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. Mariner, and D.R. Mabey (see Brook and others, Hydrothermal convection systems ≥ 90°C, *in* U.S. Geological Survey Circular 790). Supporting data from USGS computer file GEOTHERM are published in Open-File Report 78-858, available from Open-File Services Section, Branch of Distribution, U.S. Geological Survey, Box 25425, Federal Center, Denver, CO 80225

Hydrothermal convection systems, showing reservoir thermal energy in units of 10^{18} joules

Vapor-dominated systems

- 215A — 1-10
- 40 — 10-100

Hot-water systems > 150°C

- 146 — 1-10
- 64A — 10-100
- 215 — > 100

Hot-water systems 90-150°C

- 30 — < 1
- 59 — 1-10
- 117 — 10-100
- 102 — > 100

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* 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 25425, Federal Center, Denver CO 80225

Volcanic systems showing estimated thermal energy in units of 10^{18} joules. Most are silicic and thought to have a magma chamber within 10 km of the surface

- UT4 — < 100
- ID4 — 100-1000
- AZ1 — 1000-10,000
- ID1 — > 10,000

CA11 — Volcanic system 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

CA7 — Basaltic lava field younger than 10,000 years, showing major vent

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 ≥ 20°C

- ○ Surface temperature not known
- ⊖ Surface temperature ≤ 50°C
- ⊕ Surface temperature > 50°C

5 — Area of significant lateral extent favorable for discovery and development of local sources of low-temperature (< 90°C) geothermal water. Identifying number refers to area listed in USGS Circular 790. Areas are defined by E.A. Sammel (USGS) and Duncan Foley (ESL/UURI) in cooperation with state agencies on the basis of thermal springs, wells, and geohydrologic 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 control

60 ▲ Published regional heat flow datum in milliwatts/m²

▲ Unpublished USGS regional heat flow datum.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

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

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

NGSDC/NOAA, Boulder, CO 80303

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For full references, credits, and explanations of data sets, see Muffler, L.J.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, C44, Riverdale, MD 20840

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