ENGINE WP4

Drilling, Stimulation and Reservoir Assessment

Status at Mid-term Conf.

Sverrir Thorhallsson

Potsdam, January 10, 2007

WP4 closed meetings at the Mid term Conference

Agenda for January 10 at 8:30-10:30:

1. **Formalities (Welcome/Apologies/Attendance)**
2. **Organization of WP4 in 2006, compilation of received material.**
3. **Presentation of the status of activities of each partner.**

Agenda for January 12 at 14:30-16:00:

4. **Organization of WP 4&7 activities --- We have to choose an expert group to help the WP leaders!**
5. **Organization of Workshop Reykjavik "Drilling cost effectiveness and feasibility of high-temperature drilling", Workshop 4, 28-29 June 2007**

WP4 at Launching Conf.

WP4 and WP7

- WP4 - Drilling, stimulation and reservoir assessment (S. Thorhallsson, T. Kohl)
  - Drilling technology, reservoir modeling and management
  - Gaps, barriers and cost effectiveness
- WP7 - Expertise on drilling, stimulation and reservoir assessment (E. Huenges)
  - Synthesis on best practices, barriers holding back development and possible solutions

WP4 objectives

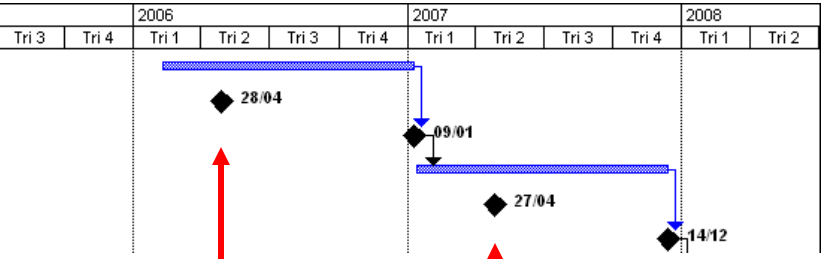
- The objective of Workpackage 4 is to integrate scientific and technical know-how and practices related to the drilling, stimulation and reservoir assessment of Unconventional Geothermal resources and Enhanced Geothermal Systems.
- The breakdown of Workpackage 4 is following the main scientific issues:
  - *Dynamics of the geothermal field, stimulation and reservoir assessment*
    - Stress pattern
    - Stimulation and improvement of the permeability of a geothermal field
    - Dynamics of the fissured horizons and induced microseismicity
    - Reservoir physics and physical properties of rocks and hydro fracturing group
    - Fluids, rock-fluid interaction, tracer and geochemistry, scaling factor
  - *Drilling*
    - Drilling cost effectiveness and feasibility of high-temperature drilling
- Micro-drilling

Some WP4 topics

- Drilling technology:
  - State of the art. Ways to cut cost. HT drilling.
- Operational experiences:
  - 10 sites with existing wells, 3 sites in prep.
- Reservoir enhancing methods:
  - hydraulic, thermal, explosive, chemical.
- Testing:
  - Hydraulic, tracers, scaling, monitoring syst.

WP4 time plan

N°	Nom de la tâche	Durée	Début
32	Integration 1	240 jours	Mar 07/02/06
33	Workshop 3	2 jours	Ven 28/04/06
34	Mid term conference and review	3 jours	Mar 09/01/07
35	Integration 2	240 jours	Ven 12/01/07
36	Workshop 4	2 jours	Ven 27/04/07
37	Final conference of the CA	3 jours	Ven 14/12/07

