

California steaming: Geysers show geothermal potential

By Jim Borg 5/14/90
Advertiser Science Writer

GEYSERVILLE, Calif. — Along Sonoma County's Big Sulfur Creek, wisps of steam against the green hillside offer the first hint of human activity.

A closer look reveals the characteristic cooling towers and a network of pipes that resemble the legs of a huge spider.

Farther down the winding road, more pipes and plants emerge from the mountainous terrain.

Straddling the border of Sonoma and Lake counties in northern California, the one-time resort area known as The Geysers encompasses the world's largest and most successful geothermal energy field.

Nestled above California wine country, the rock-encased reservoir of 355-degree steam feeds plants engineered to pump out 1,900 megawatts of electricity. That's a little shy of generating capacity in the entire state of Hawaii.

But after a decade of heavy development, the reservoir is literally running out of steam, with power production dropping dramatically and future plant construction curtailed.

"Geothermal is not a renewable resource," remarks Harry Bain, a spokesman for the principal steam developer at the Geysers, Union Oil Co. of California. "We recognized that it would deplete. I think that what caught everyone by surprise is the depletion accelerated... At first, nobody wanted to believe it."

Environmental and production problems at The Geysers have been used as ammunition against proposed large-scale geothermal power in Hawaii.

But while the energy potential of The Geysers was obviously overestimated, geologists say there are important differences between these underground steam pockets and the magma-heated groundwater on the east rift of Kilauea Volcano.

Still, if the steam merchants had it all to do over again, "I

think it would be a little slower development that we've had here," says Myron Burr, a resource engineer with Unocal's Geothermal Division in Santa Rosa. "Assess the resource and see how it's going to behave under development."

At this end of the Mayacmas Mountains, underground steam forms from water heated by molten rock or magma, itself the product of immense pressure from a complicated collision of geological faults. A system of fissures allows some steam to escape to the surface.

When bear hunter William Elliott stumbled across the yellow vents in 1847, the overwhelming smell of sulfur — or brimstone — led him to call Geysers Canyon "the gate of Hades."

In the late 19th and early 20th century, The Geysers were a popular resort offering mineral baths and invigorating treks to colorful spots with names like Witches' Caldron and Devil's Tea Kettle. The steam-spewing fumaroles attracted such visitors as Ulysses Grant, Mark Twain and Teddy Roosevelt.

The energy potential was first tapped in 1920, but commercial

development didn't arrive for another four decades.

Between 1960 and March 1979, 12 power plants were installed on the Sonoma County side, providing a total of 608 megawatts to Pacific Gas & Electric Co. The two largest plants carried a generating capacity of 106 megawatts.

Against the oil crisis of 1973 and with long delays in nuclear power plant construction, natural steam seemed an ideal energy resource. By the 1980s, large plants were the rule rather than the exception.

"Everybody wanted geothermal," says Burr.

Unocal, Thermal Power Co., and Phillips Petroleum added another six plants with a total capacity of nearly 700 megawatts, including two in Lake County. One of the Lake County plants, designated PG&E-13, with a capacity of 135 megawatts, is the largest geothermal plant in the world.

A number of other smaller private and municipal power



Advertiser photo by Jim Borg

Billows of water vapor rise from the ridge-top cooling towers of two 53-megawatt geothermal plants operated by Pacific Gas & Electric Co. in Sonoma County, Calif.

generating interests also eagerly tapped into the reservoir, raising the total installed capacity to about 1,900 megawatts. (Hawaii's installed capacity is about 1,950 megawatts.)

To the consternation of all involved, steam pressure at The Geysers began to fall off rapidly in 1987. As a result, plans for two 140-megawatt plants and a smaller Phillips plant have been scrapped.

And Unocal's 16 PG&E units, carrying a capacity of 1,100 megawatts, have seen a steady decrease in power production to a current average of about 755 megawatts, says Bain.

"Too many straws in the soda," remarks Lake County supervisor Voris Brumfield, a resident of nearby Anderson Springs.

What geologists discovered too late about the Geysers is that the underground steam is surrounded to a large extent by tight formations of rock that prevent the reservoir from being replenished rapidly by rain.

"The hypothesis is that there is natural recharge," says Bain. "We feel it takes place at the edges of the reservoir, but it

tends to be a sealed system. As an industry at The Geysers, we're withdrawing those fluids a lot faster than nature can replace them."

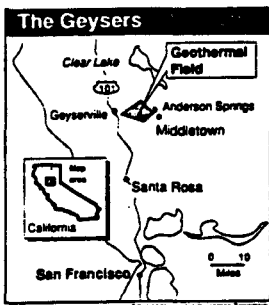
One former engineer now with a competing company put it more bleakly. The Geysers, he said, are "not in hydrological communication with the rest of the world."

Engineers have attempted to produce more steam by injecting water into the ground, but the sudden rush of cooler fluid has caused rocks to explode, damaging the well equipment.

Only recently have experiments with re-injection proved encouraging, says Bain.

"We're beginning to see some really dramatic results in a pressure sink where we're injecting," he says. "There are not that many wells involved. We wanted to isolate a part of the field where we can experiment, but in some of these areas we're experiencing almost 100-percent recovery."

Overall, while the steam supply is tailing off, "we're seeing a long tail," says Bain. Unocal expects to provide at least 600 megawatts worth of steam to PG&E through the 1990s.



Advertiser graphic by James Tompkins