

Desired Equipment/Tools for High Temperature Geothermal Applications

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Request: Your comments and suggestions on this list of desired equipment/tools/techniques and their specifications are requested. If you know of the existence/availability/suppliers of any of these tools, we would appreciate receiving their contact information. Where the tool exists, we would like to know about the “demonstration experience” with it at all the specified conditions, the length of time of the demonstration, the performance characteristics, etc.

Please send your comments/information to: Dr Steve Bauer: sjbauer@sandia.gov; with a copy to: Mike Mongillo (Secretary IEA-GIA): mongillom@reap.org.nz

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Specifications:

- Temperature: up to 250 °C, continuous operation
- Pressure: up to 70 MPa, continuous operation
- Capable of working in aggressive environment, i.e. brine up to saturation, well deviation of up to 30° and well enlargement (wash out) of up to 20 inches
- Gasses: fluids with traces of helium, hydrogen and CO₂

Desired tools:

- 1. Reliable PTS tool** which works in real time (surface readout and can be deployed for 2-3 weeks) with:
 - Temperature resolution of better than 0.01 °C,
 - Flows of 0-50 l/s with resolution of 0.1 l/s,
 - Pressure resolution of 0.01 bar with very small thermal mass.
- 2. Borehole explosive calibration tool:**
 - 1 to 5 kg of explosive,
 - With T zero output at the surface.
- 3. Borehole microseismic sondes:** Accelerometer based 3 component sondes:
 - Able to deploy in wells 4-8.5” in diameter,
 - Output around 1000 volts/g,
 - Resolution of around 5 micro g or better,
 - A flat bandwidth of 5-1000 Hz,
 - With and without clamps,
 - Fundamental resonance of the tool to be above 3,000 Hz.
- 4. High temperature electronic component database** so that others can produce instruments.
- 5. Multiple downhole fluid sampler.**
- 6. HT salinity sensor** for logging a well.
- 7. HT gamma tool.**
- 8. HT dump bailer** so that tracers can be deposited in a specific zone in a well.
- 9. HT and long term reliable downhole suction pump** (up to 50 l/s).

10. High efficiency & long term reliable injection pump.

11. High temperature straddle and single retrievable packer for stimulation and zone isolation.

12. Instrumented straddle packers for hydrofrac stress measurement:

- Includes a BHTV & seismic sensor to observe the frac as it fails, and
- Able to find sigma max direction.

13. Fibre optics sensors for deployment in a well and behind a casing (pressure, temperature and microseismic).

14. Downhole seismic source (sparker) for carrying out cross-hole seismic imaging and tomography. A seismic sensor string to assist the survey.

15. Reliable downhole drilling motor for use in deep hard rock formations (vibration is an issue with these motors).

16. Small diameter (around 2"dia) drilling rig for:

- Drilling and deploying seismic sensors at shallow depth, i.e. up to 200 m,
- Fast drilling,
- Can also be used for geothermal exploration survey (temperature).

17. Reliable HT cable and cable head.

18. Downhole thermal conductivity measurement device/technique.

19. HT downhole tool to directly measure reliable porosity/ permeability.