the ENGINE resources and Workpackage leaders

To promote an efficient network of geothermal activities, the Co-ordination Action defines and manages joint and common initiatives through (Figure 2):

- an Integration Phase, i.e. a bottom-up and federative strategy to motivate the scientific community to face up to the scientific and technical challenges. Workshops and conferences are regularly organised to ensure a smooth and streamlined flow of exchanges and co-ordination. *This integration of scientific and technical know-how and practices provides an updated framework of activities concerning geothermal energy in Europe. It covers all initiatives and bottlenecks encountered during the Investigation of EGS and unconventional Geothermal resources (WP3), Drilling, stimulation and reservoir assessment (WP4) and Exploitation, economic, environmental and social impacts (WP5).* For each of these Workpackages, the co-ordination work is aimed at (i) presenting the state-of-the-art, (ii) defining the most appropriate scientific and technological approaches, (iii) identifying the main gaps, barriers and unsolved questions; (iv) analysing how such know-how and procedures can be transferred and bottlenecks overcome. The economic factor and the cost-effectiveness of each scientific and technological approach are systematically considered. The deliverables mainly consist of publications providing access to the conclusions of these integration actions and, in particular, to the state-of-the-art.
- a Synthesis Phase; i.e. the creation of Expert Groups/panels in charge of defining priorities in the field of research investment and strengthening the links with the financial and political institutions. Four groups of experts, acting within WP 6-7-8, perform an evaluation of the best practices and innovative concepts to be adopted on the different types of activities covered by the WP 3-4-5. WP9 on *Risk evaluation for the development of geothermal energy* is aimed at synthesising the main scientific and technical aspects, as well as economic and environmental constraints, resulting from the different expert groups. Deliverables include a Best Practice Handbook and the definition of innovative concepts for geothermal investigation, reservoir stimulation and assessment and exploitation.

A scientific and technical European Reference Manual for the development of *Unconventional Geothermal Resources* will finally present this Best Practice Handbook and will include all publications, information, metadata base, database and models collected and compiled during the integration phase of the Co-ordination Action.

1.1.2. Contractors involved

The project involves 31 contractors. The workpackage leaders are presented on figure 3. The first group of partner has a broad knowledge covering large aspects of the geothermal energy. It comprises **BRGM** (France), co-ordinator of the ENGINE project, **CFG SERVICES** (France), **GeoForschungsZentrum Potsdam** (GFZ, Germany), **ISlenskar ORkurannsoknir** (ISOR, Iceland GeoSurvey), **Centre for Renewable Energy Source** (CRES, Greece), **the Geological Survey of Denmark and Greenland** (GEUS, Denmark), **Shell International Exploration and Production B.V.** (SIEP B.V., Netherlands).

The second group of partner has a knowledge covering mainly the exploration and drilling and reservoir assessment: the **Instituto di Geoscienze e Georisorse** (IGG, Italy), the **Department of Geophysics of the Eotvos University** (ELTE, Hungary), the Institute of Earth Sciences, Dept. of Tectonics, of the **Vrije Universiteit Amsterdam** (VUA, Netherlands), the **Groupement Européen d'Intérêt Economique "Exploitation Minière de**

la Chaleur" (GEIE "EMC", an international consortium operating on the site of Soultz-sous-Forêts, France), the **Panstwowy Instytut Geologiczny** (PGI, Polish Geological Institute, Poland), **Tsentr geoelektromagnitnykh issledovaniy Instituta fiziki zemli Rossiskoi akademii nauk** (GEMRC IPE RAS, GEoelectromagnetic Research Center of the Institute of the Physics of the Earth, Russian Academy of Sciences , Russian Federation), the **Geologijos Ir Geografijos Institutas** (IGGL, Institute of Geology and Geography, Lithuania).

A large group of partners have a large experience in drilling and reservoir assessment, exploitation and impact of the geothermal energy. It is composed of the **Netherlands Organisation For Applied Scientific Research** (TNO, Netherlands), ten laboratories of the French **CNRS** (France) involved in the HDR Soultz experiment, **Geoproduction Consultants** (GPC, France), the Chemical Process Engineering Research Institute (CPERI) of the **Center for Research and Technology-Hellas (CERTH)**, the Environmental Research Laboratory of the **National Centre for Scientific Research "Demokritos"** (NCSR, Greece), the **Institutt for Energiteknikk** (IFE, Institute for Energy Technology, Norway), the **Deep Heat Mining Association** (DHMA, International Consortium), The company **Geowatt AG**, the **Instituto Geológico y Minero de España** (IGME Geological and Mining Institute of Spain, Spain), the **Leibniz Institute for Applied Geosciences** (GGA-Institute, Germany)

Another group of partners are mainly involved in the development and management of exploitation and in impact studies of the geothermal energy: the **Institut für Energetik und Umwelt** gGmbH (IE, Institute for Energy and Environment, Germany), the **Institut vysokikh temperatur Rossyiskoi akademii nauk** (IVTRAN, Institute for high temperatures, Russian academy of sciences, Russian Federation), **the Institute for Geothermal Research of the Daghestan Scientific Centre of Russian Academy of Sciences** (IGR DSC RAS, Russian Federation) and 3 private firms, **ORME JEOTERMAL A.S.**, operating in Turkey, **Joint Stock Company "Intergeotherm"** (JSC "Intergeotherm", Russian Federation), involved in the construction of geothermal plants worldwide and **MeSy GeoMessSysteme GmbH** (MeSy, Germany) partner of the European HDR Soultz-sous-Forêts project, the **University of Oradea** (UOR, University of Oradea, Romania).

The European Community has offered possibilities to associate new partners from third countries with ongoing projects through INCO (International cooperation). This opportunity has been successfully taken up by inviting research institutes and private firms that have experience in stimulation of natural or provoked reservoirs in geothermal fields to join the consortium. **Filtech Energy Drilling Corporation** (Philippines), **Instituto de Investigaciones Eléctrica** (IIE, Mexico), **Centro de Investigación Científica y Educación Superior de Ensenada** (CICESE, Mexico), and **LaGeo S.A. de C.V.** (El Salvador) are thus involved since the 1st November 2007 into the network.

BRGM (France) is the co-ordinator of the ENGINE project. The Co-ordination is performed by Patrick Ledru, Project coordinator at the Research Division of the BRGM, with the support of Albert Genter, Project manager (until September 2007) and Philippe Calcagno, Project manager (since September 2007). Christian Fouillac, Research Director of the BRGM, is chairing the Executive group of this Coordination Action (see contact details in Table 1). The management structure is presented on figure 4.

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Table 1. Coordinator Contact details

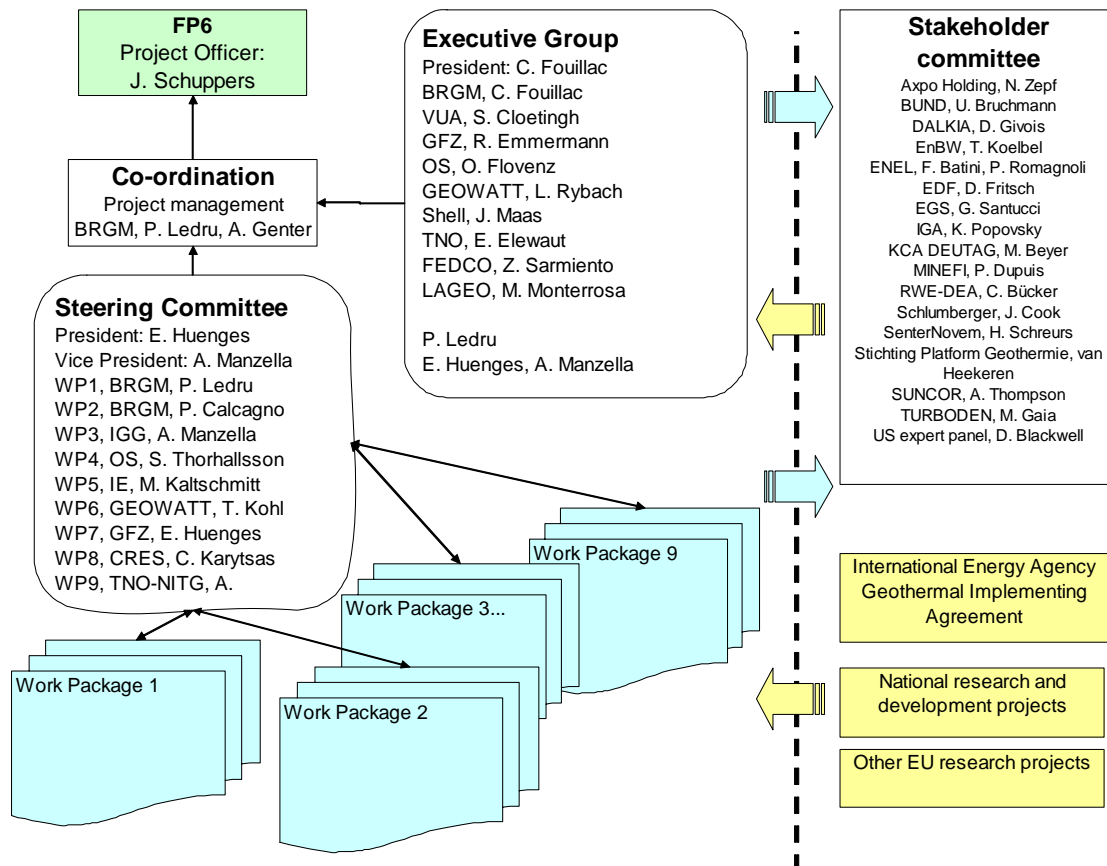


Figure 4. Management structure of the project

1.1.3. Work performed and results achieved so far

After 2 years, the project has organised 2 conferences and 6 specialised workshops, following what was defined in the work plan. CD-Roms and Newsletters have disseminated information resulting from each meeting and the web site <http://engine.brgm.fr> has had a constant growth of visits. All presentations, abstracts and articles can be downloaded from the web site through an appropriate software (INDICO) developed for management of conferences and workshops.

