

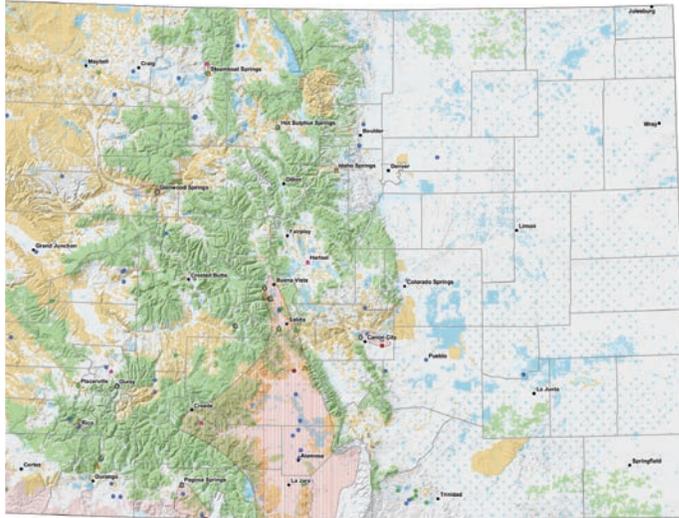


# Geothermal Technologies Program Colorado



(NREL, Warren Gretz, PIX07933)

***The entire San Luis Valley in south-central Colorado and many smaller areas throughout the mountainous part of the state have good low-temperature (less than 100°C, or 212°F) geothermal resources. Such resources have the potential for direct-use applications and many Colorado towns and businesses already take advantage of them. Colorado has more than a dozen significant hot springs resorts and public bathing facilities, many of which also use geothermal water for space heating. Colorado also has several fish farms, one district heating system, and one greenhouse using geothermal water.***



Idaho National Laboratory <http://geothermal.id.doe.gov/maps-software.shtml>

***Although Colorado geothermal development has thus far been limited to direct use of low-temperature surface resources, the state has several indicators for power development potential from deeper resources. Subsurface heat flow, for example, is high in the western part of the state, notably the Arkansas River Valley and the San Luis Valley.***

## Current Development

The hot springs pool in Glenwood Springs, Colorado, billing itself as the world's largest, is a major tourist attraction. The town hosts more than two million visitors per year, and its geothermal attractions are clearly the major draw. Alamosa, Ouray, Salida, and Steamboat Springs all have community owned geothermal bathing facilities and Colorado has numerous active small and moderate private hot-springs resorts.

Thinking about fish farming in Colorado, you would expect to hear about growing trout in water from cold mountain streams. The state does have plenty of that, but also has a number of warm-water aquaculture facilities benefiting from geothermal water supplies, most notably in the Alamosa area. Facilities there raise tilapia, catfish, and striped bass,

and one has made itself a tourist attraction by also raising alligators! In the Buena Vista area, which also supports a couple of hot springs resorts, geothermal heat is being used to heat a commercial greenhouse.

The town of Pagosa Springs has had a geothermal district-heating system for more than 20 years. Originally built with support from the DOE Geothermal Technologies Program, the system now serves 15 customers including the town's three schools, the county building, two office buildings, and two churches. At least a dozen public buildings throughout the state use geothermal heat pumps for heating and cooling systems. Systems installed by school districts in Colorado Springs and Fort Collins, for example, were able to cut energy costs in half. Some of these new construction systems paid for themselves within 5 years, and the

***The Hot Springs Lodge and Pool in Glenwood Springs is a major reason the Colorado resort town draws more than two million visitors per year.***

## A Strong Energy Portfolio for a Strong America

Energy efficiency and clean, renewable energy will mean a stronger economy, a cleaner environment, and greater energy independence for America. Working with a wide array of state, community, industry, and university partners, the U.S. Department of Energy's Office of Energy Efficiency and Renewable Energy invests in a diverse portfolio of energy technologies.



