

# Geothermal Energy:

Exploration, Geoscience and Modeling



Geothermal energy currently provides about 3% of the electricity used in the US but the potential is much greater. Los Alamos has the history, depth and breadth to achieve significant advances in site characterization, reservoir creation, well-field development and completion, and system operation.

**Left:** Fenton Hill, NM, site of the first LANL geothermal investigations during the mid 1970s.

**Insets:** Views of the Tiwi geothermal field in Bicol, Southern Luzon in the Philippines. Tiwi has been in production since 1979 with 330 MWe of generating capacity. LANL scientists consulted with Unocal and Philippine Geothermal, Inc. at this location in 1995.

## Background

For nearly 40 years, LANL has participated in the study, characterization, development, and modeling of geothermal systems. Beginning in the early 1970s with the demonstration of the feasibility of enhanced geothermal systems at the Fenton Hill site, LANL has continued to apply advanced technology at EGS around the world including the Coso Geothermal System in California, Hijori Hot Dry Rock Test Site in Japan, Rosemanowes site in Great Britain, and Soultz-sous-Forets in France.

## Capabilities

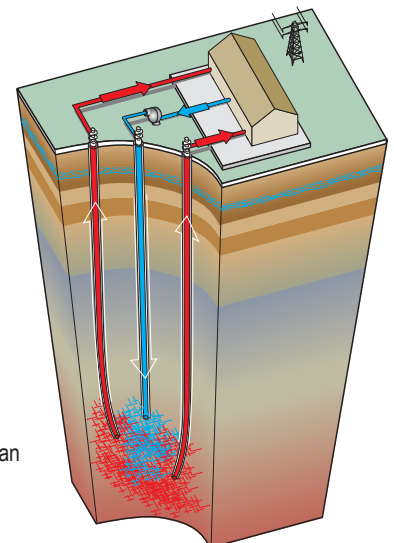
- Advanced modeling capabilities of fluid and heat flow in geothermal reservoirs; the Finite Element Heat and Mass (FEHM) computer code is used worldwide in the simulation of geothermal systems.
- Precise microseismicity expertise to map fracture propagation and fluid flow
- Extensive experience in hydrothermal system resource assessment including geology, geophysics, hydrogeochemistry, and modeling at sites in Mexico, Central America, Italy, Philippines, and the US.
- Unique laboratory facilities that allow for the quantitative analysis of solids, liquids, and gasses at geothermal conditions (up to 400°C and 1 Kbar).

## Future Applications

- Subsurface temperature assessment and prediction/geothermometry
- Geophysical data collection, interpretation and geologic mapping
- High-temperature packer development
- Core sample evaluation, borehole geophysics
- Geomechanical modeling, geodynamics, microseismic data interpretation
- Development of smart tracers
- Simulation of heat and fluid flow to optimize reservoir operation

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**Right:** Schematic diagram of an enhanced geothermal system