As an introduction to the main sessions of the mid term conference, work package leaders have presented the main outcomes of the meetings and specialised workshops and from some elaborated synthesis (see <http://conferences-engine.brgm.fr/conferenceDisplay.py?confId=4>). These documents have already provided a framework for some of the R&D issues that will result from the ENGINE project.

Several points about the impact of the Coordination Action have already been emphasized, such as the interest of partners to share their knowledge and practices, the progressive broadening of the community participating to these meetings and the definition of R&D's stakes for developing unconventional geothermal resources. The close and frequent relationship and exchanges between partners belonging to the conventional geothermal community and partner representing European EGS pioneers was also a major element of success for the meetings hold during the two years of ENGINE. A new step has been done from the extension of the network to 4 new partners from Targeted Third Countries, i.e. Mexico, Salvador and Philippines. The settlement of a stakeholder committee has also permitted to enhance links between R&D teams and stakeholders by providing strategic guidance to the Executive Group and to Contractors in general. This has coincided with the official start of the expert groups in charge of defining the best practices and priorities for research investment.

1.1.4. Intention for use and impact

The main potential impact expected from the Co-ordination Action is to re-establish the institutional and political support that is currently lacking to ensure that geothermal energy reaches its full efficiency and profitability thresholds at European scale. It is first of all necessary to structure the geothermal-energy community towards the definition of innovative research projects. The emergence of such projects requires a capitalisation of the knowledge of the different actors currently playing in the "geothermal field", which implies sharing experiences, exchanging best practices and clearly identifying the gaps and barriers. The expected impact of this Co-ordination Action is that a large scientific research community will be mobilised that is able to promote such spin-off projects with industrial partners. The Co-ordination Action also intends to play a "transmission role" and constitute an exchange platform. It will provide an opportunity to integrate and synthesise all information about know how, practices, innovations and barriers at the level of the Steering Committee and Expert Groups. This will be particularly helpful during discussions with Executive Directors of international funding agencies or National Policy makers.

1.1.5. Plan for using and disseminating knowledge

The knowledge acquired during through this Co-ordination Action is already well disseminated and available through the information and publication systems, and should arise the interest of other potential scientific and industrial partners. This dissemination also contributes to the transfer of knowledge towards those requiring more information about the technical and socio-economic know-how for building up the geothermal industry, especially in Central and Eastern Europe. This could speed up the exploitation of both conventional and

unconventional geothermal resources in these countries and thus contribute considerably to the short- and long-term goals of the EU to reduce carbon dioxide emissions by increasing the share of renewable energy.

1.2. SECTION 1 – PROJECT OBJECTIVES AND MAJOR ACHIEVEMENTS DURING THE REPORTING PERIOD

For the reporting period, the main objectives were concerning the integration phase and the launching of the expertise procedure. Concerning the integration phase, the state-of-the-art is assessed in order to identify and analyse the practices, the concepts applied for exploring Unconventional geothermal Resources, as well as the main gaps in knowledge and/or technology. Each Workpackage is supervised by one leader that is member of the Steering Committee.

The integration is performed according to the following guidelines :

- the setting up of a common information system including an original collaborative platform Web site and an electronic newsletter in order to exchange and share information. All presentations, abstracts and articles can be downloaded from the web site through an appropriate software (INDICO) developed for management of conferences and workshops.
- organisation of two conferences (launching and mid-term) on Unconventional Geothermal Resource, common for all Workpackages, and 6 specialised workshops. Abstract book, CD-Roms and Newsletters have disseminated information resulting from each meeting and the web site <http://engine.brgm.fr> has had a constant growth of visits. Applications for additional funding have been successfully supported by the Co-ordination Action to support the coming of an US international expert, J. Faulds (Bureau of Mines Nevada) in BRGM Orléans on a project enabling exchange of best practices applied to geothermal resources in Turkey and education.
- the work of past and present IEA-GIA international groups has been integrated within the tasks of the Workpackages, by direct representation of the ENGINE experts in these groups and meetings (T. Megel, L. Rybach, P. Ledru, R. Baria...). Of particular interest are the GIA Annexes I on “Environmental impacts of geothermal energy development” and III on “Enhanced Geothermal Systems”. A new step has been done as the BRGM, coordinator of the project now represents France within the IEA-GIA group since March 2007.
- the exchange of personnel will be favoured as this is a highly efficient way of sharing experience, disseminating best practices and integrating information from different sources. Thus, the stay of a researcher from BRGM in GFZ Potsdam during 3 months has been set up for connecting different approaches of geophysical modelling.
- definition of a policy to encourage the publication of the state-of-the-art, compilations and the results of studies and analyses performed during the Co-ordination Action. The conferences and workshop are dedicated to this aim. Since the very beginning, the focus has been on the quality of the organisation of the meetings. After 2 years, the project has organised 2 conferences and 6 specialised workshops, following what was defined in the work plan. CD-Roms and Newsletters have disseminated information resulting from each meeting and the web site <http://engine.brgm.fr> has had a constant growth of visits. All presentations, abstracts and articles can be downloaded from the web site through an appropriate software (INDICO) developed for management of conferences and workshops. As an introduction to the main sessions of the mid term conference, work package leaders will present the main outcomes of the meetings and specialised workshops and from some elaborated synthesis (see [-13-](http://conferences-

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engine.brgm.fr/conferenceDisplay.py?confld=4). These documents already provide a framework for some of the R&D issues that will result from the ENGINE project.

- informal meetings and contacts spontaneously organised between a limited number of partners and participants
- information of all institutes that have expressed interest to be associated to this Co-ordination Action (more than 20) so that they can join the conferences and specialised workshops on their own funds or be associated as sub-contractors if necessary. Each ENGINE meeting attracts participants that are not officially members of the network, some of them from non European countries who wanted to benefit from the audience provided by the co-ordination action to present their results and projects. Such meetings constitute exceptional opportunities to develop new contacts with industry and stakeholders that are concerned by the scope of the project.

Several facts have already revealed the positive impact of this integration phase of the Coordination Action. As mentioned above, the interest of partners to share their knowledge and practices, the progressive broadening of the community participating to these meetings and the definition of R&D's stakes for developing unconventional geothermal resources has shown the strong motivation to face up the scientific and technical challenges. The close and frequent relationship and exchanges between partners belonging to the conventional geothermal community and partner representing European EGS pioneers was also a major element of success for the meetings hold during these two years of ENGINE.

The expert phase of the project has started during the mid-term conference (January 2007). Groups of experts have been constituted and each following workshops have provided opportunity for meeting and preparing synthetic documents. A first synthesis has been presented September 20 during the meeting with the stakeholders meeting in Brussels. Documents and draft versions of the Best Practice Handbook have circulated among the expert group and been progressively updated. A preliminary compilation will be presented during the final conference in Vilnius (February 2008) and will be then reviewed by independent experts before being finalised.

The settlement of a stakeholder committee has also enhanced links between R&D teams and stakeholders by providing strategic guidance to the Executive Group and to Contractors in general. The composition of this group is given in Table 2. The first meeting of this stakeholder committee has coincided with the official start of the expert groups in charge of defining the best practices and priorities for research investment.

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Table 2. Composition of the stakeholder committee

The development of links with international funding agencies and associations constitute an objective of ENGINE. In this context, several initiatives have been taken :

- new partners from Targeted Third Countries have been integrated within the network. Filtech Energy Drilling Corporation (Philippines), Centro de Investigación Científica y Educación Superior de Ensenada (CICESE, Mexico), and LaGeo S.A. de C.V. (El Salvador).have been very active since the official date of extension of the contract and have participated to most workshops and conferences. Moreover, they have been represented to the the Executive Group. However, Instituto de Investigaciones Eléctrica (IIE, Mexico) has not been able to participate to these events as the staff was not allowed to engage resources before the money was transferred on their bank account. EC has not made any pre-payment for the new partners and the Coordinator was informed about it only lately during spring 2007. Then BRGM made the pre-payment but it was too late for the partner who resigned in November 2007. The transfer of the amount of money planned for this partner to other activities has been required to the Scientific Officer.
- the Executive Group is presently developing links with international agencies. Thus, L. Rybach, C. Fouillac and the co-ordinator have intended an action, supported by the President of the BRGM, P. Vesseron, to facilitate the adhesion of France to the International Energy Agency-Geothermal Implementing Agreement (IEA-GIA) and to nominate the co-ordinator of the ENGINE project as France's Representative within this committee. The request has been accepted and France is now represented. The co-ordinator has participated in the IEA-GIA's Executive Committee meeting in Nice (March 2007) and Kandel (September 2007).
- ENGINE was invited to make several presentations during special occasions, like at the Geothermal Research Council 2007 Annual Meeting. International representatives from US and Australia have been invited to participated to workshops and conferences to provide their input taking into account the new development in geothermal projects in these countries.

It can be considered that these initiatives, along with the information system of the project and the actions of the Executive Group and Steering Committee, have already made the ENGINE project visible and sparked at least the interest of the international community.

No important problems have been recorded during the period.

1.3. SECTION 2 - WORKPACKAGE PROGRESS OF THE PERIOD

For each active workpackage, an overview of the actions carried out in the reporting period is provided.

Workpackage number	2		Start date or starting event:				t1	
Activity type	Co-ordination activity							
Participant ID	1	3	8	15	23	24	29	35
Person-months per participant:	6	4	1	2	2	6	2	1

Objectives, Information and dissemination System

The setting up of the information system of the Co-ordination Action is a very important objective as it will play a major role in the exchange and dissemination of data, good practices and standards. As publications will be the main deliverable, the publication system is also indicated as a main item of the Co-ordination Action.

