

GeoWell

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

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The GeoWell project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 654497



GeoWell consortium

Start date: 1 February 2016

Duration: 36 months

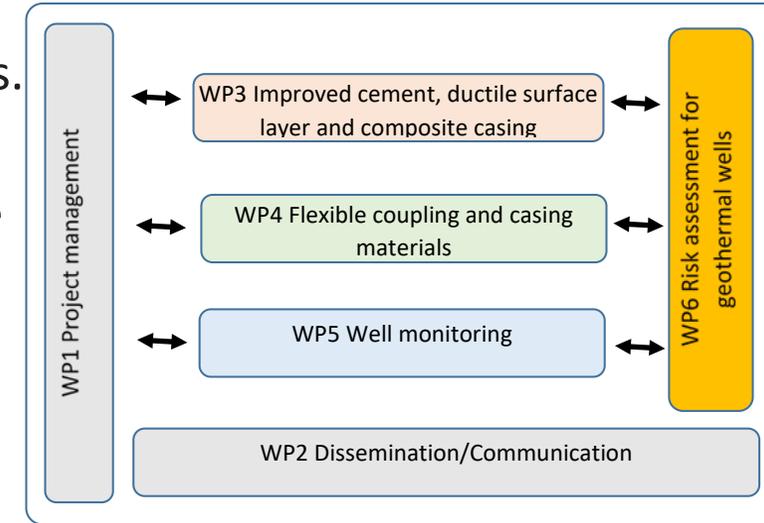
Budget: 4.7 million €



Partner	Partner's name	Country
ISOR	Íslenskar orkurannsóknir - Iceland GeoSurvey	Iceland
IRIS	International Research Institute of Stavanger AS	Norway
GFZ	Helmholtz-Zentrum Potsdam Deutsches GeoForschungsZentrum	Germany
TNO	Nederlandse Organisatie Voor Toegepast Natuurwetenschappelijk Onderzoek	Netherlands
BRGM	Bureau de Recherches Geologiques et Minieres	France
STATOIL	Statoil Petroleum AS	Norway
HS ORKA	HS Orka hf.	Iceland
AKIET	Akiet BV	Netherlands
Third Parties		
SINTEF	The Foundation for Scientific and Industrial Research at the Norwegian Institute of Technology	Norway
EGP	Enel Green Power	Italy
ICI	Innovation Center Iceland	Iceland

Concept of the GeoWell project

- The overall concept is to enhance well design and completion techniques.
- Aims to develop reliable, economical and environmentally friendly technologies for design, completion and monitoring of high-temperature geothermal wells.
- Includes all relevant steps in the geothermal well completion process:
 - Cementing of casings
 - High-temperature composite casings
 - Flexible coupling of casings
 - Material selection
 - Well monitoring
 - Risk assessment of geothermal wells
- The research is based on traditional production wells as well as deeper wells where the pressure is as high as 150 bar and temperature exceeds 400°C.
- The technology developed will be tested in laboratories and partly in real geothermal environment
Move the TRL level from 3-4 to 4-5.



Results achieved (1)

- **Cementing of casings**

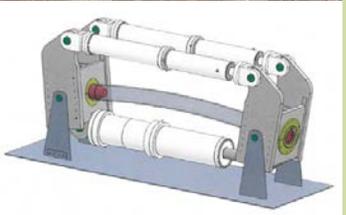
- State-of-the-art cementing practices in HT oil&gas operations has been reported.
- Analysis of cement samples from the top of the IDDP-1 well in Iceland show that Portland cements behave well and the compressive strength even increases on exposure to high temperatures. Numerical modelling has complemented the experimental results.
- Work is ongoing on the following topics: (1) pressure build-up at different temperatures in cement sheets, (2) ductile intermediate layer between casing and cement and (3) numerical modelling of failure of wellbore cement at high temperatures.

- **High-temperature composite casings (HTCC) - Glass fiber reinforced polymers**

- Temperature upgrade of the existing High Strength Composite Casing (HSCC).
- Concept design of a HTCC connection is ready (adhesive and threaded connections).

- **Flexible coupling of casings that allows axial thermal expansion/contraction**

- A prototype has been designed and built and a patent application has been filed. The prototype will be tested at ambient temperature and high pressure in a laboratory during the next few weeks.



Results achieved (2)

- **Casing materials**

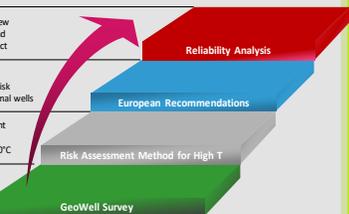
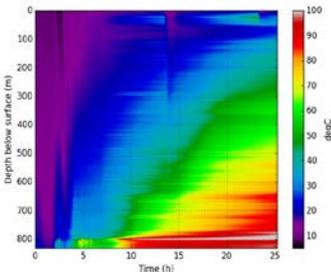
- Based on a desktop study, candidate materials have been selected for high-temperature tensile testing up to 550°C. This will enhance the existing curves for strength reduction with temperature. Also, corrosion resistance of materials in a new autoclave is being prepared for operation later this year.

- **Well monitoring by fibre optic distributed sensing technology**

- Allows for simultaneous measurement of temperature, strain and acoustic noise along the entire length of the cable to find potential defects in the well.
- A fibre optic cable was installed in the IDDP-2 well in Iceland in September 2016. The data is currently being processed to analyse the cement quality.
- Software routines to handle temperature and strain data are also under development.

- **Risk assessment related to design and operation of high-temperature geothermal wells**

- Studies made in GeoWell have shown that, compared to the petroleum industry, the geothermal industry's focus is to a little degree on barriers and integrity of the well. The most frequently addressed risk is on the project and financial level. The ongoing work focuses on barriers and associated failure modes in geothermal wells.



A wide-angle photograph of a volcanic eruption in a snowy, high-altitude landscape. A massive, billowing plume of white ash and steam rises from a snow-capped mountain peak, dominating the right side of the frame. The sky is a vibrant blue, filled with scattered white clouds. In the foreground, a flat, brownish landscape is dotted with patches of snow and small, shallow pools of water. Several small, white tents and a red-roofed building are visible near the base of the volcano. The overall scene is dramatic and powerful.

THANK YOU

Photo: Hreinn Hjartarson