High temperature geothermal well completed with Inferno tools

International, Australia

Inferno System

Background

Geothermal energy is one of the leading renewable sources of environmentally friendly power generation. It involves using the earth’s stored thermal energy to super heat water, which can then be used to directly heat homes or generate electricity. Traditionally, geothermal electric plants have been built on the edges of tectonic plates where high temperature geothermal resources are available near the surface. Recent improvements in drilling and extraction technology have enabled the creation of geothermal power plants in areas where the thermal resources lie deep under the surface.

With some of the hottest conditions anywhere in the world, granite formations in the Cooper Basin of South Australia are ideal for geothermal energy generation. This is where Geodynamics, a company focused on Enhanced Geothermal Systems (EGS), also known as hot fractured rock (HFR) geothermal energy, has been developing a largescale geothermal electricity project.

Challenge

The geothermal target formations in the Cooper Basin lie over 13,000 ft (4,000 m) below the surface and require hydraulic fracturing to increase surface area for efficient heating of injected water. Geodynamics had successfully drilled several vertical wells, but had encountered challenges with casing integrity due to the extreme conditions. In order to successfully complete and bring the wells back on-line, they needed to find a company willing to build a set of completion tools rated for 600°F (315°C) and 10,000 psi (69 MPa). Geodynamics had approached a number of companies, none of which were keen to take on the project. As a highly innovative company known for designing customized completion solutions, Packers Plus welcomed the challenge.

Solution

The project required Packers Plus to supply fit-for-purpose production packers, liner hangers, polished bore receptacles (PBR), seal assemblies, anchor latches and float equipment for 7-in. and 9 ¾-in. casing sizes. This required research into all tool parameters including metal alloys, threads, seals and elements in order to design prototype tools that could pass testing to 600°F and 10,000 psi. To add to the challenge, Geodynamics required that the tools be ready for installation in 6 months. A Packers Plus product design team was quickly assembled with representatives from Engineering, Manufacturing and Technical Services, and the Houston
Rapid Tool Development Center served as the headquarters.

**Results**

The Inferno® completion tools were successfully designed, prototyped, tested and delivered within the scheduled project timeline. Geodynamics and Packers Plus Field Operations personnel then worked together on the unique installation sequence required to complete the geothermal well. The team faced a number of upfront challenges with the mud system due to the intense heat; however, the team was able to work past these issues and successfully complete the well in preparation for hydraulic stimulation.

Geodynamics announced the successful fracture stimulation of the well at 4,400 m and 4,700 m depths with a total 3,460 bbl (550 m3) fluid resulting in a 3-fold increase in fracture conductivity. The measured temperature at the total depth of 4,900 m was 532°F (278°C), hotter than the previous wells they had completed.

Packers Plus’ success with a geothermal well not only distinguishes them as the “go-to” solutions company for complex completions, but opens up an entirely new global market for the award-winning company. Geodynamics announced the production of Australia’s first EGS 1 MWe Pilot Plant in 2013 and plans to upscale production to 500 MW within this decade.

In addition, the oil and gas industry continues to push the limits of drilling and completions by targeting deeper and hotter formations. The success of this geothermal project indicates the potential application of the Inferno tools for multi-stage hydraulic fracturing. The Inferno system would operate in the same manner as the Packers Plus StackFRAC® system, which has been run successfully in a wide variety of formations and conditions.