The breakdown of Workpackage 2 is as follow:

2.1. The information system

- 2.1.1. General information
- 2.1.2. Training and education
- 2.1.3. On-line reports and results, publications
- 2.1.4. Data and metadata base, models, open-source software

2.2. The publication system

- 2.2.1. Scientific publications (peer-review journals, proceedings of conferences and meetings, on-line on the Web site)
- 2.2.2. Reports (open file or with access restricted to Co-ordination Action members)

2.3. The dissemination system

- 2.3.1. The Web site and the electronic monthly newsletter of the Co-ordination Action
- 2.3.2. Connection to scientific Web site for dissemination of international scientific news
- 2.3.3. Participation to the national and international debates about sustainable development and renewable energy
- 2.3.4. General scientific dissemination (multimedia programmes, articles and information brochures)
- 2.3.5. Public relation through press releases and media contacts

Progress towards objectives – tasks worked on and achievements made with reference to planned objectives, identify contractors involved

The Information and Dissemination System led by P. Calcagno (p.calcagno@brgm.fr, BRGM) play a major role in the exchange and dissemination of information, data, good practices and standards within the Co-ordination Action. The WP2 work package intends to be the vector to share and to promote the action of the ENGINE community towards institutions, funding agencies and citizens.

In order to enhance the communication among the partners, a WP2 delegate was nominated by every work package leader: Chiara Giolito (giolito@igg.cnr.it, IGG) for WP3, Brynja Jonsdottir (brj@isor.is, ISOR) for WP4, Stephanie Frick (Stephanie.Frick@ie-leipzig.de, IE) for WP5, Clément Baujard (baujard@geowatt.ch, GEOWATT AG) for WP6, Angela Spalek (spalek@gfz-potsdam.de, GFZ) for WP7,

Evgenia Kontoleonos (ekont@cres.gr, CRES) for WP8, Erik Simmelink (Erik.Simmelink@tno.nl, TNO) for WP9.

The following presents the progress of WP2 and the deliverables produced over the 2nd period.

1. Scientific and technical activity

The organization of the WP2 activity follows the WP2 goals and deliverables (see ENGINE [Annex 1 - "Description of the Work" document](#)).

The scientific and technical activity was presented during the [Mid-Term Conference \(Potsdam, Germany, 09-12/01/2007\)](#) in:

- [the Dissemination and Information session \(12/01/2007\)](#).
- [two special WP2 sessions \(10 and 12/01/2007\)](#).

WP2 scientific and technical activity was also discussed during the Steering Committee meetings organized over the period (Potsdam, Germany, 08/11/2006 and 12/01/2007; Volterra, Italy, 02/04/2007). See minutes [here](#).

2. Organisation and maintenance of the Web site (<http://engine.brgm.fr>)

The [ENGINE Web site](#) is designed to be the place where the ENGINE production is shared among the partner, related and public audience. It is refined and completed during the Co-ordination Action to become a reference knowledge base on the Internet. The final version of the Web site will be available by the end of the coordination action (**Deliverable n°7**). It presents the [ENGINE Co-ordination Action](#), [partners activities](#), [press releases](#), [newsletters](#) (**Deliverable n°3**), [reference documents](#) and [links](#). Indico, a meetings management tool, allows work packages to organize the [conferences and workshops](#) they are in charge by using a dedicated part of the Web site. A section of the Web site aims at [sharing restricted access to the partners](#) for implementing and exchanging documents by using eProjet. The Web site also uses RefShare from Refworks for displaying and exporting [ENGINE bibliography](#) including partners' EGS related papers and forthcoming ENGINE papers (**Deliverable n°8**). A section dedicated to EGS lighthouse project in Europe is available and will be completed by the end of the project. A section dealing with the promotion of the geothermal energy through education and training will also be included in the ENGINE Web site.

The Web site is fully managed and regularly updated by BRGM. The Web site <http://engine.brgm.fr> is hosted by BRGM except for Indico and RefShare. The respective hosts provide maintenance under BRGM control.

3. Meetings management (<http://conferences-engine.brgm.fr>)

One of the goals of the ENGINE Co-ordination Action is to organize conferences and workshops. BRGM provides tools and methodologies to the work packages for managing the 3 conferences and 7 workshops of the project. Meetings management is achieved via the Internet using [Indico \(Integrated Digital COncference\)](#) for finding out past and future meetings, registering to a meeting, submitting abstract, reviewing proposed abstracts by organizers, uploading material (slides, papers, posters, etc.) by contributors, downloading material of past meetings by visitors.

Apart from the Internet organizing tool, BRGM helps the work packages to manage paper documentations and CD containing information and material of their meeting by defining the ENGINE publication policy.

The following meetings have been organized during the reporting period:

- [defining, exploring, imaging and assessing reservoirs for potential heat exchange - Potsdam, Germany, Workshop1, 06-08/11/2006](#)
- [special meeting \(Steering Committee\) - Paris, France, 11/12/2006](#)
- [Mid-Term Conference - Potsdam, Germany, 09-12/01/2007](#). Such as for the other Conferences and Workshops, the proceedings of the Mid-Term Conference are available on the Web site (**Deliverable n°5**). See also the appended Book of abstracts and CD.
- [Exploring High Temperature reservoirs: new challenges for geothermal energy - Volterra, Italy, Workshop2, 01-04/04/2007](#)

- [special meeting \(WP6\) - Zurich, Switzerland, 04/06/2007](#)
- [drilling cost effectiveness and feasibility of high-temperature drilling - Reykjavik, Iceland, Workshop4, 01-05/07/2007](#)
- [special meeting \(WP7, Testing Deep Geothermal Wells\) - Bochum, Germany, 24/08/2007](#)
- [increasing policy makers' awareness and the public acceptance - Athens, Greece, Workshop6, 13-14/09/2007](#)
- special meeting (Steering Committee, Executive Group and Stakeholders Committee meeting) – Brussels, Belgium, 20/09/2007.

4. Follow-up of the publications

As publications will be one of the main deliverable of the project, the publication system is indicated as an important item of the Co-ordination Action. Contents of the publications are managed by the work packages but WP2 defines a publication policy in order to ensure a coherent look of the ENGINE production. For the reporting period, the publication policy focussed on :

- [bibliography of the partners' papers related to EGS \(Deliverable n°8\)](#). BRGM provides RefShare to manage the bibliography. This task will be achieved by the end of the project.
- [newsletters](#) to report about project activities to partners and related (**Deliverable n°3**). BRGM provides a template and manage the edition of newsletters. The 4 issues that came out during the reporting period ([December 2006](#), [March](#), [June](#), [August](#) and [October 2007](#)) are appended to this report.
- [minutes](#) report about the project management meetings (Executive Group, the Steering Committee, WP, etc.) WP2 provides templates and manage the edition of the minutes. The minutes include a BRGM ID number to easily retrieve them.
- Conferences and workshops electronic and paper material. WP2 provides Indico to manage the contents of the meetings. WP2 also prepares templates for the book of abstracts, programme, list of participants and CD of a meeting. The proceedings CD is an off-line version of the meeting Web pages generated by Indico including the material (slides, papers, posters, etc.). ISSN and ISBN numbers provided by the Bibliothèque Nationale de France (French National Library) reference the CDs in order to easily retrieve them. A selection of Books of abstracts and CDs edited for the conference and workshops of the reporting period are appended to this report.

5. Dissemination and Education

A special attention is given to dissemination in order to strengthen the position of the geothermal energy among the other renewable energies. The main vector is the Web site that is dedicated to ENGINE partners, related and public audience. Newsletters play as well an important role in disseminating information (**Deliverable n°3**). Every issue is sent to ENGINE partners and related and can be displayed by public on the Web site.

During [the Dissemination and Information session](#) at the [Mid-Term Conference \(Potsdam, Germany, 09-12/01/2007\)](#), the state of the art of education and dissemination was presented in the following contributions :

- [the ENGINE information system birthday](#)
- [capacity building through training by research in geothermal activity: an experience from Mexico and Latin America](#)
- [ISS - A SUCCESSFUL TRIAL FOR INTERNATIONALIZATION OF SPECIALIZED EDUCATION AND TRAINING](#)
- [DISSEMINATION OF GEOTHERMAL KNOWLEDGE AT ISOR](#)
- [Geothermal Education in Europe and other Continents](#)

A compilation of the lighthouse geothermal projects in Europe is under progress and will be presented at the [Final Conference \(Vilnius, Lithuania, 13-14 February 2008\)](#). This work is lead by ENGINE partner GEUS (Anders Mathiesen). A questionnaire, filled by the leaders of the main projects (Soultz, Basel, Larderello, Bouillante, etc.), will be available soon on the Web site.

Training and Education is an important objective of the Co-ordination Action. ENGINE partner UOR (Marcel Rosca) presented an [updated version](#) of his work at the [Mid-Term Conference \(Potsdam, Germany, 10-12 January 2007\)](#). The final step will be a proposition for an integrated route for students in Europe and guidelines for the creation of a European centre dedicated to geothermal education to be presented during the [Final Conference \(Vilnius, Lithuania, 13-14 February 2008\)](#). In parallel, the results of this work will be presented on the Web site.

