



Geothermal Resources for Energy Development in the United States

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The [U.S. Geological Survey](#), a science agency in the Department of the Interior, assesses [geothermal resources](#) (Earth heat sources) for the development of [geothermal energy](#) in surface and subsurface geologic [formations](#) (i.e., layers of rock) in the United States as part of its [mission](#) and guided by direction in the [Geothermal Steam Act of 1970](#), the [Energy Policy Act of 1992](#), the [Energy Policy Act of 2005](#), and the [Energy Independence and Security Act of 2007](#). Some older USGS assessments (such as those published in [1970](#), [1971](#), [1975](#), [1979](#), and [2008](#)) assessed domestic geothermal resources. The Energy Act of 2020 directed the USGS to update its [2008 assessment](#) and consider potential resources using other [geothermal technologies](#). In 2025, the USGS published preliminary assessments for [enhanced geothermal systems](#) (EGS) and [reservoir thermal energy storage systems](#) (RTES) in some areas. According to the [U.S. Department of Energy](#) (DOE), geothermal resources represent a vast and largely untapped, underground resource that may provide electricity, heating, cooling, and energy storage on or off the grid. Some of this potential may require technological development, and DOE's [Office of Geothermal](#) supports innovations in technology to reduce the risks and costs of geothermal energy development.

[Innovations in geothermal energy technologies](#) may also lead to coproduction of geothermal, oil, gas, and minerals, especially [critical minerals](#) (such as in the [Salton Sea Geothermal Field](#) in California and the [Smackover Formation project](#) in Texas). Congress may consider whether geothermal resource assessments should be advanced and prioritized as the USGS has completed some preliminary assessments in some areas. The USGS assessments may enhance understanding of the nation's geothermal energy and coproduction capacity to support growing demand for [electricity](#), heating, cooling, and [energy storage](#) for buildings, infrastructure, industrial applications, and the growing number of [data centers](#). Assessing geothermal resources may support management of land and water resources (such as [federal lands and water](#)) for many purposes, such as agriculture, building/infrastructure, commercial, conservation, energy, industrial, mining, and recreation.

Status and Development of Geothermal Energy

According to the [National Laboratory of the Rockies \(NLR\) 2025 market report](#), conventional geothermal energy—from a hydrothermal field of hot, wet rocks—is commercially available, accounting for about [0.4% of electricity generation](#) in the United States in 2025. Unconventional geothermal—such as [EGS](#) using hot, dry rocks with engineered [permeability](#) and injected fluid flow—is an [emerging technology](#) that is not widely commercially available in the United States. The [USGS](#) and [DOE](#) support geologic and technological advances that may further develop geothermal energy.

According to the [NLR report](#), as of 2024, the United States was the [world leader](#) in installed geothermal for generating

electricity, while China was the leader in installed geothermal for direct heating. Also as of 2024, conventional geothermal power plants are operating in Alaska (2 plants), California (53), Hawaii (2), Idaho (1), New Mexico (4), Nevada (32), and Oregon (4); new conventional geothermal power plants are planned in California (11), Hawaii (1), and Nevada (3); new EGS power plants are planned in California (4), New Mexico (1), Nevada (3), and Texas (1); and an additional EGS plant (which will power Meta data stations) is planned in an undisclosed location east of the Rocky Mountains. Several new EGS power plants are planned for delivery of electricity directly to data centers. [Fervo Energy](#) is advancing a commercial EGS drilling and reservoir pilot project near the [Blue Mountain Geothermal Facility](#) in Nevada.

Geothermal Energy Technology

[Geothermal energy technology](#) that specifically uses Earth's heat involves drilling wells into hot rocks and extracting heat through production wells to generate electricity, provide heating and cooling, or store energy. For [conventional hydrothermal](#), drilling wells target natural fluids and natural fluid flow (i.e., [permeability](#)) in hot, wet rocks and may inject additional fluids if the natural fluid source becomes depleted. For EGS, drilling wells inject fluids into hot, dry rocks to create fractures or expand natural fractures to allow fluid flow and then inject fluids that can be extracted as heat from production wells. For example, DOE's Frontier Observatory for Research in Geothermal Energy ([FORGE](#)) near Milford, UT, has shown that an EGS engineered permeability and injected fluid geothermal reservoir can be replicated. For thermal energy storage, wells are drilled into aquifers and may store hot or cold fluids for heating, cooling, or electricity generation.

The USGS Geothermal Resource Assessments

The USGS assesses geothermal resources using data and analysis from the USGS and [other sources](#). The USGS has developed [methods](#) and [models](#) to estimate geothermal energy efficiency (i.e., heat extraction rates) based on geologic and technological factors. Energy efficiency depends on the location, volume, and formation characteristics (including composition, structure, temperature, heat flow, permeability, and whether there is natural fluid and/or steam) and the drilling, injection, and production technology. In some cases, developed geothermal energy may provide direct electricity, heating, cooling, and/or energy storage for buildings, data centers, and other commercial/industrial processes.

Hydrothermal Energy—Hot, Wet Rocks

Conventional hydrothermal electricity generation relies on naturally occurring permeable, hot, wet rocks (>90°C or 194°F) with natural reservoirs of fluid and/or steam. The rocks have permeability from naturally existing fractures and pore spaces that are sufficiently connected to allow fluid flow. Conventional

drilling depths range from thousands to tens of thousands of feet below the surface.

