OFFICE OF POWER TECHNOLOGIES

Success Stories

# Geothermal Heat Pumps are Scoring High Marks

*The Office of Power Technologies is part of the Office of Energy Efficiency and Renewable Energy*

## Geothermal heat pumps, one of the clean energy technology stars

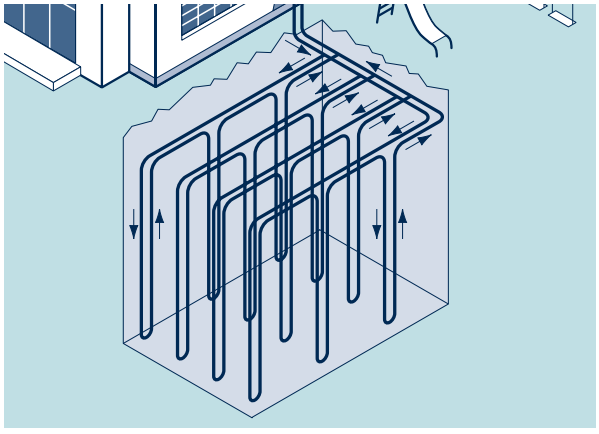
Geothermal heat pumps (GHPs) are one of the most cost-effective heating, cooling, and water heating systems available for both residential and commercial buildings. GHPs extract heat from the ground during the heating season and discharge waste heat to the ground during the cooling season. The U.S. Environmental Protection Agency found that GHPs can reduce energy consumption and corresponding emissions by 63% to 72% when compared to electric resistance heating with standard air-conditioning equipment. Payback periods often show a range from 2 to 8 years.

### *Highlights*

- ***The federal government, through its collaboration with the Geothermal Heat Pump Consortium, is seeking to install 2,000,000 GHP systems in the United States by 2005.***
- ***DOE-sponsored R&D has encouraged advances in GHP design software, in-situ thermal conductivity tests, thermally conductive grouts, snowmelt capabilities for driveways and sidewalks, and borehole liners.***
- ***The U.S. Environmental Protection Agency found that GHPs can reduce energy consumption and corresponding emissions by 63% to 72% when compared to electric resistance heating with standard air-conditioning equipment. Payback periods often show a range from 2 to 8 years.***
- ***Utility surveys indicate a higher level of consumer satisfaction for GHPs than for conventional HVAC systems. Polls consistently show that more than 95% of all GHP customers would recommend GHPs to a family member or friend and would buy a GHP again.***

About 400,000 GHPs are being used for heating and cooling of residential, commercial, and institutional buildings throughout the United States today. The growth target of the Geothermal Heat Pump Consortium (GHPC) and federal government is to install 2,000,000 GHPs by the year 2005. Achieving this goal will reduce greenhouse gas emissions by about 1.2 million metric tons or carbon a year.

In addition, surveys by utilities indicate a higher level of consumer satisfaction for GHPs than for conventional systems. Polls consistently show that more than 95% of all GHP customers would buy a GHP again and would recommend GHPs to a family member or friend.



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*A typical GHP system, such as this elementary school application, circulates water through ground-source heat exchangers to provide space heating/cooling and hot water.*

DOE is a founding member and major funding participant in the GHPC. This partnership includes more than 200 utilities in addition to GHP manufacturers; heating, ventilating, and air-conditioning vendors; architectural & engineering firms; and public agencies. The GHPC is working to educate the public about the technology and to expand the GHP market in the Untied States.

# Geothermal Heat Pumps

***If geothermal heat pumps were installed nationwide, they could save several billion dollars annually in energy costs and substantially reduce pollution.***

*—U.S. General Accounting Office, "Geothermal Energy," June 1994*

DOE funds other GHP research and development and technical assistance programs at the International Ground Source Heat Pump Association and Oak Ridge National Laboratory. The overall objective is to reduce the time and cost of installing the ground heat exchangers for both residential and commercial buildings through advances in design software, in-situ thermal conductivity tests, thermally conductive grouts, snowmelt capabilities for driveways and sidewalks, and borehole liners. New, fully integrated systems including food refrigeration, snowmelt capability, and water heating are being designed and tested in conjunction with industry.

Experience has shown that use of GHPs can benefit electric utilities and their customers. GHPs offer a flatter load profile (reduced "peaks and valleys") because they take advantage of the Earth's relatively constant ground temperature. The result is a lower contribution to weather-related peak demand (e.g., severe hot or cold spells) than other electric options. Because GHPs reduce peak demands, some electric utilities offer special electric rates for GHPs, and special financing or rebates.

A highly successful project at Fort Polk, Louisiana, where 4,003 U.S. Army housing units were converted to GHPs, is a noteworthy example of load management-related benefits. Fort Polk achieved a reduction of 43% or 7.5 MW of peak summer load after installing GHPs. Fort Polk's load factor was improved from 52% to 62%. Since the GHP systems were installed, service calls on hot summer days have dropped from 90 per day to virtually none, testifying to the reliability of GHP systems.

Financing for the project at Fort Polk was provided by the Co-Energy Group under an energy savings performance contract (ESPC). Under DOE's Federal Energy Management Program (FEMP), an ESPC program for GHPs will be available for all federal agencies by late 1998.

The Fort Polk project received Vice President Al Gore's "Hammer Award" in 1997 for "hammering away at building a better government"—one that works better and costs less. And the U.S. Army is saving about 22% compared with previous maintenance costs!

## Project Partners

*U.S. Department of Energy*

*U.S. Environmental Protection Agency*

*Geothermal Heat Pump Consortium*

*Geo-Heat Center*

*International Ground Source Heat Pump Association*

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