NREL, Warren Gretz, PX03876

**Alligators in front of snow-capped mountains? Yes the photo is real and geothermal aquaculture is what makes it possible in Colorado's geothermal-rich San Luis Valley.**

most recent did not cost any more than conventional systems. In western Colorado, the Delta-Montrose Electric Association has actively promoted geothermal heat pumps, and more than 400 homes in their service area have installed systems.

## Economic Benefits

The Glenwood Springs hot springs pool directly supports a 107-room hotel and contributes to others nearby. Two-thirds of the town's income is from non-resident sales tax. The Mount Princeton Hot Springs Resort near Buena Vista has 47 rooms and the Hot Sulfur Springs Resort 18. The smaller private resorts and the community hot springs all contribute to tourism in their communities. These and the many undeveloped hot springs in Colorado are a great attraction and play an important role in the state's recreation and tourism industry.

## Potential Development

Colorado's geothermal resources are all less than 100°C (212°F) at the surface. At greater depth, however, there are high temperatures below most of the Colorado mountains (Rio Grande Rift). Power generation is possible if higher temperature resources are available within reasonable depth—generally 120°C (248°F) within 4 km (13,123 ft)—and there would be adequate water flow. Studies by the Colorado Geological Survey, Idaho National Laboratory, and others have found promising conditions at nine areas in Colorado, most notably in the Chalk Creek area near Buena Vista, near the Mount Princeton Hot Springs Resort. Any development would need to be relatively small (perhaps 5 MW) and binary—using the geothermal water to

heat a secondary, lower-boiling-point fluid, unlike dry steam or flash steam geothermal power plants using higher temperature resources. Such a closed-loop system would, however, avoid most adverse environmental impacts.

Low-temperature geothermal resources also offer potential for development. According to a “Collocated Resources Study,” conducted by the Geo-Heat Center, 15 communities in Colorado are within 8 km (5 miles) of a geothermal resource with a temperature of at least 50°C (122°F), making them good candidates for district heating or other geothermal use.

## Policy

Colorado voters passed a referendum in 2004 for a 10% renewable portfolio standard by 2015 for the state's electric utilities that would encourage geothermal power production.

## Technical Capabilities

The Colorado Geological Survey has conducted and published several surveys of geothermal resources, including a recent compact disc of bottom-hole temperature data from oil and gas wells in the state. The DOE National Renewable Energy Laboratory in Golden, Colorado, is a national resource for geothermal and other renewable energy technologies. The state also has several universities and private consulting firms with strong geology programs.



## GEOPOWERING THE WEST

**GeoPowering the West is a cooperative federal, state, and local effort to promote awareness of the vast geothermal energy resources in the western United States, including Alaska and Hawaii. GeoPowering the West partners with businesses, government officials, Native American groups, utilities, and energy consumers to expand the use of geothermal energy.**

### For more information contact:

#### EERE Information Center

1-877-EERE-INF (1-877-337-3463)

eereic@ee.doe.gov or visit: [www.eere.energy.gov](http://www.eere.energy.gov)

#### Colorado Governor's Office of Energy Management and Conservation

Ed Lewis

(303) 866-2204

ed.lewis@state.co.us

[www.state.co.us/oemc/programs/renewable/geothermal.htm](http://www.state.co.us/oemc/programs/renewable/geothermal.htm)

#### Colorado Geological Survey

Dr. Vincent Matthews, Director

(303) 866-3028

Vince.Matthews@state.co.us

<http://geosurvey.state.co.us>

#### Geo-Heat Center - Direct-Use Technical Info.

(541) 885-1750 [geoheat.oit.edu/](http://geoheat.oit.edu/)

#### U.S. Department of Energy Central Regional Office

Sandy Glatt

(303) 275-4857

sandy.glatt@ee.doe.gov

#### U.S. Department of Energy GeoPowering the West

Roger Hill, Technical Director,

(505) 844-6111

rrhill@sandia.gov

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