Deviations from the project workprogramme, and corrective actions taken/suggested: identify the nature and the reason for the problem, identify contractors involved

No deviation from the project work programme has to be mentioned. However, the following adaptations are reported :

- newsletter issuing was originally scheduled every month. The project progress shown that the newsletter is more efficient if issued between the ENGINE meetings. The periodicity of the newsletters depends on the dates of the meetings but the average is about an issue every second month.
- as the contents of the Web site evolve with the project progress (meetings organization, bibliography, ENGINE papers, etc.), the finalized version of the Web site will be available at the end of the Co-ordination action (March 2008). However, a particular attention is and will be paid to maintain the Web site up-to-date.
- the CD of proceedings for the workshop 6 (Athens, Greece) is delayed due to technical reasons. It will be distributed at the [Final Conference \(Vilnius, Lithuania, 13-14 February 2008\)](#).
- ISOR has been involved in the activities of this workpackage although it was not planned originally. This is mainly because of the growing interest for dissemination and promotion of geothermal energy in Iceland
- GFZ has not contributed to this workpackage although it was originally planned. This is mainly because its involvement has been focused on expertise on drilling and stimulation and because, for practical accounting reasons, GFZ has not been able to charge the activity of the staff.

Table 4a: Deliverables List

Del n°	Deliverable name	WP n°	Date due	Actual/Forecast delivery date	Lead contractor
3	A provisional Web site and an electronic monthly newsletter	2	t3	10/11/2005	1
4	Presentation and documentation of the provisional Web site and of the perspective of the information system at the Launching conference, Session 2	2	t3	15/02/2006	1
5	Proceedings of the Mid term conference, Session 2. Information and Dissemination System	2	t14	February 2007	1
6	Proceedings of the Final conference, Session 2. Information and Dissemination System	2	t25	March 2008	1
7	A finalised Web site and an Information System (including an electronic monthly newsletter)	2	t14	Partly done, to be completed by the end of the project	1
8	The bibliography of the Co-ordination Action	2	t14	Partly done, to be completed by the end of the project	1

Documents appended to this report :

- book of abstracts of the Workshop 1 Defining, exploring, imaging and assessing reservoirs for potential heat exchange - Potsdam, Germany, Workshop1, 06-08/11/2006 online available at <http://conferences-engine.brgm.fr/getFile.py/access?resId=1&materialId=12&confId=1>

- book of abstracts of the Mid-Term Conference (Potsdam, Germany, 10-12 January 2007) online available at <http://conferences-engine.brgm.fr/getFile.py/access?resId=0&materialId=21&confId=4>
- book of abstracts of the Workshop 2 Exploring High Temperature reservoirs: new challenges for geothermal energy - Volterra, Italy, Workshop2, 01-04/04/2007 online available at <http://conferences-engine.brgm.fr/getFile.py/access?resId=2&materialId=8&confId=2>
- book of abstracts of the Workshop 4 Drilling cost effectiveness and feasibility of high-temperature drilling - Reykjavik, Iceland, Workshop4, 01-05/07/2007 online available at http://www.isor.is/engine/ENGINE_BOA_Abstract_workshop4.pdf
- book of abstracts of the Workshop 6 Increasing policy makers' awareness and the public acceptance - Athens, Greece, Workshop6, 13-14/09/2007 online available at <http://conferences-engine.brgm.fr/getFile.py/access?resId=0&materialId=16&confId=7>
- CD of the Workshop 1 (Potsdam, Germany, 6-8 November 2006) ISBN 978-2-7159-2986-9. Orleans, BRGM Editions. Collection Actes/Proceedings. ISSN 1773-6161. janvier 2007.
- CD of the Mid-Term Conference (Potsdam, Germany, 10-12 January 2007) ISBN 978-2-7159-2987-6. Orleans, BRGM Editions. Collection Actes/Proceedings. ISSN 1773-6161. Avril 2007.
- CD of the Workshop 2 (Volterra, Italy, 1-4 April 2007) ISBN 978-2-7159-2988-3. Orleans, BRGM Editions. Collection Actes/Proceedings. ISSN 1773-6161. Juillet 2007.
- CD of the Workshop 4 (Reykjavik, Iceland, 2–5 July 2007) ISBN 978-2-7159-2989-0 Orleans, BRGM Editions. Collection Actes/Abstracts. ISSN 1773-6161. Octobre 2007.
- newsletter #5 December 2006 online available at http://engine.brgm.fr/bulletins/ENGINE_Newsletter5_122006.pdf
- newsletter #6 March 2007 online available at http://engine.brgm.fr/bulletins/ENGINE_Newsletter6_032007.pdf
- newsletter #7 June 2007 online available at http://engine.brgm.fr/bulletins/ENGINE_Newsletter7_062007.pdf
- newsletter #8 August 2007 online available at http://engine.brgm.fr/bulletins/ENGINE_Newsletter8_082007.pdf
- newsletter #9 October 2007 online available at http://engine.brgm.fr/bulletins/ENGINE_Newsletter9_102007.pdf

Workpackage number	3			Start date or starting event:	t1												
Activity type	Co-ordination activity																
Participant ID	1	3	5	8	11	12	13	14	15	16	17	18	22	25	34	35	
Person-months per participant:	4	4	1	6	3	3	1	1	4	2	3	3	3	6	2	3	

Objectives, Investigation of Unconventional Geothermal Resources and EGS

The objective of Workpackage 3 is to integrate scientific and technical know-how and practices related to the investigation of Unconventional Geothermal Resources and Enhanced Geothermal Systems.

The breakdown of Workpackage 3 is following the main scientific issues:

3.1 *Integration of recent progress in knowledge concerning the European lithosphere*

3.2 *Mechanical behaviour of the upper crust and its response to stress, fluid circulation and heat-flow gradients*

3.3 *Exploring different types of geothermal reservoir*

3.3.1 High-energy geothermal fields (active/recent volcanism and peripheral zones)

3.3.2 High-temperature / low-permeability reservoirs (hot dry rocks)

3.3.3 New deep, and possibly supercritical, geothermal reservoirs

3.3.4 Multipurpose geothermal reservoirs

3.4 *Technological challenge of the investigation phase*

3.4.1 Improved exploration methods for deep geothermal resources

3.4.2 Combined geological and geophysical imaging methods for defining and assessing reservoirs for potential heat exchange

3.4.3 3D modelling and imaging of permeable systems

For each of the above, the state-of-the-art must be established in order to identify and analyse the best practices to be adopted, the innovative concepts to be applied or developed, as well as the main gaps in knowledge and/or technology.

Progress towards objectives – tasks worked on and achievements made with reference to planned objectives, identify contractors involved

This Second Year of activity have seen two main moments for WP3, led by A. Manzella :

- the **Mid Term Conference** provided an excellent opportunity for partners to learn what are the main geothermal exploration technologies and how to use them. Ten invited speakers presented a review of geochemical, geophysical, geological, petrophysical and reservoir modelling tools; a summary of the main results of Workshop 1; examples of reactive transport and fluid circulation in fracture models; a review of the role of tectonics for geothermal exploration and a new crustal model of Europe, to be used as input to the European strength map. The conference had a wide attendance and exploration session reached a vast public.
- during **Workshop 2 “Exploring high temperature reservoirs: new challenges for geothermal energy”** hosted from 1st to 4th of April 2007 in Volterra, Italy, partners and visitors had the possibility to hear and discuss about exploration tools for high enthalpy and supercritical systems, how to integrate them, what was achieved in different parts of the world by geothermal exploration and what could be done in the future. A particular emphasis was given to new approaches, such as modelling tools for volcanological studies, CO₂ as possible carrier and heat exchanger, new tools for high temperature condition. The workshop was attended by 77 participants from 16 countries and 5 continents. Forty ENGINE representatives from 14 partner organisations had the opportunity to share knowledge and debate with numerous external participants from 27 different organisations from industry and research centres.

Three Meetings took place between the leader and the participants to WP3. Two meetings were organized during the Mid Term Conference, in Potsdam on January 2007, and a third was organized during Workshop 2, in Volterra on April 2007. The organization of activity was discussed during the meetings and the related description (Minutes) was sent after the meetings and listed as available documents on the website. During the two **meetings in Potsdam** participants defined together what topics they were mostly involved in. A main responsible was defined for each deliverable and the main deviations from the foreseen deliverables have been jointly defined (see following paragraph).

During the **meeting in Volterra** the main responsible of each Review Article provided a definite title of the deliverable, a list of participants, and the main structure of the deliverable.

A questionnaire have been sent to partners requesting information to be later used for building the exploration tools database, Although this database can be considered fully representative only if and when all partners will be listed and information updated, this is considered a good way to show the importance of joining and coordinating so many different partners working in the same but rather large field, i.e., geothermal investigation and exploration. The database will schematically represent the main exploration methods, and will list all available tools among the Engine partners, both hardware and software, and in what project the experience has been gained. The questionnaire was filled by some, but not all the partners and the database is on-going.

Deviations from the project workprogramme, and corrective actions taken/suggested: identify the nature and the reason for the problem, identify contractors involved

The **Deliverables 14 and 15** about “Knowledge of the European lithosphere” and “Mechanical behaviour of the upper crust” have been joined - in agreement with all workpackage partners. One review paper will be produced covering both aspects foreseen by the two papers since the most experienced partners are the same for both fields and the two themes are strictly interconnected.

Deliverable 18 is changed to a database of exploration tools provided by the Engine partners (see previous paragraph) since the WP3 partners agreed that very little can be added to what has been already published in the recent geothermal conferences (World Geothermal Congress in primis). This database has been partially done and will be completed and delivered before the end of the project.

Deliverable 20 have been postponed to March 2008 and a dissemination policy is being defined on this regard in accordance to the other WPs.

IGG has been very much involved in the activities of this workpackage as workpackage leader and has over passed the originally planned person months (5 months instead of 2 for year 2).

VUA has been involved in the activities of this workpackage but, for practical reason, has not been able to charge the activity of the staff.

IIE has not been involved in the activities of this workpackage for practical reasons related to the delay for the transfer of budget.

