

# Kaldera Bit Drills Geothermal Well Section 25% Farther for Northern California Power Agency

Roller cone bit extends average run length 150 ft in HT application

## CHALLENGE

Drill an 8½-in geothermal well section of at least 600 ft through a formation composed of fractured sandstone at temperatures ranging from 500 to 600 degF.

## SOLUTION

Run an 8½-in Kaldera\* roller cone drill bit for high-temperature (HT) and geothermal applications.

## RESULTS

Drilled for 49 hours from a depth in of 7,233 ft to 8,005 ft, which represents a 14-hour increase in bit life and a run length increase of 25% when compared with bit runs in offset wells.



## Long vertical sections challenge drilling efficiency

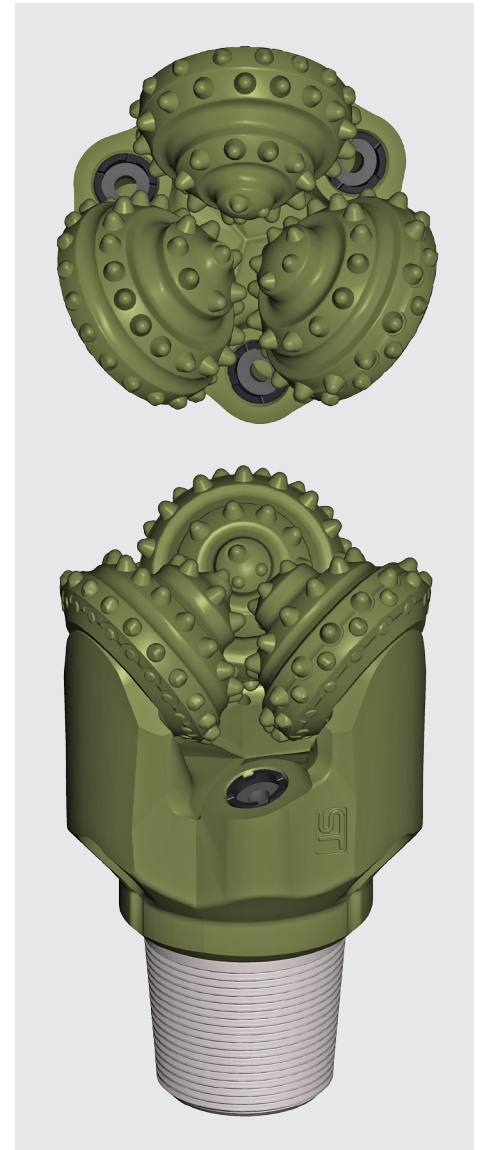
In the Mayacamas Mountains of northern California is a field of reservoirs with natural steam known as The Geysers. Metamorphosed sandstone, shale, and granite comprise the geothermal reservoirs of The Geysers, which reach temperatures of 600 degF.

To access this geothermal resource, the Northern California Power Agency (NCPA) conducts drilling to provide steam for its electrical generating facilities.

Because temperatures for this application range from 500 degF to 600 degF, wells are drilled using air to cool the bearings of open roller bearing bits instead of standard drilling mud. The 8½-in roller cone bits being used for the application had an average drilling life of 30 to 35 hours, before they were tripped out to avoid bearing failure and loss of cones. NCPA sought a more durable bit that would reduce trips and improve drilling performance.