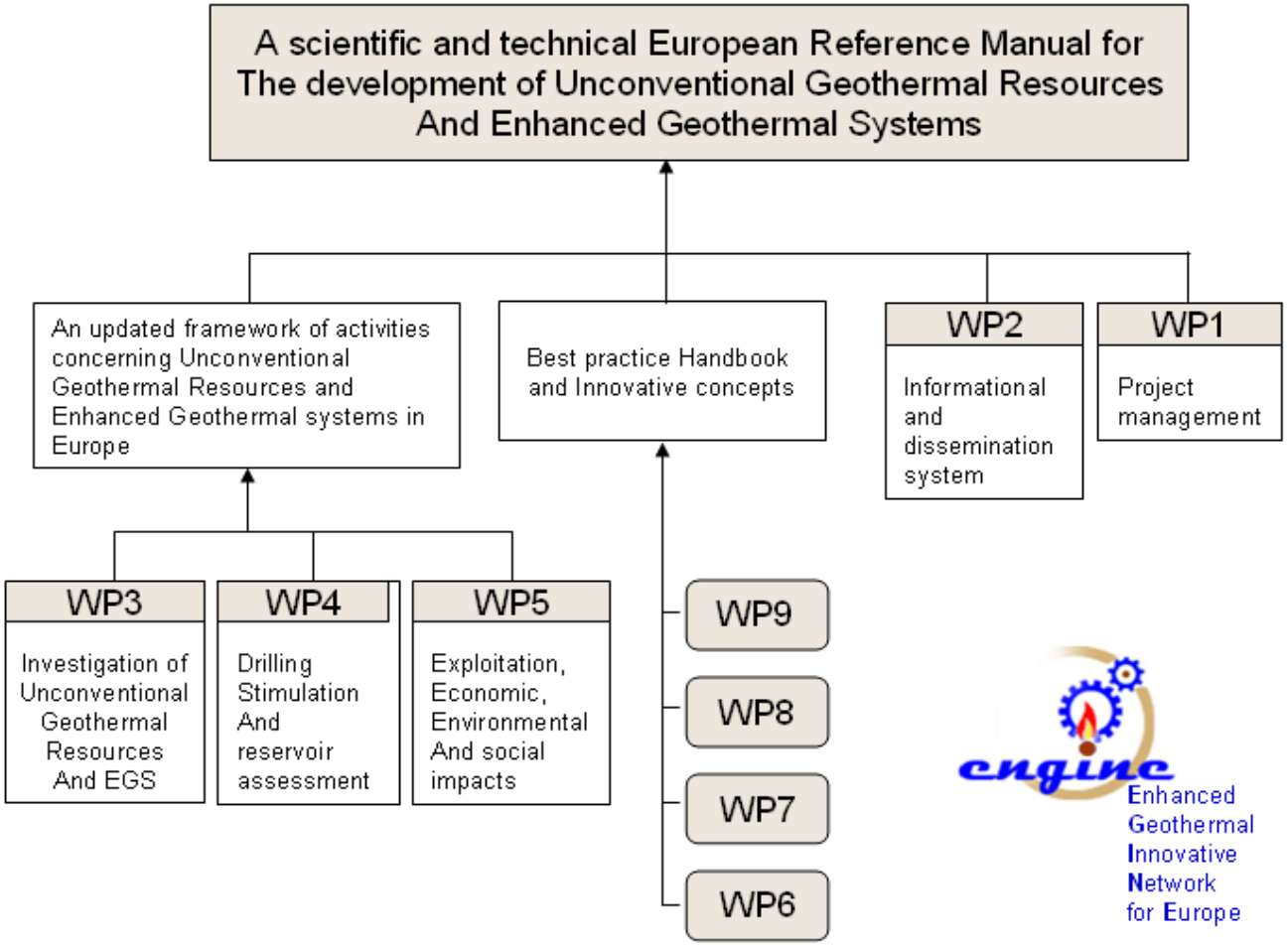


Zurich Reykjavík

Workshop 3 “Stimulation of reservoir and induced microseismicity” to be held in Switzerland, organised by GEOWATT.

Workshop 4 “Drilling cost effectiveness and feasibility of high-temperature drilling” to be held in Iceland, organised by ISOR.

Structure



engine
Enhanced Geothermal Innovative Network for Europe

engine

Request for info. from partners

ENGINE WP4/WP7 PARTNERS
REQUEST FOR INFORMATION BY MARCH 10th

Now that ENGINE has been launched it is time organize the WP in more detail. The project proposal gives the overall description of the goals of ENGINE and outlines the plans for each of the work packages. Additional information was provided in Orléans during the Launching Conference.