Table 4b: Deliverables List

Del n°	Deliverable name	WP n°	Date due	Actual/Forecast delivery date	Lead contractor
9	Proceedings of the Launching conference, Session 3. Investigation of Unconventional Geothermal Resources and Enhanced Geothermal Systems.	3	t3	13-15 February 2006	8
10	Proceedings of the Mid term conference, Session 3. Investigation of Unconventional Geothermal Resources and Enhanced Geothermal Systems.	3	t14	February 2007	8
11	Proceedings of the Final conference, Session 3. Investigation of Unconventional Geothermal Resources and Enhanced Geothermal Systems.	3	t25		8
12	Guide to the Workshop 1 "Defining, exploring, imaging and assessing reservoirs for potential heat exchange"	3	t6	8-10 November 2006	8
13	Guide to the Workshop 2 "Exploring Supercritical fluid reservoir: a new challenge for geothermal energy"	3	t18	April 2007	8

14	A Review article about recent progress in knowledge concerning the European lithosphere and the exploration of EGS	3	t25		8
15	A review article about Mechanical behaviour of the upper crust and its response to stress, fluid circulation and heat-flow gradients	3	t25		8
16	A review article about Exploring different types of geothermal reservoir	3	t25		8
17	A review article about Technological challenge of the investigation phase	3	t25		8
18	An inventory of database, maps and models concerning the distribution of heat within the upper crust	3	t25		8
19	Reports of study and analysis	3	t25		8
20	General scientific dissemination (multimedia programmes, articles and information brochures, to be decided according to the results of the integration) about Investigation of Unconventional Geothermal Resources and Enhanced Geothermal Systems	3	t25		8

Table 5a: Milestones List

M. no	Milestone name	WP no.	Date due	Actual/Forecast delivery date	Lead contractor
4	Workshop 1	3	t6	8-10 November 2006	4
8	Workshop 2	3	t18	April 2007	8

Workpackage number				4				Start date or starting event:				t1								
Activity type				Co-ordination activity																
Participant ID	1	3	4	5	8	9	12	13	14	16	19	20	21	23	28	31	32	33	34	36
Person-months	3	3	6	1	2	1	2	3	1	4	2	2	2	2	3	3	3	2	3	3

Objectives, Drilling, stimulation and reservoir assessment

The objective of Workpackage 4 is to integrate scientific and technical know-how and practices related to the drilling, stimulation and reservoir assessment of Unconventional Geothermal Resources and Enhanced Geothermal Systems.

The breakdown of Workpackage 4 is following the main scientific issues:

4.1 *Dynamics of the geothermal field, stimulation and reservoir assessment*

- 4.1.1 Stress pattern
- 4.1.2 Stimulation and improvement of the permeability of a geothermal field
- 4.1.3 Dynamics of the fissured horizons and induced microseismicity
- 4.1.4 Reservoir physics and physical properties of rocks and hydro fracturing group
- 4.1.5 Fluids, rock-fluid interaction, tracer and geochemistry, scaling factor

4.2 *Drilling*

- 4.2.1 Drilling cost effectiveness and feasibility of high-temperature drilling
- 4.2.2 Micro-drilling and laser drilling

For each of the above, the state-of-the-art must be established in order to identify and analyse the best practices to be adopted, the innovative concepts to be applied or developed, as well as the main gaps in knowledge and/or technology.

Progress towards objectives – tasks worked on and achievements made with reference to planned objectives, identify contractors involved

Two WP meetings were organized during the Mid Term conference. The first one for WP 4 held 09.01.2007 and the second one together with WP7 on 12.01.2007. Presentation of the status of activities of each partner was made and a table made to show outstanding work. Organisation of WP 4&7 activities was the main topic for the second meeting. Experts in drilling and reservoir assessment were nominated and the list was to be completed at the Reykjavik workshop The organisation of the Reykjavik workshop 4 was also discussed. Minutes were prepared of these meetings.

Workshop 4 of the ENGINE project “Drilling cost effectiveness and feasibility of high-temperature drilling” was organised by Iceland GeoSurvey (ISOR) in Reykjavik. The Workshop took place from 2nd to 5th July 2007 with 67 participants from 13 European countries and additional participants and contributions from El Salvador, Philippines, and Canada. Four thematic sessions were defined (Case histories of EGS and high-temperature drilling; Innovative technology and drilling effectiveness; Well design and cementing; Reservoir assessment, stimulation, testing and logging). The abstracts, PowerPoint presentations, posters and the main conclusions are available on the workshop Web page and are to be published in time for the Final Conference on a CD-ROM. Two field trips were organized for the participants.

A joint meeting for WP4 and WP7 was held in Reykjavik at the time of workshop 4. On the agenda was: Presentation of the status of each partner, designation of missing experts, discussion on proposed

structure - Best Practice Guide, reservoir assessment, roadmap for remaining work.

A report dedicated to chemical stimulation has been prepared by DHMA as a result of a specific analysis (Deliverable 28): Review on chemical stimulation techniques in oil industry and applications to geothermal systems by Sandrine Portier, Laurent André & François-D. Vuataz.

Deviations from the project work programme, and corrective actions taken/suggested: identify the nature and the reason for the problem, identify contractors involved

No major deviation from the project work programme has to be mentioned for the reporting period.

GFZ has not contributed to this workpackage although it was originally planned. This is mainly because its involvement has been focused on expertise on drilling and stimulation and because, for practical accounting reasons, GFZ has not been able to charge the activity of the staff.

NSCRD, GPC, IFE, CERTH and FEDCO have been very much involved in the activities of this workpackage and have over passed their originally planned person months.

Table 4c: Deliverables List

Del n°	Deliverable name	WP n°	Date due	Actual/Forecast delivery date	Lead contractor
21	Proceedings of the Launching conference, Session 4. The drilling, stimulation and reservoir assessment of Unconventional Geothermal Resources and Enhanced Geothermal Systems	4	t3	13-15 February 2006	4
22	Proceedings of the Mid term conference, Session 4. The drilling, stimulation and reservoir assessment of Unconventional Geothermal Resources and Enhanced Geothermal Systems	4	t14	9-12 January 2007	4
23	Proceedings of the Final conference, Session 4. The drilling, stimulation and reservoir assessment of Unconventional Geothermal Resources and Enhanced Geothermal Systems	4	t25		4
24	Guide to the Workshop 3 "Stimulation of reservoir and induced microseismicity"	4	t17	29 June–1 July 2006	4
25	Guide to the Workshop 4 "Drilling cost effectiveness and feasibility of high-temperature drilling "	4	t19	2-5 July 2007	4
26	A review article about recent progress in knowledge concerning the Dynamics of the geothermal field	4	t25		4
27	A review article about Drilling	4	t25		4
28	Reports of study and analysis	4	t25	One report: May 2007	4
29	General scientific dissemination (multimedia programmes, articles and information brochures, to be decided according to the results of the integration) about drilling, stimulation and reservoir assessment of Unconventional Geothermal Resources and Enhanced Geothermal Systems	4	t25		4

Table 5b: Milestones List

M. no	Milestone name	WP no.	Date due	Actual/Forecast delivery date	Lead contractor
5	Workshop 3	4	t17	29 June–1 July 2006	4
9	Workshop 4	4	t19	2-5 July 2007	4

Workpackage number	5		Start date or starting event:		t1												
Activity type	Co-ordination activity																
Participant ID	1	3	6	7	8	9	10	18	22	23	26	27	30	31	33	36	
Person-months per participant:	2	3	1	3	1	5	6	4	3	2	3	3	5	1	3	2	

1.3.1. Objectives, Exploitation, economic, environmental and social impacts

The objective of Workpackage 5 is to integrate scientific and technical know-how and practices related to the development and management of exploitation. It will also identify and analyse the environmental and socio-economic barriers that hamper the development of the geothermal industry.

The breakdown of Workpackage 5 is following the main scientific issues:

5.1. Exploitation

- 5.1.1. Unconventional exploitation systems
- 5.1.2. Development of innovative tools for exploitation
- 5.1.3. State-of-the-art of down-hole fluid treatments
- 5.1.4. Plant and reservoir monitoring
- 5.1.5. Re-injection

5.2. A global economic approach of geothermal energy

- 5.2.1. Sustainability of geothermal energy
- 5.2.2. Multiple integrated uses group
- 5.2.3. Socio-economic benefits of geothermal exploitations
- 5.2.4. Energy-economic placements

5.3. Environmental impacts

- 5.3.1. Barriers to development
- 5.3.2. Microseismicity and risk assessment related to stimulation and exploitation
- 5.3.3. Conditions for a 100% clean exploitation of geothermal energy

5.4. Increasing policy makers awareness and public acceptance

- 5.4.1. Building a network for political support
- 5.4.2. Societal needs and public requirement
- 5.4.3. Communication policy

For each of the above, the state-of-the-art must be established in order to identify and analyse the best practices to be adopted, the innovative concepts to be applied or developed, as well as the main gaps in knowledge and/or technology.

Progress towards objectives – tasks worked on and achievements made with reference to planned objectives, identify contractors involved

Article about economics.

“Economic analysis of geothermal energy provision in Europe”, 29/10/2007

Besides the use of high enthalpy fields, which are limited to a few places and in most cases already used, an extended geothermal electricity generation in the future needs especially to the larger potential of low enthalpy resources which are scarcely exploited so far. Apart from technical challenges which power production from geothermal low enthalpy fields are facing, also economic barriers hinder the wider use of geothermal energy within Europe. Therefore the power production costs of geothermal low enthalpy fields will be analysed in this paper in order to identify the crucial cost factors and to point out which measures could result in a widely economic feasible geothermal power production in Europe.

Article about socio-economics/Article about non-technical barriers.

"Non-technical Barriers preventing a Further Use of Geothermal Energy", 29/10/2007

The article about socio-economic benefits was discussed for the first time during the 2nd work package meeting in Strasbourg. In agreement with the attending partners, the title was changed to non-technical barriers which are more appropriate to consider on a European scale.

