
The Economic, Environmental, and Social Benefits of Geothermal Use in Hawaii

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Geothermal heat or water has been used in the Aloha State for centuries. Missionaries exploring Hawaii in the early 1800s witnessed the Native Hawaiians soaking in the warm springs. Today, naturally occurring steam vents and warm ponds are used for recreational and agricultural purposes.

Due to the state's geology, cracks in the earth in volcanically active areas allow steam to rise to the surface through vents. Some people stick coils of copper pipe into these "wild" steam vents to heat water. Others relax and rejuvenate in the many natural warm ponds located along the Puna coast.

Despite the wealth of geothermal resources, however, few small businesses directly use geothermal heat or water in Hawaii. The Kapoho Kai Nursery in Pahoia has built a small greenhouse over a steam vent. The



Steam vents along the Sulphur Banks Trail near the Kilauea Visitor Center (Photo: U.S. Department of the Interior)

steam heats the greenhouse, encouraging the landscaping palms to germinate. According to the owner, an added bonus is the steam's slight sulphur content which discourages the growth of unwanted pests.

The 27-acre Steam Vent Mission in the Kingdom of Heaven, formerly known as the Steam Vent Inn and Health Retreat, contains more than 150 active steam vents. "A natural wonderland in tropical paradise" invites guests to "relax, rejuvenate, and heal in Hawaii's only lava-heated steam saunas and adjacent geothermal bathing pools."

The largest use of geothermal in Hawaii is electricity generation. Located about 21 miles south of Hilo on the Big Island of Hawaii, the Puna Geothermal Venture (PGV) has produced electricity from geothermal resources since April 1993.

PGV has an installed capacity of 30 megawatts (MW), and sells about 212 million kilowatt hours (kWh) per year to Hawaii Electric Light Company (HELCO). The geothermal plant supplies about 20 percent of the Big Island of Hawaii's total electricity demand.

Economic benefits

PGV benefits Hawaii's economy in many ways. It creates jobs. With an annual payroll of more than \$3.8 million, PGV provides well-paying full-time jobs to about 30 people. Using a standard multiplier of 2.5, the geothermal plant creates 75 direct, indirect, and induced jobs in Hawaii.

In addition to job creation, PGV contributes to Hawaii's economy through local, state, and federal taxes, and royalties. The plant pays more than \$2.5 million a year in taxes and royalties. In 2005, it paid \$969,980 in royalties—50 percent goes to the state, 30 percent to the county, and 20 percent to the Office of Hawaiian Affairs.

Over the 13 years PGV has been generating electricity, the plant has paid about \$50 million in payroll, and \$32.5 million in taxes and royalties.

Last but not least, geothermal energy reduces the demand for imported oil, helping to stabilize the cost of electricity.

Imported petroleum currently supplies about 90 percent of the state's energy. In 2004, utilities spent \$524.2 million on fuel for electricity production, passing the cost on to the customer, who in turn paid \$1.656 billion for electricity.

Using indigenous geothermal resources, PGV has reduced the need to import more than 5 million barrels of oil since 1993. Using the average price per barrel from 2000 through 2005 of \$26.78, PGV has resulted in an estimated cost savings of \$144.6 million from 1993 to the present.

According to the Energy Resources Coordinator's 2004 Annual Report, "Every barrel of oil saved translates to more dollars available to the local economy, in addition to the many environmental benefits."

Environmental benefits

In addition to jobs, taxes, royalties, and reducing Hawaii's reliance on imported fuel, PGV prevents the emissions of greenhouse gases (GHG) and air pollutants. Since 1993, the Puna geothermal power plant has offset roughly 2.5 million tons of

carbon dioxide emissions that would have been generated by a similar-sized fossil fuel plant. This is equivalent to 5.4 million barrels of oil. In addition, the plant annually offsets the emission of 1,328 tons of nitrogen oxides and 983 tons of sulfur dioxides (see Table 1).

In comparison, as a whole, Hawaii's electric industry emitted 29,000 tons of sulfur dioxide; 15,000 tons of nitrogen oxides; and 9 million tons of carbon dioxide in 2002. The annual GHG emissions are equivalent to burning 19 million barrels of oil.

The PGV geothermal plant also eliminates the need to ship fuel oil from the refineries on Oahu, reducing the risk of oil spills.

Social benefits

Social benefits are difficult to measure quantitatively. The Energy Resources Coordinator's 2004 Annual Report stresses energy's relevance to standard of living, a contributor to social well-being. The report notes that "Energy continues to be a key factor shaping Hawaii's economy, environment, and standard of living. A stable energy supply is essential to continued prosperity."

The use of indigenous energy resources, such as geothermal, results in predictable long-term electricity rates, and ensures that fewer dollars leave the state to purchase fuel and are instead available for other purposes within the islands' economy. A strong local economy includes a vibrant visitor industry: the Department of Business, Economic Development and Tourism (DBEDT) projects that Hawaii expects to host 7.7 million visitors spending 70,000 days and \$12.4 billion in 2006.

The Future

Hawaii is rich with low- and medium-temperature geothermal resources which could be developed into thriving small businesses. Geothermal heat or water, including the waste heat from the Puna geothermal plant, could be used to dry fruit; provide cold storage or refrigeration; grow fish or other aquatic species; heat greenhouses; process agricultural goods, e.g., lumber, macadamia nuts, and animal feed; pasteurize or sterilize; and pamper guests in spas and resorts.

PGV has received permits to double its installed capacity to 60 MW. Doing so would likely also double the significant economic and environmental contributions it makes to Hawaii.

In addition, the State is exploring producing hydrogen via electrolysis using geothermal.



Puna Geothermal Venture, Pahoehoe, Hawaii
(Photo: Ormat)

The potential for geothermal to contribute to Hawaii economically, environmentally, and socially—even more than it already does—is substantial.

Name	Location, County	Installed Capacity MWe	Annual Energy produced kWh	Annual Emissions Offset (tons)			Years online	Total Carbon dioxide offset (tons)
				Nitrogen oxides	Sulfur dioxide	Carbon dioxide		
Puna Geothermal Venture	Pahoehoe, Hawaii	30	212,060,000	1,328	983	196,812	13	2,558,552

Table 1 — Annual greenhouse gas and air pollutant emissions offset by Puna Geothermal Venture.