

Global energy company cuts average drilling time for geothermal wells by 70 percent

New Halliburton drilling techniques and high-temperature cements reduce well construction costs and minimize environmental impact



HAL6715

OVERVIEW

With 40 percent of the world's total geothermal resources, Indonesia is transforming its economy with clean, renewable energy. Since the 1990s, Halliburton has provided drilling and cementing services for one of the leading players in this fast-growing market.

Despite the challenges of working in highly fractured rock that can be extremely hard or soft, remote locations, difficult terrain, and production temperatures reaching 600° Fahrenheit (316° Celsius), Halliburton has enabled this global energy leader to complete wells faster, more cost-effectively, and with an unparalleled safety record. The company is completing wells three times faster than its competitors. It is also making more efficient use of infrastructure and reducing well site construction costs. Because of these exceptional efficiencies, the company now works with Halliburton on almost all of its geothermal projects.

CHALLENGE	SOLUTION
<p>Cuttings accumulation can bind drill bits</p> <p>Because of its high fracture density, volcanic rock is often drilled without mud. Yet air and water are much less efficient at evacuating cuttings, which can fall back into the hole and quickly bind the drill bit.</p>	<p>Continuous monitoring cuts lost-in-hole time</p> <p>Using measurement-while-drilling (MWD) technology, Halliburton can monitor downhole pressures and use special techniques to clear holes before cuttings reach levels that could cause lost time.</p>
<p>Reliable cementing in 600°F production temperatures</p> <p>Designing slurries that can withstand this kind of heat over time is difficult. The cured slurry must resist failure in ultra-high temperatures, be lightweight to avoid fracturing soft rock, and resilient to the cumulative stress of frequent tremors.</p>	<p>New slurries reduce casing collapse, wellhead growth</p> <p>Halliburton has formulated new modified gel slurries for each stage of the wellbore. They resist strength retrogression in high temperatures and offer early compressive strength development and short transition times.</p>
<p>Balancing ROI and environmental preservation</p> <p>Many geothermally rich areas are also protected conservation areas where the government wants to limit development. But the fewer wells available to produce steam for on-site generators, the more difficult it is to achieve an optimal return on investment.</p>	<p>Multiple wells from one pad</p> <p>Halliburton developed new directional drilling techniques for geothermal that allow more wells to produce from a single pad. This not only increases a site's generating capacity, it minimizes disruption to the environment and significantly lowers construction costs.</p>



In more than 15 years working with this global energy company, Halliburton has never had a major safety incident — no serious injuries, no missed time, and no delays.

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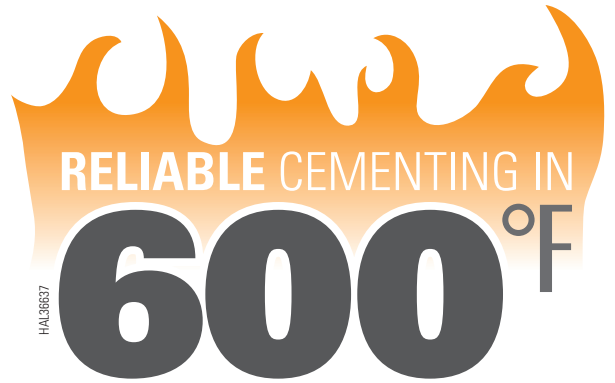
**HALLIBURTON
COMPLETES WELLS
UP TO 70% FASTER**

Depending on the location, Halliburton completes wells in 18–28 days on average. One well was completed in just nine days.



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Halliburton engineers developed new lightweight, gel-based slurries designed to withstand production temperatures up to 600° Fahrenheit (316° C) without losing structural integrity.



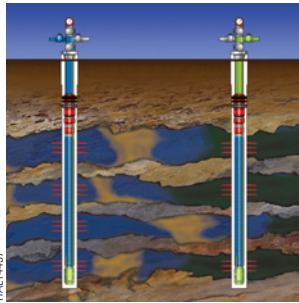
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**COST PER
KILOWATT
HOUR**

By completing wells faster, most cost-effectively and more safely, Halliburton has helped its client reduce the cost per kilowatt hour of electricity generated.

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HAL1457



HAL36639



HAL723



HAL1238

Making capital-intensive geothermal more economical to produce

Positioned along the intersection of three tectonic plates, Indonesia is one of the most volcanically active regions of the Pacific Ring of Fire. Despite the nation's abundant resources, however, geothermal energy did not become commercially viable until the 1990s.

Enormous capital investment is required to bring new sites online. Most geothermal developments are located along mountain ranges deep within the rainforest, and the logistics of transporting equipment and crews can be daunting. Power plants and transmission lines must be constructed at each site to get steam-generated electricity to the national power grid. Two wells—a water injection well and a production well—are required to generate steam, and each can cost as much as \$6 million to drill.

Once infrastructure is in place, however, every additional well drilled is an instant revenue stream. Halliburton has helped one of the region's major geothermal players reduce the cost per kilowatt hour by working continually to complete wells faster, more cost-effectively, and more safely.

Experienced team understands the challenges of drilling without fluid

A major drilling expense in this environment is nonproductive time. Because much of the formation is rock that fractures easily under pressure, drilling teams frequently work in dry holes. Under these conditions, bottom-hole assemblies (BHAs) can easily get stuck if cuttings accumulate. Efforts to clear the hole frequently just exacerbate the problem and cause cavings.

In these situations, Halliburton's years of experience offer a huge advantage. A single dedicated team works on-site at every new geothermal development in Indonesia, building on previous successes to continually refine the drilling process. Using measurement-while-drilling (MWD) technologies that enable them to monitor downhole temperature and pressure, they can keep an eye on accumulation and clean the hole before blockages occur.

New cements create strong bonds in hot, porous rock

Cementing is another significant challenge in a geothermal environment, where high temperatures and highly fractured formations can lead to casing collapse and wellhead growth.

To combat these problems, Halliburton formulated new slurries that are lighter—reducing bottomhole pressure on the formation—and faster to develop compressive strength, minimizing cementing losses into the formation. The slurries also include silica flour that keeps them from failing at high temperatures.

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Maintaining strong record of safety in harsh conditions

It's not easy to get equipment and crews to production sites in remote, mountainous terrain where the only roads are narrow, winding and treacherous. And even the most experienced team might be nervous drilling into an active volcano. In more than 15 years working with this global energy company, however, Halliburton has never had a major safety incident — no serious injuries, no missed time, and no delays.

A promising energy future for Indonesia

Geothermal energy provides a growing percentage of Indonesia's total electricity supply. The shift is part of a concerted effort by the Indonesian government to move toward safe, sustainable energy sources to strengthen its economy. Halliburton's success in helping one of the region's largest geothermal energy companies drive down the cost of production has helped accelerate the industry's growth.