Article about environmental impacts. The article about environmental impacts will be co-ordinated by IE. Based on the paper authored by CRES "Environmental Impact of the Geothermal Industry" (see Launching Conference) and a study made for the Federal Ministry of Environment in Germany by IE this article will be composed. The article will be available by the next reporting period.

Workshop 6. Workshop 6 was organised by CRES. The location of this workshop was moved to Athens in order to enable an easier access to speakers and presenters. Over 20 presentations and 30 participants led to a successful meeting in September 2007. The presentations as well as a summary of the workshop have been put on the Engine-website. During the workshop a work package meeting took place.

Article about awareness and acceptance. This article will be co-ordinated by CRES. The article will be based on the experiences and information of workshop 6.

Reports of study and analysis. General reports of study and analysis have been provided by the WP5 partners CRES, IVTRAN, JSC, IGR, IGG and IE. Among these studies and analysis (Deliverable 39), the specific analysis done by E. Shpilrain, Advanced efficient cycles and schemes for geothermal energy conversion in the frame of FP6 project "ENGINE", is considered an important contribution for the development of new energy conversion systems.

Deviations from the project work programme, and corrective actions taken/suggested: identify the nature and the reason for the problem, identify contractors involved

Deviations from the project work programme are:

Workshop 6 was delayed to September 2007; the location was moved to Athens

GFZ has not contributed to this workpackage although it was originally planned. This is mainly because its involvement has been focused on expertise on drilling and stimulation and because, for practical accounting reasons, GFZ has not been able to charge the activity of the staff.

IGR has been very much involved in the activities of this workpackage and has over passed the originally planned person months (3 months while no more time was available for year 2).

Table 4d: Deliverables List

Del n°	Deliverable name	WP n°	Date due	Actual/Forecast delivery date	Lead contractor
30	Proceedings of the Launching conference, Session 5. Exploitation, economic, environmental and social impacts	5	t3	13-15 February 2006	10
31	Proceedings of the Mid term conference, Session 5. Exploitation, economic, environmental and social impacts	5	t14	9-12 January 2007	10
32	Proceedings of the Final conference, Session 5. Exploitation, economic, environmental and social impacts	5	t25		10
33	Guide to the Workshop 5 "Electricity generation, combined heat and power"	5	t21	14-16 September 2006	10
34	Guide to the Workshop 6 "Increasing policy makers awareness and the public acceptance"	5	t10	13-14 September 2007	10
35	An article about Economic approach of geothermal energy	5	t25	29 October 2007	10
36	An article about Socio-economic benefits of geothermal exploitations	5	t25	29 October 2007	10
37	An article about Environmental impacts	5	t25		10

38	An article about Increasing policy makers awareness and public acceptance	5	t25		10
39	Reports of study and analysis	5	t25	One report: October 2007	10
40	General scientific dissemination (multimedia programmes, articles and information brochures, to be decided according to the results of the integration) about the development and management of exploitation	5	t25		10
41	General scientific dissemination (multimedia programmes, articles and information brochures, to be decided according to the results of the integration) about economic, environmental and social impacts	5	t25		10

Table 5c: Milestones List

MI n°	Milestone name	WP no.	Date due	Actual/Forecast delivery date	Lead contractor
6	Workshop 5	5	t21	14-16 September 2006	10
10	Workshop 6	5	t10	13-14 September 2007	10

Workpackage number	6			Start date or starting event:				t14				
Activity type	Co-ordination activity											
Participant ID	1	3	4	6	8	11	14	17	22	25	29	35
Person-months per participant:	1	2	1	1	2	2	1	2	2	4	6	2

Objectives, Expertise on investigation of Unconventional Geothermal Resources and EGS

The objective of this expertise is, using information collected during the integration phase of the Co-ordination Action, an evaluation of the most pertinent methods for resource investigation of Unconventional Geothermal Resources and Enhanced Geothermal Systems. Generic studies for such resources will be realised in contrasting geo-environments in Europe. Two chapters 1a and 1b of the Best Practice Handbook concerning the definition of innovative concepts for investigating geothermal energy and Highlights of Generic studies for Unconventional Geothermal Resources and Enhanced Geothermal Systems in contrasting geo-environments in Europe will be the deliverables of this work.

Progress towards objectives – tasks worked on and achievements made with reference to planned objectives, identify contractors involved

The main objective of the Work Package 6 is to provide chapter 1a and 1b of the Best Practice Handbook and chapter 1 of the European Reference Manual for the development of Unconventional Geothermal Resources and Enhanced Geothermal Systems.

In order to do so, the following steps were achieved :

- conclusion of the steering committee in Volterra (Workshop 2) were compiled into a first draft version and submitted as a base of further discussions to the partners of the WP6
- a special meeting concerning WP6 was organised in GEOWATT, Zürich on June, 4th 2007. The structure of the Best Practice Handbook was deeply discussed and important decisions concerning contents of the book were made. At this occasion, the structure and content of the chapter 1 was adjusted (see "Deviations from the project work programme"). The following institutions were represented at this meeting: BRGM, GEIE, GEOWATT, GEMRC, GFZ, IGEM, IGG, TNO, VUA, ELTE.
- no contact could be established to PGI, they are absent at meetings
- the results of the meeting were compiled into a new document, detailing the structure and contents of the chapter. In this document, expected contributions of the members of the Work Package were defined. Each partner was asked to write a part of the chapter, as decided in Zürich, according to his competence field. This document was sent in mid July to the WP6 partners. The following institutions were asked to contribute to the chapter: BRGM, GEIE, GEOWATT, GEMRC, GFZ, IGEM, IGG, ISOR, TNO, VUA, ELTE.
- contributions of the authors came back in early September and were integrated into the structure of the Best Practice Handbook chapter 1.
- first results were presented to the steering committee and to the Stakeholder Committee in Brussels on September 21st. "Presentation Best Practice Handbook Chapter 1: Site investigation and Reservoir Characterization"

The contribution of the authors was reformulated in order to enhance the clarity of the Best Practice Handbook chapter 1. Results were discussed with the steering committee in Leiden on November the 7th, during the Workshop 7.

Deviations from the project work programme, and corrective actions taken/suggested: identify the nature and the reason for the problem, identify contractors involved

The content and title of the two subchapters 1a and 1b will be lightly modified, according to the conclusion of the discussions lead in Zürich in June 2007 with all the Workgroup partners:

- chapter 1a: "Site Screening using a Downscaling Workflow" is the proposed title for chapter 1a. It will provide a state of the art of the different methods used to investigate (locate and identify) a geothermal reservoir.
- chapter 1b: "From different geo-environments to analogue sites" will provide workflow examples in different geo-environments and will identify the research needs and propose analogue sites to investigate problems or develop new methods and concepts to help identifying geothermal reservoirs.

GFZ, VUA, ELTE, GEMRC has contributed to this workpackage but, for practical accounting reasons, has not been able to charge the activity of the staff. BRGM has over passed the originally planned person months (2 months instead of 1 month available for year 2).

Table 4e: Deliverables List

Del n°	Deliverable name	WP n°	Date due	Actual/Forecast delivery date	Lead contractor
42	A chapter 1a of the Best Practice Handbook on the definition of innovative concepts for investigating geothermal energy	6	t30		29
43	A chapter 1b of the Best Practice Handbook on generic studies for Unconventional Geothermal Resources and Enhanced Geothermal Systems in contrasting geo-environments in Europe	6	t30		29
44	A chapter 1 of the European Reference Manual for the development of Unconventional Geothermal Resources and Enhanced Geothermal Systems	6	t30		29

Workpackage number	7						Start date or starting event:						t14				
Activity type	Co-ordination activity																
Participant ID	1	3	4	6	13	14	16	19	20	21	28	31	32	33	34	36	
Person-months per participant:	1	6	1	1	2	1	3	1	1	1	3	2	2	1	1	1	

Objectives, Expertise on drilling, stimulation and reservoir assessment

The objective of this expertise is, using information collected during the integration phase of the Co-ordination Action, an evaluation of the most pertinent methods for drilling and reservoir assessment. A chapter 2 of the Best Practice Handbook and the definition of innovative concepts will be the deliverables of this work.

Progress towards objectives – tasks worked on and achievements made with reference to planned objectives, identify contractors involved

The ENGINE Midterm conference, which took place in Potsdam January 9 -12 2007, with 118 participants, was scientifically prepared, organized and hosted by GFZ (3). Conference sessions covered: 1. Global developments, 2. Exploitation, economic, environmental and social impacts, 3. Drilling stimulation and reservoir assessment, 4. Investigation of unconventional geothermal resources and particular enhanced geothermal systems and 5. Dissemination and information. A book of abstracts was compiled and edited, which was made assessable to conference participants, as hard copy and CD. The book of abstracts is meanwhile available via the ENGINE web page <http://conferences-engine.brgm.fr/conferenceDisplay.py?confId=4> alongside minutes of all committee meetings (Executive group meeting, Stakeholder meeting and Steering committee meeting) which took place during the conference.

The ENGINE workshop 4, Drilling cost effectiveness and feasibility of high temperature drilling, Reykjavik, July 2 - 5, 2007, was scientifically co-prepared. Abstract contributions were provided with the topics :

- drilling into deep sedimentary reservoirs – case study Groß Schönebeck (Brand, W.)
- innova Rig - an instrument for a European Geothermal Drilling Program (Huenges, E.)
- evaluation of cementing integrity using distributed temperature sensing (Henninges, J.)
- conventional logging - geothermal wells (Schulte, T.)