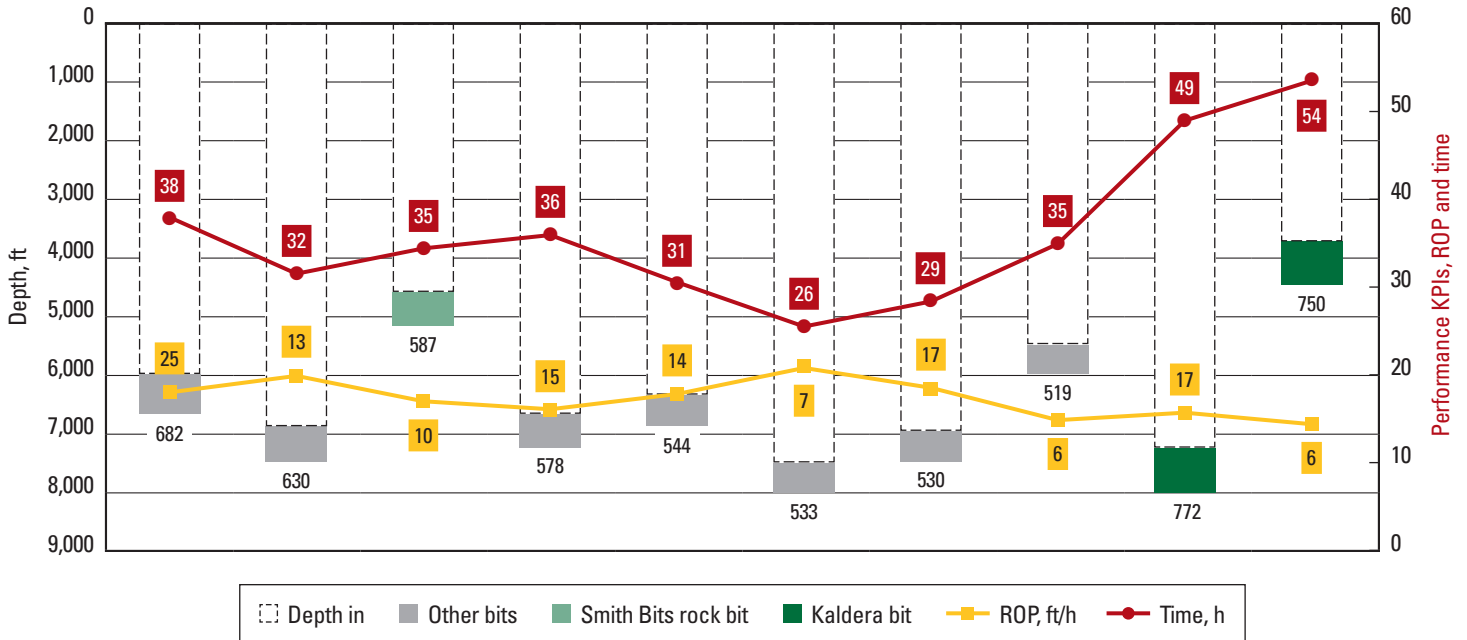
## Advanced bearing system materials answer HT application challenge

To increase NCPA's drilling performance, Smith Bits provided the 8½-in SK47YAODR Kaldera HT roller cone bit. The bit's advanced bearing system materials enable it to endure the extreme heat that can break down standard bearing lubricants and compromise seals. This break down quickly erodes bearing functionality, leading to premature loss of roller cone performance and shortening bit life.



*The Kaldera bit's highly durable seals and bearings enabled it to endure 500 to 600 degF bottomhole temperatures, drilling 25% farther than other bits used in reservoirs of The Geysers.*

## CASE STUDY: Kaldera bit drills 25% farther in temperatures reaching 600 degF



The Kaldera bit drilled 14 hours longer and approximately 150 ft farther than other bits, representing a run length increase of 25%.

The Kaldera bit's increased bearing durability and longer bit life is the result of specially developed materials used in its advanced HT design:

- finite element analysis (FEA) optimized seal geometry and gland design
- robust grease reservoir system
- high-load capacity bearing design and materials
- computer numerically controlled (CNC) precision manufacturing tolerances.

### Kaldera bit advances drilling performance

The 8½-in Kaldera bit drilled for 49 hours from a depth in of 7,233 ft to 8,005 ft, enduring bottomhole temperatures that ranged from 500 to 600 degF. When compared with bits used to drill offset wells, the Kaldera bit drilled 14 hours longer and approximately 150 ft farther, representing a run length increase of 25%.

#### SK47YA0DR (Sealed Bearing) 8½-in Kaldera Bit Drilling Summary

Operator	NCPA
CO,ST-field	Sonoma, CA-Geysers
Well	A Pad#1 Redrill
S-T-R	3-10N-8W
Depth in	7,233 ft
Depth out	8,005 ft
Section length	772 ft
Drilling time	49 h
ROP	15.76 ft/h
WOB	10,000-20,000 lbf
Rpm	50/60
Total flow area	2.4 in <sup>2</sup>
Air flow rate	2,100 ft <sup>3</sup> /min
Bottomhole temperature	500-600 degF
Dull grading	4-4-WT-A-F-E-F-IN-RG-TD

[slb.com/Kaldera](http://slb.com/Kaldera)

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