

## Deep slim hole, diamond core drilling program proves effective for geothermal assessment in Hawaii

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The Hawaii State legislature, in 1988, funded a deep, slim-hole, diamond core drilling program, known as the Scientific Observation Hole (SOH) program, "to stimulate geothermal development and confirm the geothermal resources of Hawaii". This program was designed by the Hawaii Natural Energy Institute (HNEI) at the University of Hawaii at Manoa to assess the geothermal resources of the Kilauea East Rift Zone on the Big Island of Hawaii. The program is funded by the Hawaii Department of Business, Economic Development, and Tourism (DBED) and managed by HNEI.

To assess the geothermal potential of the Kilauea East Rift Zone (KERZ), a fence of four holes, three of which were drilled, were sited along the long axis of the KERZ within existing Geothermal Resource Subzones (GRZ). These holes were located to provide stepout drill coverage between existing and planned geothermal production wells, and to pair the SOHs with production wells to test for permeability across the rift zone.

Successful drilling techniques and casing procedures were devised as the rock section became known and its characteristics noted. Above 130°C (270°F) a complex stearate was added to the drilling fluids to maintain lubricity. Above 165°C (330°F) a mixture of soda ash, high temperature polymer, complex stearate,

and sepiolite virtually eliminated high torque and vibration problems normally associated with high temperature drilling.

The core and other data from the SOHs have proven to be extremely valuable for both active developers in siting production wells, and in the understanding of the subsurface geologic conditions. The first hole drilled, SOH-4, provided thermal and permeability conditions along the eastern portion of the True/Mid-Pacific Geothermal Venture's lease, and was instrumental in the location of True's #2 site. SOH-4 was drilled to a total depth of 2,000.1 metres (6,562 feet) and recorded bottom hole temperature of 306.1°C (583°F) at a depth of 1,950.7 metres (6,400 feet). The second hole, SOH-1, effectively defined the northern extent of the Puna Geothermal Venture's (PGV) HGP-A - KS-1A reservoir, doubled the proven reservoir size, and provided sufficient data to the lending institution for continued project funding. SOH-1 was drilled to a total depth of 1,684.3 metres (5,526 feet) and recorded a bottom hole temperature of 206.1°C (403°F). The third hole, SOH-2, was drilled on a PGV lease to a total depth of 2,073.2 metres (6,802 feet), recorded a bottom hole temperature of 350.6°C (663°F), and may have intersected a potential reservoir at a depth of approximately 1,624 metres (5,000 feet).