

Geothermal Energy in the Western United States

Map 1 of U.S. Geological Survey Circular 790, "Assessment of Geothermal Resources of the United States-1978"



Identified Hydrothermal Convection Systems

Thermal energies estimated by C.A. Brook, R.H. Munner, and D.R. Malby (see Brook and others, Hydrothermal convection systems: $\geq 50^{\circ}\text{C}$ in U.S. Geological Survey Circular 790 Supporting data from USGS computer file GEOTHEM are published in Open-File Report 78-858, available from Open-File Services Section, Branch of Distribution, U.S. Geological Survey, Box 2425, Federal Center, Denver, CO 80225.

Hydrothermal convection systems, showing reservoir thermal energy in units of 10^{14} joules

Vapour-dominated systems

Hot-water systems $>150^{\circ}\text{C}$

Hot-water systems $90-150^{\circ}\text{C}$

Hot-water systems $<90^{\circ}\text{C}$

Identifying numbers refer to individual hydrothermal convection systems for which thermal energies are listed in USGS Circular 790. The number of circles (1 to 4) symbolizes the thermal energy of each system and is not representative of the area of the system.

Igneous Systems

See Smith, R.L., and Shaw, H.R., Igneous-related geothermal systems in the U.S. Geological Survey Circular 790. Complete listing of location, age, composition, size, and thermal energy is given in USGS Open-File Report 78-925, available from Open-File Services Section, Branch of Distribution, U.S. Geological Survey, Box 2425, Federal Center, Denver, CO 80225.

Volcanic systems showing estimated thermal energy in units of 10^{14} joules. Most are silicic and thought to have a magma chamber within 10 km of the surface.

Volcanic systems for which no thermal estimate has been made. Most are andesitic or basaltic and are assumed to have no magma chamber within 10 km of the surface. Silicic systems are included where data are inadequate to allow thermal estimates.

Basaltic lava field younger than 10,000 years, showing major vents.

Identifying letters and numbers refer to igneous systems listed in USGS Circular 790 and USGS Open-File Report 78-925.

Low Temperature Geothermal Waters

See Sammel, E.A., Occurrence of low-temperature geothermal waters in the United States, in U.S. Geological Survey Circular 790.

Thermal springs, generally $\geq 20^{\circ}\text{C}$

Surface temperature $\leq 30^{\circ}\text{C}$

Surface temperature $> 30^{\circ}\text{C}$

Area of significant lateral extent favorable for discovery and development of local sources of low-temperature ($< 90^{\circ}\text{C}$) geothermal water. Identifying number refers to area listed in USGS Circular 790. Areas are defined by E.A. Sammel (USGS) and Duncan Foley (ES&L/USGS) in cooperation with state agencies on the basis of thermal springs, wells, and geologic settings generally favorable for recovery of thermal water. Existing knowledge does not in general permit the inference that thermal water may be found everywhere within the depicted areas, nor do the boundaries represent certain knowledge of the areal extent of the geothermal systems.

Well or test hole in which thermal gradient and temperature at depths less than 1 km represent a local shallow geothermal anomaly—shown only outside shaded areas described above.

Regional Heat Flow

See Sass, J.H., and Lachenbruch, A.H., Heat flow and conduction-dominated thermal regimes, in U.S. Geological Survey Circular 790.

Generalized contour of regional heat flow in milliwatts/m². Dashed contour indicates area of less certain contour.

Unpublished USGS regional heat flow datum. Numerical value not given but used for drawing generalized contour.

Known Geothermal Resources Area (KGRA)

National Park or selected National Monument

Selected cities

Population greater than 100,000

Population less than 100,000

Interstate Highway

Scale 1:2,500,000
1 centimeter equals approximately 25 kilometers
1 inch equals approximately 40 miles

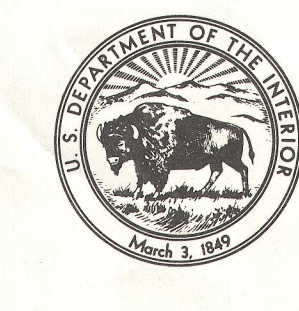
Albers equal area projection based on standard parallels 20°N and 45°N

Map produced by Paul J. Grim (National Geophysical and Solar-Terrestrial Data Center) and George W. Berry (Earth Science Laboratory/University of Utah Research) in collaboration with assistance of Joy A. Kellman, Thomas S. Jackson, and Ronald H. Smith

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For full references, credits, and explanations of data sets, see Muller, L.P., ed., 1979, Assessment of geothermal resources of the United States—1978, U.S. Geological Survey Circular 790.

Unfolded map available from NOAA/National Ocean Survey, Distribution Division, C-4, Silverdale, WA 98280.

USGS Circular 790 with folded maps available free of charge from Branch of Distribution, U.S. Geological Survey, 1200 South Eads St., Arlington, VA 22202.