From you, the ENGINE partners taking part in WP4 and WP7, we need the following information at this time to plan the work for the first term. We the information is needed by March 10th as the first plan will be prepared on March 15th.

1. In order to communicate with each of the partners we need the name of the contact person for WP4 and WP7. The recipients of this e-mail are assumed to be the person in question. If this is not so, please inform by e-mail to s@isor.is.

2. Two specialized workshops are already planned. Each of the partners must contribute to at least one of the two workshops :
Workshop 3 “Stimulation of reservoir and induced microseismicity” to be held in Switzerland end of June 2006, organized by GEOWATT,
Workshop 4 “Drilling cost effectiveness and feasibility of high-temperature drilling” to be held in Iceland end of June 2007, organized by ISOR.

As stated in the project description “the state-of-the-art must be established in order to identify and analyze 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”. Active participation in the workshops is essential for this to be successful. We would at this time like to hear what subjects you will cover and also the suggested title of paper to be presented at the workshops. This will allow the WP leaders to identify early where there is coverage of the subject and where there may be gaps. Ernst Huenges has drafted the attached map (.pdf file) with keywords for the critical items to be covered and who will provide the expertise. This is just a first draft, but after having received the replies to this e-mail a revised one will be prepared.

By 10th March 2006 by each participant: obligatory 1-3 lines to define the input of each institute for WP 4. Also titles of workshop titles you plan to submit (Note: At the proper time the papers will be formally submitted through the ENGINE web page). Please send this information to **s@isor.is**.

March 3, 2006

BRGM

As promised please find here enclosed some requested information for WP4/WP7:

- 1) The WP4/WP7 brgm contact will be Hubert Fabriol (h.fabriol@brgm.fr). For the moment, it will be the same person even though for the expertise (WP7), the brgm contact could change in the future.

- 2) for the forthcoming Zurich meeting, we will send directly the brgm participant list to Geowatt. Several brgm people will attend this workshop. As far as I know, S. Gentier, A. Blaisonneau, Ph. Jousset, A. Bitri. Ph. Calcagno for the WP2 will probably attend the meeting.

- 3) The main subjects and brgm inputs dealt with

  - Hydro-mechanical modelling of hydraulic stimulations in a fractured granite based on the Soultz hydraulic experiments. The main persons involved are Sylvie Gentier, Arnold Blaisonneau, & Xavier Rachez. Our contribution will be more focused on a better understanding of the physical mechanisms which take place during hydraulic stimulations of a fractured granite. Generalizing to other EGS sites having different seismo-tectonic conditions has to be discussed and evaluated in the framework of Engine workshops.

  - New methodology for characterising hydrothermal systems based on broadland seismology (Guadeloupe, Soultz). The main persons involved are Philippe Jousset, Hubert Fabriol and Adnan Bitri.

DHMA

- The input of DHMA will concern the following topics:
- - Planning and management of deep boreholes.
- - Application of integrated data analysis for reservoir engineering.
- - Hydraulic and chemical stimulation techniques.

Geowatt

- "reservoir modelling and management" (subtopics: reservoir modelling; sustainable operation; energy supply) hydraulic testing, target injection) and
- "stimulation techniques" (subtopics:hydraulic fracturing; shearing waterfracs; proppant fracs; induced seismicity measurements - interpretation & modelling) and thermal stimulation
- We are preparing a review paper on stimulation techniques that will be presented at the workshop

GGA

- Our contribution will be about the experiences we gained from massive water frac stimulations and extensive hydraulic testing we performed at our deep test well Horstberg Z1. Being involved in the Soultz project, we can tell about the transferebility of the water frac technique from different geological settings. We can also compare geophysical frac monitoring done during the stimulation with results from the Soultz site.
- Planning to drill a well at our Hannover site and applying concepts and methods developed at the test well, we will be able to discuss results from different deep wells. We will also have experiences in operation of a drilling project.
- We would like to contribute to workshop 3: "Massive stimulation and hydraulic tests performed in low-permeable sediments" may be the working title of our contribuation.
- Concerning WP 4, at the end of June 2007, we hopefully started drilling a 3,8 km deep well at our site in Hannover. At that point we will be able to share the experiences with the cost of drilling and of course with operating a drilling project. Peculiarity will be, that we drill directly besides a residential area. In this field not too much experience ist there, which, however, we consider very important and worthwhile to share with the project.
- working title: "Experiences with drilling a well dowtown"..

