Geothermal Heat Pump (GHP) Case Studies

Case Study: "GHP schools used approximately 26% less source energy per square foot of floor area," according to an evaluation of Lincoln, Nebraska schools by the Department of Energy. The report concludes that the schools using GHP technology "outperform others in the school district."
Source document: Geothermal Heat Pumps in K-12 Schools: A Case Study of the Lincoln, Nebraska Schools. Oak Ridge National Laboratory, ORNL/TM-2000/80, p. 12. Retrieved February 4, 2013 at http://www.ornl.gov/sci/ees/etsd/btric/pdfs/com_ghpsinschools.pdf

Case Study: Annual electrical consumption in Fort Polk family housing was reduced 33% with a 43% reduction in the peak summer demand by installing GHPs, according to an independent Oak Ridge National Laboratory evaluation. Annual natural gas consumption of 26 billion BTUs was totally eliminated. Carbon emissions were reduced by 22,400 tons per year. The project was funded and built by an energy services company. Operational cost savings are used by the Army to repay the firm's initial capital costs and an ongoing maintenance fee. Even after these payments, Fort Polk saves about $345,000 annually in operating costs. Once the 20-year contract with the private sector firm ends, the Army's operating cost savings will jump to about $2.2 million per year during the remaining GHP service life.
Source document: Big Savings from the World's Largest Installation of Geothermal Heat Pumps at Fort Polk, Louisiana. Department of Energy. Retrieved February 5, 2013 at http://www.ornl.gov/sci/femp/pdfs/fortpolk.pdf

Case Studies: 256 case studies of geothermal heat pump installations for school, commercial and residential buildings are summarized in a U.S. Department of Energy-funded report. The report finds that savings from GHP use vary over a wide range. Variations are the result of factors such as climate, GHP type, soil conditions, equipment efficiencies, sizing and other issues. On average, the report found:

School Geothermal Heat Pump Annual Savings				
	Mean Annual Savings (%)			
Conventional System	Number	Energy	Number	Dollars
Electric Resistance Heat	2	51%	3	45%
Natural Gas Furnace	3	61%	1	13%
Fuel oil	1	76%	1	58%
Commercial Geothermal Heat Pump Annual Savings				
	Mean Annual Savings (%)			
Conventional System	Number	Energy	Number	Dollars
Electric Resistance Heat/AC	6	59%	5	56%
Air-Source Heat Pump	3	40%	3	37%
Natural Gas Furnace	4	69%	4	49%
Fuel oil	6	72%	7	31%
Residential Geothermal Heat Pump Annual Savings				
	Mean Annual Savings (%)			
Conventional System	Number	Energy	Number	Dollars
Electric Resistance Heat/AC	21	57%	18	54%
Air-Source Heat Pump	33	31%	21	31%
Natural Gas Furnace/AC	17	67%	21	18%
Oil Furnace/AC	6	71%	9	33%
Other (propane, unspecified	7	46%	7	39%

Source document: Ground-source Heat Pump Case Studies and Utility Programs, Paul J. Lienau, Tonya L. Boyd, Robert L. Rogers, Geo-Heat Center, Oregon Institute of Technology. Prepared For: U.S. Department of Energy, Geothermal Division, April 1995. Retrieved February 4, 2013 at http://geoheat.oit.edu/pdf/hp1.pdf

national ground water association®

Phone/ Toll-free 800 551.7379/ 614 898.7791 **Fax/** 614 898.7786
Web/ www.ngwa.org and www.wellowner.org
Address/ 601 Dempsey Road/ Westerville, Ohio 43081-8978 U.S.A.

Case Study: In 2006, two identical office buildings were constructed in Edmond, Oklahoma. One building was equipped with a traditional heating, ventilation and air conditioning system, and one building was equipped with a GHP. Energy use was metered for both buildings. The building with a GHP has an annual energy saving of 47%. In addition, the building with a GHP reduced the utility's peak demand by 35%.
Source: Communication from the GEOexchange Association. Contact information at:
http://www.geoexchange.org/index.php?option=com_contact&view=contact&id=1&Itemid=19

Case Study: Every Habitat for Humanity home in Oklahoma is equipped with a GHP and solar photovoltaic. The energy cost for each home averages a dollar per day. Low-income families are better able to stay in their homes because of the significant energy cost savings.
Source: Communication from the GEOexchange Association. Contact information at:
http://www.geoexchange.org/index.php?option=com_contact&view=contact&id=1&Itemid=19

Case Study: This project identifies common characteristics of successful GHP systems in commercial buildings and the prevalence of problems related to long-term ground temperature change. A general trend of improved Energy Star ratings was found for newer GHPs. All of the reviewed installations that were done in the last six years had an Energy Star rating above 80 and most above 90. The project focused on systems in the southern Kentucky to Florida Panhandle area but was also expanded to look at south-central Texas and central Illinois. Twenty-two of 35 buildings reviewed attained an Energy Star designation. Energy Star designation means that normalized building source energy use is lower than 75% of equivalent buildings.
Source document: Long-Term Commercial GSHP Performance Part 1: Project Overview and Loop Circuit Types. Steve Kavanaugh, Ph.D. ASHRAE Journal. June 2012, p 48-55.

Future Case Studies: Ground Source Heat Pump Data Mining Research Project. The U.S. Department of Energy is currently conducting research into GHP data mining. This project is intended to build public awareness of GHP technology through the development of case studies outlining costs and benefits. Seven demonstration projects have completed construction and are collecting performance data currently. In-depth case studies for two to three of these projects are anticipated in 2013.
Source document: Ground Source Heat Pump Data Mining Research Project. Department of Energy. Retrieved February 5, 2013 at http://www1.eere.energy.gov/buildings/technologies/proj_pump_data_research.html

For further information about GHPs or the National Ground Water Association (NGWA), contact:

J.C. Sandberg, NGWA Washington Representatives
Baker, Donelson, Bearman, Caldwell & Berkowitz
920 Massachusetts Avenue NW, Suite 900
Washington DC 20001
(202) 508-3470
jcsandberg@bakerdonelson.com

The National Ground Water Association is a not-for-profit professional society and trade association for the groundwater industry. Our members from all 50 states include some of the country's leading public and private sector groundwater scientists, engineers, water well contractors, manufacturers, and suppliers of groundwater-related products and services. The Association's vision is to be the leading groundwater association that advocates for the responsible development, management, and use of water.