A joint WP4/WP7 working group meeting took place at the Reykjavik workshop with participation from: FEDCO (33), IGME (31) MESY (16), BRGM (1), BESTEC (GEIE (14)), GGA (13), TNO (6), LAGEO (36), GEOWATT (29), IFE (21), GFZ (3), ISOR (4). In order to further move forwards towards the deliverables of work package 7, the chapter 2 of a Best Practice Handbook (deliverable no. 45) and a chapter 2 of a European Reference Manual (deliverable no. 46), tasks were specified regarding identification and provision of key publications, associated participants responsible for these tasks were identified, and deadlines agreed on, regarding handing in of key publications and participant contributions to the Best Practice Guide. Additional to the list of experts already nominated, Ragnar Asmundson of ISOR (4), volunteered to act as ENGINE expert in the field of well stimulation in volcanic settings.

Deviations from the project work programme, and corrective actions taken/suggested: identify the nature and the reason for the problem, identify contractors involved

No deviation from the project work programme has to be mentioned for the reporting period. Nevertheless, two adaptations can be reported :

- a special meeting for testing deep geothermal wells, was held in Bochum by Fritz Rummel (Mesy(16)) trying to fulfil his expert role within the project, by providing a contribution to deliverable No. 45. Special meeting participation was: BRGM (1), GGA (13), GFZ (3), MESY (16).
- with regard to the initial budget, GFZ travel costs have been higher than estimated, due to extensive contributions to ENGINE workshops and conferences. These contributions came to a major degree from GFZ staff, bringing their expertise into the project, without being actually paid by ENGINE. At the same time, the GFZ costs spent on personnel were lower than in the initial budget.
- CERTH has over passed the originally planned person months (3 months instead of 2 months available for year 2) while IIE has not been involved in the activities of this workpackage for practical reasons related to the delay for the transfer of budget.

Table 4f: Deliverables List

Del n°	Deliverable name	WP n°	Date due	Actual/Forecast delivery date	Lead contractor
45	A chapter 2 of the Best Practice Handbook and the definition of innovative concepts for drilling, stimulation and reservoir assessment	7	t30		3
46	A chapter 2 of the European Reference Manual for the development of Unconventional Geothermal Resources and Enhanced Geothermal Systems	7	t30		3

Workpackage number	8			Start date or starting event:				t14				
Activity type	Co-ordination activity											
Participant ID	1	3	7	9	10	18	22	26	27	33	34	36
Person-months per participant:	1	1	2	2	2	5	2	3	2	1	1	1

Objectives, Expertise on exploitation, economic, environmental and social impacts

The objective of this expertise is, using information collected during the integration phase of the Co-ordination Action, an evaluation of the most pertinent methods for exploitation of the geothermal resource. The economic, environmental and social impacts will be illustrated and proposals for promotion of the positive impacts will be made. A chapter 3 of the Best Practice Handbook and the definition of innovative concepts will be the deliverables of this work.

Progress towards objectives – tasks worked on and achievements made with reference to planned objectives, identify contractors involved

During the Engine Mid Term conference (Potsdam, January 2007) the Engine expert group was set up comprising distinguished experts from the geothermal community from exploitation oriented firms with good knowledge of the geothermal market, related economics, environmental issues and socio-economic barriers. The group consists of the following members:

Dr. C. Karytsas	CRES	chairman	WP8 participant
Mr. D. Mendrinou	CRES	member	WP8 participant
Mr. Z. Sarmiento	FEDCO	member	network partner
Dr. K. Povarov	JSC	member	WP8 participant
Dr. A. Alkhasov	IGR DSC RAS	member	WP8 participant
Prof. O. Mertoglu	ORME	member	WP5 participant
Dr. L. Le Bel	BRGM	member	WP8 participant
Dr. D. Tournaye	CFG	member	WP8 participant
Dr. P. Ungemach	GPC	member	industry
Dr. O. Flovenz	ISOR	member	research agency
Prof. J. Goldbrunner	GEOTEAM	external	industry
Dr. P. Seibt	GTN	external	industry
Dr. J. Van Wees	TNO	observer	WP5 participant

The experts group composition was approved by the project executive group during its meeting of Potsdam.

Since then, the above group of experts has been working towards the preparation of chapter 3 of the best practice handbook and the definition of innovative concepts of exploitation (deliverable 47), towards the preparation of chapter 4 of the best practice handbook analysing the economic, environmental and social impacts (deliverable 48), as well as towards the preparation of chapter 3 of the European reference manual for the development of unconventional geothermal resources and enhanced geothermal systems (deliverable 49).

The experts group evaluated all different aspects of geothermal energy exploitation and economic, environmental and social impacts. The results are included in the chapters under preparation as follows:

Best practice handbook chapter 3 “Exploitation: best practices and innovation needs”: Plant configurations (condensing, binary, hybrid, combined geothermal and gas), economic considerations, thermodynamic cycle, turbine type, plant cooling means, technology, cogeneration of heat and power, fluid supply an

disposal (wells, casing, piping, production pumps, reinjection pumps, heat exchangers, inhibition systems), heating, environmental protection, field management, monitoring and control, further R&D needs.

Best practice handbook chapter 4 “Environmental and socioeconomic impact”: Emissions reduction, benefits to local environment and community, environmental concerns in low enthalpy hydrothermal fields, high enthalpy hydrothermal fields and enhanced geothermal systems, social aspects.

European reference manual chapter 3 “EGS exploitation”: Scientific and technical aspects, power generation in cases of hydrothermal fields, enhanced geothermal systems and unconventional geothermal resources, heat supply, cogeneration of heat and power, economic constraints, induced seismicity, R&D needs towards delivered unit energy costs reduction.

For this purpose the experts group took into consideration the work, the reports and the results of the workshops and conferences produced for the purposes of this project and especially for work package 5. In general the work was organised as follows:

Expert group members from CRES (WP8 leader) prepared the draft deliverables 47-48-49. These were mailed out several times to the other members of the Expert Group as well as to the WP 5 and 8 partners, who replied with their comments. The chapters were then discussed during the Athens Workshop. In addition, based on the above work, research policy priorities for EGS were drafted and discussed during the Brussels meeting of 20th September 2007.

Deviations from the project work programme, and corrective actions taken/suggested: identify the nature and the reason for the problem, identify contractors involved

No major deviations from the program are observed.

GFZ has contributed to this workpackage but, for practical accounting reasons, has not been able to charge the activity of the staff. IIE has not been involved in the activities of this workpackage for practical reasons related to the delay for the transfer of budget.

Table 4g: Deliverables List

Del n°	Deliverable name	WP n°	Date due	Actual/Forecast delivery date	Lead contractor
47	A chapter 3 of the Best Practice Handbook and the definition of innovative concepts for exploitation	8	t30		18
48	A chapter 4 of the Best Practice Handbook analyzing the economic, environmental and social impacts	8	t30		18
49	A chapter 3 of the European Reference Manual for the development of Unconventional Geothermal Resources and Enhanced Geothermal Systems	8	t30		18

Workpackage number	9		Start date or starting event:				t25							
Activity type	Co-ordination activity													
Participant ID	1	3	4	6	7	10	11	16	18	20	26	27	29	30
Person-months per participant:	1	1	1	5	1	1	1	1	1	1	1	1	1	1

Objectives, Risk evaluation for the development of geothermal energy

The objective of this expertise is a technical and socio-economic risk evaluation for the development of geothermal energy taking into account the information collected during the bottom up and expertise phases of the Co-ordination Action. It will also aggregate the main conclusions of each expertise. A European Reference Manual for the development of Unconventional Geothermal Resources and Enhanced Geothermal Systems will result of this work.

Progress towards objectives – tasks worked on and achievements made with reference to planned objectives, identify contractors involved

The work of the work package consisted of attending all the workshops and meetings of ENGINE and to prepare the workshop 7” Risk analysis for development of geothermal energy”. The workshop has been organised as planned, involving WP leaders from WP6, WP7 and WP8, providing an excellent starting point for an integrated presentation of risk evaluation for the development of geothermal energy.

The workshop’s discussion focussed on rationales for future research needed to fill in gaps

Deviations from the project work programme, and corrective actions taken/suggested: identify the nature and the reason for the problem, identify contractors involved

For deliverable 51 and 52 it has been decided, in close feedback to comments of stakeholders of the stakeholder meeting in Brussels 20th September that Engine should focus on delivering advices for future research facilitating uptake of EGS fitting in the EU agenda of renewable energy for 2020.

For this reason, it has been decided by the Steering Committee of Engine that WP9 will focus on delivering techno-economic methods and tools for a quick scan of EGS prospectivity in Europe for the next 5-10 years, identifying technical, economic and legal/HSE barriers to be overcome by future research and EU incentives. A draft report on techno-economic methods and tools will be presented at the final meeting, serving as starting point to be filled in by country coordinators to allow to build a portfolio of prospectivity and techno-economic barriers therein.

Table 4h: Deliverables List

Del n°	Deliverable name	WP n°	Date due	Actual/Forecast delivery date	Lead contractor
50	Guide to the Workshop 7 "Risk analysis for development of geothermal energy"	9	t27		6
51	An article presenting the risk evaluation for the development of geothermal energy	9	t30		6
52	European Reference Manual for the development of Unconventional Geothermal Resources and Enhanced Geothermal Systems	9	t31		6

Table 5d: Milestones List

MI n°	Milestone name	WP no.	Date due	Actual/Forecast delivery date	Lead contractor
6	Workshop 5	50	t27		6

1.4. SECTION 3 – CONSORTIUM MANAGEMENT

This section presents the status of the project, its management and follow-up activities, including information on :

- consortium management tasks and their achievement; problems which have occurred and how they were solved
- contractors: Comments regarding contributions, changes in responsibilities and changes to consortium itself¹, if any. The schedule of the ENGINE coordination activity is presented in figure 5.

Other information about the ENGINE consortium management activities are presented within the periodic management report.

Workpackage number	1	Start date or starting event:	t1
Activity type	Management activity		
Participant ID	1		
Person-months per participant:	10		

Objectives, the project management

The objectives of the project management are (i) the preparation, start up and closure of the project administration and organisation, (ii) the reporting with the Authorities of the 6th Framework, (iii) the smooth and streamlined information flow within the consortium, (iv) the controlling duties of the project.