IFE

Our activities are: scale detection, corrosion, tracer technology (incl. high T tracers), fluid characterisation, geochemistry, reservoir modelling and reservoir management. All this comes from our activities which we gear towards petroleum industry. The titles for the workshops will be related in particular to "Scale detection"," Scale monitoring" and use of "Tracers for reservoir management". Most likely the work related to scale will be subject of the first workshop (3) and tracers in the second workshop (4) or bit of both in each ,as these activities are interlinked. We have to take an internal discussion on this here at IFE first.

IGG

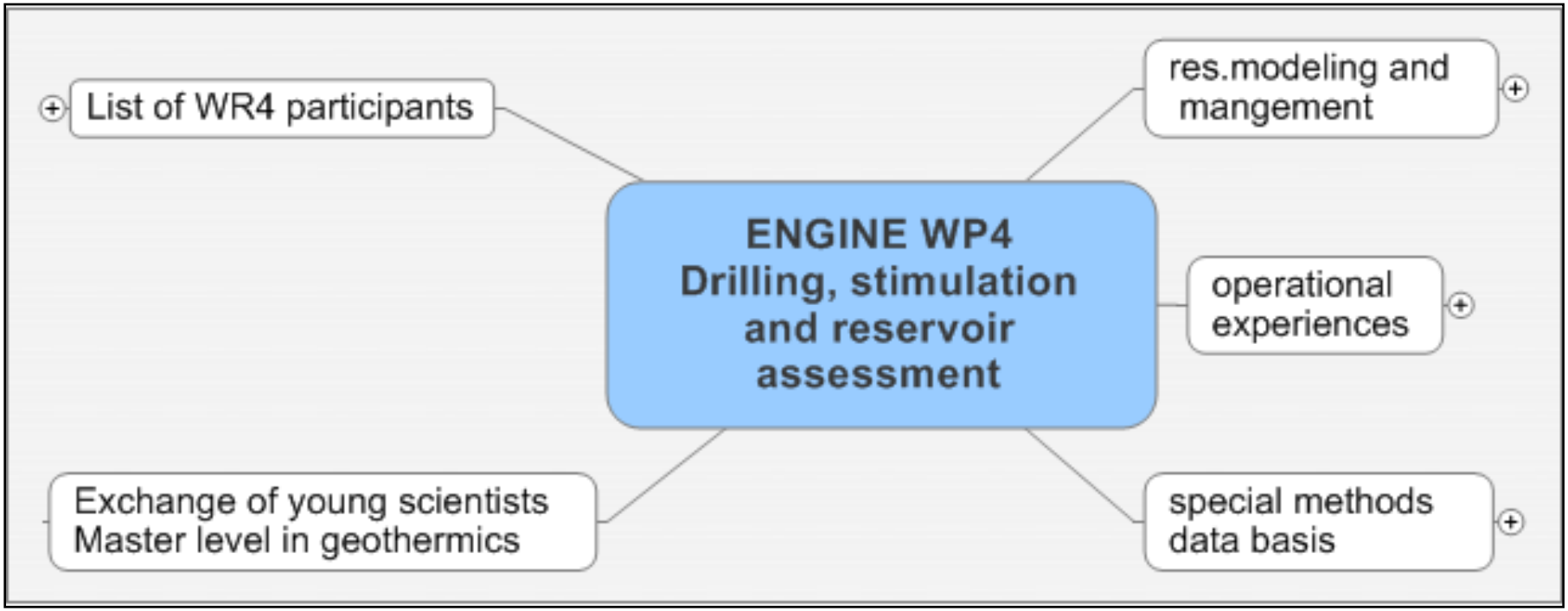
- Originally I thought that my institute could participate to WP4/WP7 with the expertise we had regarding reservoir modelling and assesment: you may know that in developing TOUGH software there was a close collaboration between Pruess and some colleagues of mine here in Pisa. Unfortunatly this branch of research has almost disappeared, and I came now to the conclusion that nobody is able to represent this part for IGG.
- However, I consider this part very important and I will try to fill the gap as soon as possible. I am in contact with Enel on this part, and I-GET project will be the occasion to work on this matter again. If, as I hope, we will be able to cooperate with Thomas Kohl we might be able to present something in the workshops with him, and in any case there will be some result with TOUGH2 from I-GET project in cooperation with Enel for workshop 4 in Iceland.

