ETIP WG Session on Deep Drilling

Agenda

10:30	00:10	Welcome	Bertani
10:40	00:05	ETIP	Bertani
10:45	00:15	Scope of the WG (required input for draft research agenda FP9; SET Plan DoI on deep drilling)	Huenges
11:00	00:05	RHC Platform	
11:05	00:05	EERA JPGE SPv Constructing Geothermal Wells	Iverson
11:10	00:05	IEA	
11:15	00:45	DECRAMBLE (incl. 25' discussion)	Drilling Engineer of ENEL
12:00	01:00	Lunch	
13:00	02:00	Brief presentations from participants (5')	convenor: Huenges
15:00	00:30	Coffee Break	
15:30	00:30	Discussion on novel drilling methods (Thermal, Jet, Mecha, ...)	convenor: Reinsch
16:00	00:30	Discussion on Well Construction and Completion	convenor: Sørlie
16:30	00:20	Other innovations for cheaper and faster drilling	convenor: Batini
16:50	00:10	Wrap up and Nomination of a presenter during DG ETIP	Huenges
17:00		End of meeting	

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Input FP9 2020 +

- What will be state of the art after horizon 2020?
- Where should we set our focus?
  - short-term
  - long-term

SET Plan DOI on deep drilling

- DETAILED PRIORITIES FOR GEOTHERMAL ENERGY IN HORIZON 2020 WP 2018-2020

ACTION A1.2

Deep Geothermal – Deep drilling	**Develop novel drilling technologies including non-mechanical methods**

Scope Deep geothermal drilling is challenged by high temperatures, highly corrosive environments and comparatively hard rocks. New methods to address these challenging environments with the potential to accelerate the drilling process, reducing costs and risks shall be tested in a realistic and beyond the laboratory scale way. Such methods include percussive drilling for deep/hot wells (fluid hammers etc.) and non-mechanical drilling method development (such as laser, plasma, hydrothermal flame drilling).. Benchmark testing in boreholes should be attempted. These methods should be able to work to depths in excess of 5000 m depth and 250ºC, taking into consideration high anisotropic stresses, static pressure at these depths and return of cutting to the surface.

Expected Impact New technologies will be ready for testing at the real scale in deep wells. Reduction in drill time ~20% by 2025 with the potential to reduce by 50% in 2040.

TRL Target 3,4 → TRL 4,5

Budget 6 M€

Doi #5

ACTION A2.2

Deep Geothermal – Deep drilling	**Optimized and reliable drilling and well completion**

Scope Geothermal well construction and maintenance over the lifetime of the installations is challenged by high temperatures, corrosive environments. To increase the economic viability of a geothermal development advanced drilling technologies currently not used in geothermal well construction have to be adapted and optimised for the specific project requirements. Implementation of advanced technologies includes, but is not limited to, process automatization, drilling fluids to compensate unwanted loss of circulation zones as well as improved cementing procedures and well tubulars and stimulation methods improvement for deep wells. Risk assessment and lifetime analysis of the new technologies and approaches must be part of the project. Innovative system to avoid/reduce the discharge of geothermal fluid into atmosphere while drilling and flow tests will be considered. Horizontal - multilateral wells cluster in hard (granite/basalt)- hot (>300°C) geological formations will be also considered. Increased technology transfer from the oil and gas industry on horizontal well drilling and completion is also needed. The proposed procedures should result in a significant reduction of overall costs over the lifetime of the installations.

Expected Impact Potential reduction of overall project costs related to subsurface installations by up to 20%.

TRL Target 5,6 → TRL 6,7

Budget 20 M€

Doi #5

ACTION A2.6

Deep Geothermal – Operations	**Resource potential, data and technical risk management tools**

Scope The correct assessment of geothermal resources and quantitative assessment of risk for prospect development is a key factor in the geothermal energy development. For market uptake, the target should not only be limited to identify promising areas but also to estimate how the resource fits demand, how it is economically viable. On top of these technical considerations, potential environmental impacts and social aspects are crucial topics to infer the geothermal resource reliability.

An improved resource assessment, data accessibility and risk management tools are key to identify resource locations which can be developed at low cost, and improved access to relevant data and performance and risk assessment tools promote commercial project development and lower governmental incentives required.

Thousands of disused production and exploration wells into oil and gas reservoirs exist in Europe. It would be an advantage to compile a database of these wells to complement existing heat models of the continent. The data from many of these wells can be used to more accurately pinpoint feasible geothermal production areas without the need to drill costly exploration wells. Therefore, upfront costs are decreased and the initial risk of the geothermal projects is decreased.

Expected Impact Data organization and new and more integrated geothermal potential computation and maps, also taking into account economic, environmental and social aspects /risk management.

TRL 5 to 6 → TRL 7 to 9

Budget 5 M€

Doi #3, #4, #5

RHC Platform

WG2b Deep Drilling

Annex VII: Advanced Geothermal Drilling & Logging Technologies

- **Investigate and promote methods to reduce drilling and logging costs, clarify best practices and encourage the sharing of methods and technologies**
  - **Compile geothermal well drilling cost and performance information, and store in an accessible database**
  - **Hold an international best practices drilling symposium**
  - **Monitor and exchange information on drilling technology development and new applications**

IEA Geothermal Implementing Agreement

EERA JPGE

AAT Geothermae
Antea Group
BHGE
CNR
CRES
EIFER
Empresarios Agrupados Internacional
ES-Géothermie
ETHZ
Fangmann Energy Services
FM Consultants Associates
Fonroche Géothermie
gec-co GmbH
Geo Energie Suisse
GEORG
greenfield water foundation
Halliburton Company Germany GmbH

Helmholtz Centre Potsdam GFZ
IFP Energies nouvelles
IFPEN
International Geothermal Centre GZB
MAGMA ENERGY ITALIA S.R.L.
Netherlands Enterprise Agency /RVO
Politecnico di Milano
Provenance Exploration Consultancy BV
Statoil ASA
Storengy
Stork
Studio Idrogeologico Geoeco
TLS GEOTHERMICS
TWI
turboden / mhi
University of Coimbra
VITO
Zorlu Geothermal

Drilling method	TRL level	Potential market introduction	Target
Laser assisted rotary drilling	3-4		Hard rock
Spallation (hydro flame)-assisted rotary drilling	3-4		Hard rock/ hole enlargement
Jetting	3-4		Soft rock/stimulation
Jet-assissted rotary drilling	3-4		Hard rock (up to 200°C)
Electro impuls	3-4		Hard rock
Hammer (air)	9		Hard rock
Hammer (water)	9		Hard rock
Hammer (mud)	3-4		Hard rock
Casing while drilling?			
Plasma drilling	2-3		Hard rock
questions/targets: how to get energy/electricity to the bit Benchmark testing? Matrix on pricing and drilling performance Innovations for soft rock?			

Discussion on novel drilling methods (Thermal, Jet, Mechanical, ...)

ETHZ
Thermodrill
SURE
GZB → Laser Drilling
Hammer Drilling ST1 Helsinki

	TRL level	Potential market introduction	Target
Cementing process, material			
LCM			
High temperature mud			
Casing setting, materials			
Material properties			

Discussion on Well Construction and Completion

GeoWell
DECSCRAMBLE
DEEPEGS IDDP2
Geoenergy-Celle

Other innovations for cheaper and faster drilling

Shaft Drilling