Conventional hydrothermal resources are commonly associated with [volcanic activity](#) or [tectonics](#) (i.e., faults and fault movement, mountain building, and other crustal processes), and any constructed hydrothermal energy systems may be vulnerable to damage from natural geologic hazards. For example, The Geysers conventional hydrothermal electricity generation systems in California (the largest [geothermal electrical operation](#) in the world according to [The Geysers, Calpine](#)), are near [faults and volcanoes](#), hazards that should be considered in system operations. [The Geysers geothermal field](#) is a vapor-dominated system (there are no natural hot fluids or [geysers](#) in the field). In 1997, electrical system operators began [injecting](#) treated Lake County wastewater into the geothermal field to offset declining steam levels. Another example, the [Puna Geothermal Venture \(PGV\)](#) in Puna, Hawaii Island, draws steam heated at depth by hot volcanic fluids from [Kilauea volcano](#), among the most active volcanoes in the world, to drive turbines and supply electricity to [Hawaiian Electric](#). PGV reinjects hot fluids to maintain its system and conserve water. PGV provided about [29% of electricity needs](#) on the island in 2017. PGV was shut down because the [2018 Kilauea eruption](#) led to lava flows covering the complex and eliminating access.

[Induced earthquakes](#) from [fluid injection](#) (such as fluid injection to replenish conventional hydrothermal systems or [geothermal stimulation](#) and fluid injection used in EGS) and other geothermal energy development activities are additional risks that must be considered. Induced earthquakes have been [detected at The Geysers](#) and have been attributed to drilling, injection, and production activities.

Conventional hydrothermal resources for heating, such as hot springs and steam vents, can be found at the surface to thousands of feet in depth. [According to NLR](#), there were about 500 geothermal direct heating systems in the United States as of October 2024, including systems for the heating of resorts and pools (281 installations), space heating (77), aquaculture (47), greenhouses (37), [district heating](#) (25), and other applications (15). The oldest example of district heating in the United States is buildings in [Boise, ID](#), directly heated by a geothermal resource, including nearby surficial hot springs.

Enhanced Geothermal Systems—Hot, Dry Rocks

Electricity generated in an EGS relies on engineered fluid flow systems constructed in low-permeability, hot, dry rocks. A drilled well injects fluid into the target formation of hot, impermeable rocks to create fractures or expand natural fractures to allow fluid flow. The [geothermal stimulation technique](#) is similar to [hydraulic fracturing](#) used in shale-rich formations to produce oil or gas. DOE supports research, development, and demonstration for EGS, such as [FORGE](#) and the [Newberry Geothermal Project](#) on the flank of Newberry Volcano in Oregon. Policy and industry stakeholders also suggest that the similar expertise, workforce, and infrastructure in the oil and gas industry may support the commercial development of EGS in the United States.

In 2025, the USGS completed a [provisional assessment](#) of the geothermal resources for EGS electricity generation associated with high-temperature, low-permeability, dry geologic

formations of the Great Basin and noted high potential resources in California, Idaho, Nevada, and Utah. The largest uncertainty in the assessment was estimating which geologic formations can be stimulated sufficiently and economically produce geothermal energy. Establishing a functional and sustainable fracture pattern in the rock is critical for commercial EGS. The USGS plans to assess potential resources for EGS elsewhere, such as in the Williston Basin (beneath the Dakotas) and the Illinois Basin.

Underground Thermal Energy Storage Systems—Shallow to Deep Aquifers

More [energy storage](#) is needed in the United States, and there is increasing interest in developing geothermal resources for energy storage as another option besides [energy storage batteries](#). As directed by the Energy Act of 2020, the USGS has added [three types of thermal energy storage](#) (TES) systems to its geothermal resource assessments. Aquifer thermal energy storage (ATES) stores hot or cold water in shallow [aquifers](#). Borehole thermal energy storage (BTES) uses underground pipes to store hot or cold water. BTES can be used anywhere that [groundwater flow rate](#) is not too high, but requires more wells to store an equivalent amount of energy as other TES. Reservoir thermal energy storage (RTES) stores hot or cold water in deep aquifers, often with low-quality (i.e., saline/brackish waters) and low-flow-rate groundwater. RTES may allow more energy storage because of higher temperature differences than other TES. RTES would have less conflict with high-quality groundwater needs, because most of the deep aquifers are disconnected from other water systems. RTES may be able to repurpose idle or unproductive oil and gas wells for geothermal energy. DOE has [several projects](#) to retrofit wells or coproduce geothermal energy from producing oil and gas wells.

The USGS [2025 Reservoir Thermal Energy Storage Pre-Assessment for the United States](#) examined eight metropolitan areas across different climates and subsurface conditions: Albuquerque, NM; Charleston, SC; Chicago and Decatur, IL; Lansing, MI; Memphis, TN; Phoenix, AZ; and Portland, OR. All eight areas were favorable for RTES.

Congressional Considerations

Identifying geothermal resources and developing geothermal energy systems has typically garnered [bipartisan support](#) in U.S. energy policy. The Biden Administration's [Executive Order 14141](#) called upon any artificial intelligence infrastructure, such as data centers, to consider using geothermal energy and established Priority Geothermal Zones. The second Trump Administration's [Executive Order 14156](#) identified geothermal as an essential energy that should be further developed.

Some bills in the 119th Congress would expand geothermal resource assessment to Puerto Rico ([H.R. 10275](#), introduced), expand geothermal research and development ([H.R. 8790](#), passed in House, and [S. 4406](#), committee reported favorably; [H.R. 7568](#), introduced), and expand geothermal demonstration projects ([H.R. 8437](#), reported as substitute, and [S. 4116](#), reported with amendment). Congress may consider whether the USGS preliminary geothermal assessments published in 2025 advance the development of geothermal energy and whether additional assessments should be prioritized.

Linda R. Rowan, Analyst in Natural Resources and Earth
Sciences

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