- In conclusion, please continue to consider me as representative for IGG also on this matter, although I am not at the moment particularly expert in this sector, and forgive me for not providing the expertise I foresaw. Participation of IGG will be minor in this regard.
- If necessary, however, I can send you all the published material for the old activity on this sector.

IGME

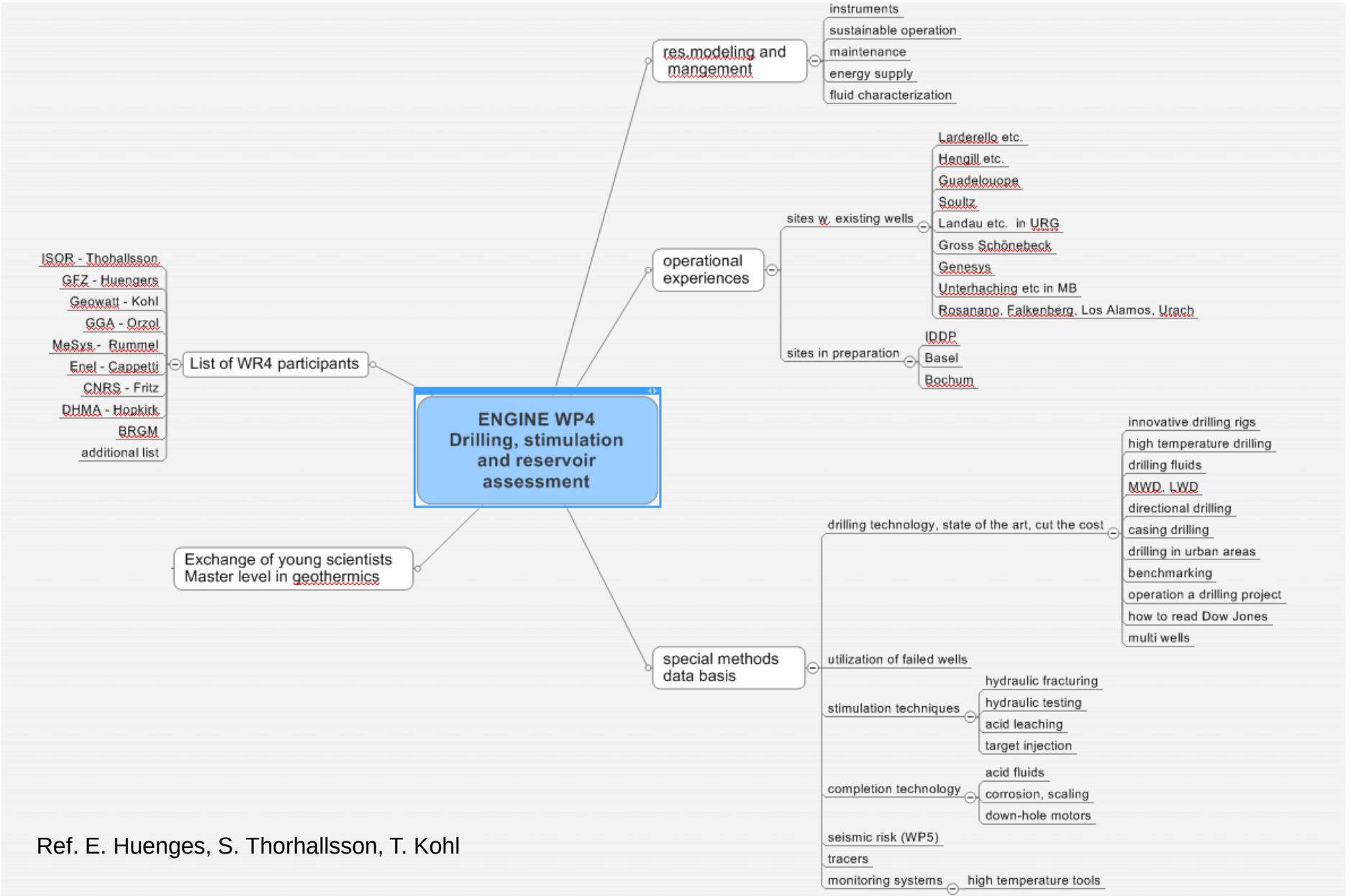
IGME will contribute to WP4 with the experience on drilling and stimulation of wells. In particular with the experience on explosive stimulation. This experiences will be prepared for Workshop 3. Other contributions will be added in the next days.