Progress towards objectives – tasks worked on and achievements made with reference to planned objectives, identify contractors involved

The management activity of the coordination action has mainly consisted in:

1. Following up the project administration and organisation

- Following up administrative and organisation procedures in BRGM
- Signature of the contract with the Targeted Third Countries (February 2007)
- Transfer the second pre-financing budget to all the partners (June 2007)
- Setting up the stakeholders committee (meetings on 10 January, 20 September 2007)
- Support to work package leader for settlement of work package activities
- Organisation of the meetings of the Executive Group (10 January, 20 September 2007) and Steering Committee (8 November, 11 December 2006, 12 January, 2 April, 20 September 2007)
- Organisation of the Mid-term conference: 122 registered participants, involvement of 30 partners

¹ Changes to the consortium membership must be addressed in a specific request for an amendment to the contract

of the ENGINE network, participation of 15 non-partner research institutes, 53 presentations that can be downloaded from the [Website](#), 26 European and non-European countries represented, presentation of the other geothermal energy FP instruments (EGS Pilot Plant, I-GET, HITI).

- Presentation of communications at the Launching conference:
 - o R. Emmermann
 - o J. Schuppers
 - o C. Fouillac, Geothermal energy and strategies to reduce greenhouse gas emissions
 - o P. Ledru, A. Genter, Why a co-ordination action about Enhanced Geothermal System?

Reporting with the Authorities of the 6th Framework

- Participation of Scientific Officer to the Executive Group
- Communication of the reports of the meetings of the Executive Group and Steering Committee and of the Newsletters
- Preparation and acceptance of the first intermediate report
- Preparation of the second intermediate report

Smooth and streamlined information flow within the consortium

- Preparation of reports of the meetings of the Executive Group and Steering Committee
- Conception of the Newsletters (December 2006, March, June, August, October 2007)

Controlling duties of the project

Promotion of the ENGINE coordination action at an international level (expenses were charged on ENGINE project for the scientific communication in San Diego, following authorization of the Project Officer, all other expenses being covered by the inviting institution or by other funds).

Invited speaker in international panels:

- P. Ledru. Renewable energy. Electricity generation and Direct use, Geothermy. EU workshop, Mexico city, Mexico, 26-27 September 2006
- P. Ledru. Climate change and resource depletion: geological answers. French-Serbian European Summer University, Belgrade, 22 October 2006
- P. Ledru. Renewable energy. Electricity generation and Direct use, Geothermal energy. All-Party Parliamentary Group for Earth Sciences at the House of Commons, London, United Kingdom, 21 November 2006.
- P. Ledru. Co-ordination of the present research and development initiatives for geothermal energy in Europe and worldwide. 13th Annual Symposium NSG, Earth's Energy budget in Past, Present and Future, Universiteit Utrecht, Netherlands, 30 November 2006.
- A. Genter. Unconventional geothermal reservoirs in Europe for producing electricity: challenges and perspectives of the ENGINE project. Multi-Country workshop on EU legislation and best practices in geology for sustainable use of natural resources. Session D: Sustainable Use of Energy, Budapest, Hungary, 21-22 November 2006.
- P. Ledru. Renewable energy, Electricity generation and Direct use: Geothermal energy, Earth Sciences Group, House of Commons, London, 21 November 2006.
- A. Genter. The ENGINE coordination action: an overview, Geothermal Workshop, EGEC European Geothermal Energy Council, Brussels, Belgium, 24 November 2006.
- P. Ledru. European ENhanced Geothermal Systems development: the ENGINE project. Geothermal Energy from Oil and Gas Wells, Dallas, 12-13 June 2007.
- P. Ledru. R&D and industrial perspectives for the development and enhancement of geothermal systems in Europe. Séminaire franco-russe « Efficacité énergétique », Ekaterinburg, 24 septembre 2007
- P. Ledru. ENhanced Geothermal Innovative Network for Europe: a cooperation action aiming at

developing Unconventional Geothermal Resources. The International Conference on High Temperature Electronics, Oxford 17-19th September 2007.

Scientific communication:

P. Ledru et al. ENhanced Geothermal Innovative Network for Europe (the ENGINE Co-ordination Action). GRC meeting, San Diego, USA, 11-13 September 2006.

P. Ledru, A. Genter. ENhanced Geothermal Innovative Network for Europe. Proceedings European Geothermal Congress 2007 Unterhaching, Germany, 30 May-1 June 2007

P. Ledru et al. ENhanced Geothermal Innovative Network for Europe: the state-of-the-art. GRC meeting, Reno, USA, 1-3 October 2007.

Working group:

Presentation of the ENGINE project to Peter Reid from Petratherm (Australia) during an informal meeting in BRGM Orleans and a Soultz site visit on March 2006.

Executive Committee International Energy Agency, Geothermal Implementing agreement, IEA Headquarters, Paris, France, 16-17 March 2006

Executive Committee International Energy Agency, Geothermal Implementing agreement, San Diego, USA, 7-8 September 2006.

Information on ENGINE project and involvement of new TTC partners. IIE office, Cuernavaca, Mexico, 25 September 2006.

Information on Work Schedule under ENGINE Project and about prospects for cooperation with Russia, JSC Intergeotherm office, Moscow, Russia, 16 November 2006.

Participation to the Executive Committee International Energy Agency, Geothermal Implementing agreement, Nice, France, 16-17 March 2007.

Presentation of the ENGINE project and review of on going ENGINE actions at the Workshop organized in Moscow: Utilization of Geothermal Energy in Russian Federation, 21st September, 2007, Moscow

Participation to the Executive Committee International Energy Agency, Geothermal Implementing agreement, Kandel, Germany, 25-26 October 2007.

Preparation of spin-off projects

Participation to the preparation of the FP7 GEISIR Project to the 1st call for proposal of DG Research.

Preparation of a project "Structural controls on geothermal activity in western Turkey: analogues to the western great basin, USA" for a 1 year sabbatical year for J. Faulds (Bureau of Mine Nevada) in BRGM Orleans (project supported by a grant from Region Centre).

Deviations from the project work programme, and corrective actions taken/suggested: identify the nature and the reason for the problem, identify contractors involved

During the first year it had not been possible to prepare the six months report that was planned as the deliverable n°2. The approval of the second intermediate report by the scientific and administrative officer has been received and the preparation of another 6 months report was not relevant. The information of the Project Officer of the EU Commission has then been done through streamlined information flow: reports

of the meetings of the Executive Group (10 January, 20 September 2007) and Steering Committee (8 November, 11 December 2006, 12 January, 2 April, 20 September 2007), Newsletters (December 2006, March, June, August, October 2007). All these documents are available on the web-site. In case a report should be needed, an edition of all these documents will be done. Otherwise, this formal report will be considered as the deliverable n°2.

Table 4i: Deliverables List

Del n°	Deliverable name	WP n°	Date due	Actual/Forecast delivery date	Lead contractor
1	A project Manual, defining the guidelines of the Co-ordination Action, submitted for approval to the Executive Group, presentation at the Launching conference, Session 1	1	t3	29 November 2005	1
2	Six-months reports to the EU Commission	1	t3	15 December 2006	1

Table 5e: Milestones List

M. no	Milestone name	WP no.	Date due	Actual/Forecast delivery date	Lead contractor
1	Kick off meeting	1	t1	10-11 November 2005	1
2	Six-months reports to the EU Commission	1	t6, 12, 18, 24, 30	15 December 2006	1
3	Launching conference	1	t3	12-15 February 2006	1
7	Mid Term conference	1	t14	10-12 January 2007	
11	Final conference	1	t25		
13	Achievement of the Best Practices Handbook	1	t30		
14	Achievement of the European Reference Manual	1	t30		
15	Final meeting	1	t30		

1.5. SECTION 4 – OTHER ISSUES

The ENGINE project was not subjected to requirements and/or recommendations concerning ethical issues.

APPENDICE : List of deliverables

Deliverable 5: Proceedings of the Mid term conference, Session 2. Information and Dissemination System

Deliverable 7: A finalised Web site and an Information System (including an electronic monthly newsletter). Partly done, to be completed by the end of the project

Deliverable 8: The bibliography of the Co-ordination Action. Partly done, to be completed by the end of the project

Deliverable 10: Proceedings of the Mid term conference, Session 3. Investigation of Unconventional Geothermal Resources and Enhanced Geothermal Systems.

Deliverable 13: Guide to the Workshop 2 "Exploring Supercritical fluid reservoir: a new challenge for geothermal energy"

Deliverable 22: Proceedings of the Mid term conference, Session 4. The drilling, stimulation and reservoir assessment of Unconventional Geothermal Resources and Enhanced Geothermal Systems

Deliverable 24: Guide to the Workshop 3 "Stimulation of reservoir and induced microseismicity"

Deliverable 25: Guide to the Workshop 4 "Drilling cost effectiveness and feasibility of high-temperature drilling"

Deliverable 28: Report of analysis, Sandrine Portier, Laurent André & François-D. Vuataz, Review on chemical stimulation techniques in oil industry and applications to geothermal systems.

Deliverable 31: Proceedings of the Mid term conference, Session 5. Exploitation, economic, environmental and social impacts

Deliverable 34: Guide to the Workshop 6 "Increasing policy makers awareness and the public acceptance"

Deliverable 35: Article, M. Kaltschmitt, Economic approach of geothermal energy.

Deliverable 36: Article, M. Kaltschmitt, Socio-economics / non-technical barriers of geothermal exploitations.

Deliverable 39: Report of analysis, E. Shpilrain, Advanced efficient cycles and schemes for geothermal energy conversion in the frame of FP6 project "ENGINE"



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