GeoWell

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Innovative materials and designs for long-life high-temperature geothermal wells

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Editorial - GeoWell

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In 2008, European countries agreed on the ambitious target to increase the use of renewable energies to 20% of the European energy consumption by 2020, in particular through the Horizon 2020 program. The GeoWell project will contribute to the 2020 goal by providing new and improved well technology for high-temperature geothermal energy generation.

The aim of GeoWell

The project aims to develop reliable, economical and environmentally friendly technologies for design, completion and monitoring of high-temperature geothermal wells with the intent to expedite the development of geothermal exploitation globally. GeoWell will address all relevant steps in the geothermal well completion process to enhance the lifetime of high-temperature geothermal wells. These include cement and sealing technologies, material selection and coupling of casings. Methods of temperature and strain measurements in wells, using fibre optic technologies to monitor well integrity, will be developed as well as methods for risk assessment with respect to the design and operation of high-temperature geothermal wells.

To assure an outstanding quality of the approach and the final results of the project, the research is focused on both traditional production wells and deeper wells where the pressure is as high as 150 bar and temperatures exceed 400°C. The developed technologies will be tested under in-situ conditions in laboratories, and also in existing geothermal environment, moving the TRL (Technology Readiness Level) from 3-4 to 4-5.

The main project segments

Cement: Develop cement and sealing technologies optimized for high-enthalpy geothermal applications in order to ensure casing protection and zonal isolation at elevated temperatures and pressures (up to 450°C and >100 bars).

High-temperature composite casings (HTCC): Assess the potential of using high temperature composite casings in geothermal wells. HTCC will be designed and tested in laboratories.

Flexible coupling: Design and test flexible couplings for casings where thermal expansion due to heating or cooling is allowed with lower strain on the casing material to ensure well integrity.

Casing materials: Standard and innovative casing materials will be tested to withstand temperature loading and aggressive geothermal environment to ensure a long lifetime of casings. Cladded casing materials will also be tested.

Well monitoring: Identify processes that affect the integrity of a geothermal well by developing and testing distributed fibre optic sensing technologies to simultaneously measure temperature, strain and acoustic noise within the cemented annulus of a geothermal well.

Risk assessment: Develop risk and reliability analysis tools for risk assessment of geothermal wells, both high enthalpy wells and extreme temperature wells in volcanic areas.

Initial steps

Since this three-year project started in February 2016 work has been initiated in all work packages. Experience from cementing in HT oil&gas SAGD systems (steam assisted gravity drainage) has been collected and cement samples from the IDDP-1 well in Iceland have been analysed. This will be useful for further development of high-temperature cements. Work on design of a flexible coupling to mitigate the effects of thermal expansion of casings in high temperature geothermal wells is ongoing and a prototype will be ready for testing in a laboratory soon. A study of casing materials has started, mainly looking at metallic materials but also composite materials. Also, experiments with temperature and strain measurements in a geothermal well using a fibre optic cable have started as well as work on developing risk assessment methods for the geothermal industry.

IDDP-1 cement sampling. Source ÍSOR.

Installation of a fibre optic cable behind casing in a low temperature well in Berlin. Source: GFZ

Partners

The GeoWell consortium gathers 8 partners from public research institutes, academia, industry, and one SME, as well as two third parties:

ÍSOR, Íslenskar orkurannsóknir
Iceland GeoSurvey (Iceland)

Owned by the Icelandic government, ÍSOR provides specialized services to the Icelandic power industry, the Icelandic government and international companies.

Helmholtz-Centre Potsdam - GFZ German Research Centre for Geosciences (Germany)

Research at GFZ focuses on the geosphere within the highly complex System Earth with its further subsystems, its interacting subcycles, and its wide network of cause-and-effect chains. One of the central questions is how georesources, e.g. geothermal energy, can be used in a sustainable way.

IRIS, International Research Institute of Stavanger AS (Norway)

IRIS is an independent research institute conducting research in petroleum, new energy, marine environment, biotechnology and social science and business development.

TNO, Nederlandse Organisatie Voor Toegepast Natuurwetenschappelijk Onderzoek (Netherlands)

TNO is an independent research organisation that focuses on transitions or changes in five social themes: Industry; Healthy Living; Defence, Safety & Security; Urbanisation and Energy.

HS Orka hf. (Iceland)

HS Orka is Iceland's third largest energy company. It owns and operates two geothermal power plants in Iceland.

BRGM, Bureau de Recherches Geologiques et Minieres (France)

BRGM is the French geological survey and France's reference public institution for Earth Science applications in the management of surface and subsurface resources and risks.

Statoil ASA (Norway)

STATOIL carries out exploration, production, transport, refining and marketing of petroleum and petroleum derived products on the Norwegian continental shelf. Now, Statoil is also operating within renewables.

Akiet BV (Netherlands)

Akiet delivers composite geothermal wells in order to enable cost-effective drilling and installation of casings with light-weight equipment.