Organization – original “plan”



Ref. E. Huenges, S. Thorhallsson, T. Kohl

Break down – WP4 (March 2006)



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Ittingen Workshop on Stimluation and Microseismisty

- Chemical stimulation in granitic rocks, experiences from the Soultz project
- Stimulating volcanic geothermal reservoirs
- Stimulation Techniques in Petroleum Industry
- Review of Stimulation Techniques at ExxonMobile
- Review of Stimulation Techniques - State Derived from Available Literature
- Processes induced by proppant frac treatments in deep sediments
- Rock mechanics
- Review paper on application of waterfrac treatments in Soultz-sous-Forêts
- Experiences in measuring induced seismicity in granitic rocks
- Lessons learn from 30 years hydraulic fracturing in granitic rocks (Falkenberg, Rosemanowes, Soultz) and application in the devonian sediment case study Prometheus
- Stimulation experience "Well HE-21"
- Application of waterfrac-techniques in sedimentary geothermal reservoirs-case study at site Groß Schönebeck….
- Application of waterfrac-techniques in sedimentary geothermal reservoirs-the genesys case
- Interpretation of Microseismic Cloud in Soultz
- Evaluation of the Soultz clouds
- interpreting induced seismicity at the KTB site
- Impact from stimulations at Soultz
- Review paper on application of proppant frac treatments in sedimentary environment
- Hydraulic interpretation of measured induced seismicity in the Soultz case study

“Deliverables”

		WP4	WP7	Kick-off	Launching	Ittingen	Strassburg	Postdam	Mid-term	Reykjavík
		Manmonths		meeting	Conf.	WS3	WS5	WS1	Conf.	WS4
ÍSOR	*Thorhallsson*	6	1						X	
BRGM	*Genter*	3	1							
GEIE	*Gerard*	1	1							
GFZ	*Huenges*	3	6						X	
Geowatt	*Kohl*									
GGA	*Orzol/Schellschmitt*	3	2						X	
Me-Sys	*Rummel*	4	3							
CNRS	*Vutaz*	1							X	
DHMA	*Hopkirk*	3	3							
Shell	*Maas*	1								
TNO	*Lokhorst*		1						X	
IGG	*Manzella*	2								
CFG	*Cotiche*	1								
NSRCRD	*Stamatakis*	2	1						X	
GPC	*Ungemach*	2	1							
IFE	*Muller*	2	1							
GEUS	*Matiesen*	2								
IGME	*Garcia*	3	2							
CERTH	*Karabelas*	3	2							

NOTE: Yet to be filled out

FOR NOW (Friday s meeting)

- Work to do list
- Appoint a WP4/WP7 Group of Experts
- Organization of the Reykjavík workshop "Drilling cost effectiveness and feasibility of high-temperature drilling", Workshop 4, 28-29 June 2007
- START PLANNING YOUR TRIP TO REYKJAVÍK IN JUNE!