

Geothermal: The Clean Energy Secret

May 7, 2008



Published by Dr. Patrick Moore in conjunction with
the New York Affordable Reliable Electricity Alliance (New York AREA)



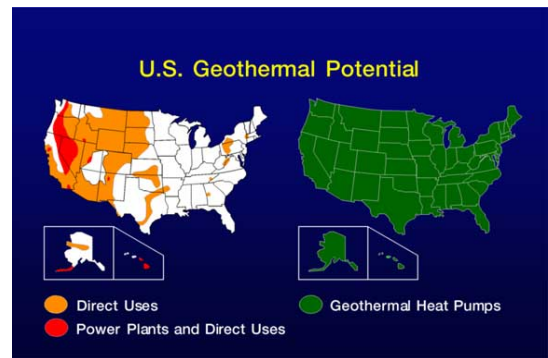
Geothermal: The Clean Energy Secret

While there has been tremendous discussion about the potential of renewable sources of power like wind, solar and biomass, one of the most successful and appealing technologies – geothermal power – has been largely ignored.

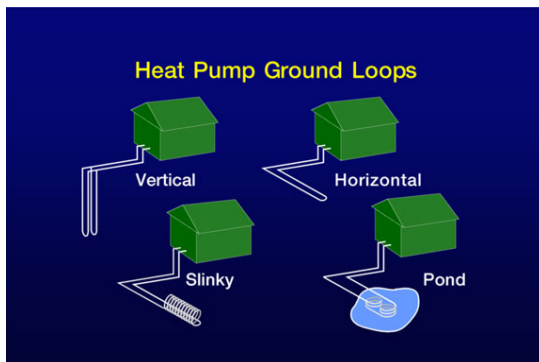
There are two distinct types of geothermal energy. One type of geothermal is based on the natural heat of the earth, where below the earth's crust the decay of radioactive elements heats the earth to over 1600 degrees Fahrenheit. This heat can be tapped to produce steam to make electricity or to produce hot water for direct heating of buildings. The other type of geothermal energy is based on the stored solar energy within a few hundred feet of the earth's surface. By employing geothermal heat pumps (GHPs) this energy can be used to heat and cool buildings as well as to supply domestic hot water. Although geothermal power currently supplies less than one percent of the nation's electricity, there is great potential to harness geothermal heat pumps for heating and cooling.

Geothermal Power in New York

Although there is potential for the use of geothermal energy in New York State, there has been little discussion about the potential role for this clean and renewable energy source in the state's energy supply. The east coast of the U.S. lies on relatively stable plates with little to no volcanic activity. For this reason larger scale geothermal district heating or electricity production (details below) are not viable or cost effective. However, there is great potential in New York State and across the United States for the use of geothermal heat pumps as a variety of different systems and designs have been created to take advantage of any type of terrain. The diagram below shows different heat pump ground loops.



Courtesy of the Geothermal Education Office



Courtesy of the Geothermal Education Office

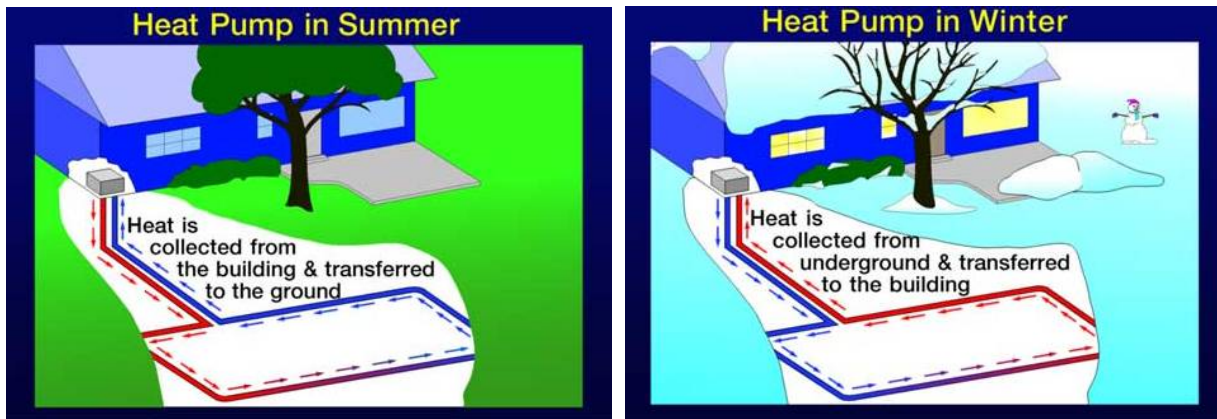
In 2000/2001 efforts were taken to encourage the installation of GHPs when the Geothermal Heat Pump Consortium (GHPC) was created to educate home- and business-owners about the benefits of installing GHPs for heating and cooling. Then Governor Pataki awarded the GHPC a \$250,000 grant to continue their education and outreach on GHPs. The New York State Energy and Research Development Authority (NYSERDA) partially funds the GHPC and provides incentives to help offset the cost of GHP installation. NYSERDA President William M. Flynn stated "...NYSERDA is eager to continue and expand our efforts to bring energy efficiency and

renewable energy technologies to the forefront and allow New York State to reap the energy, environmental, and economic benefits [that geothermal] technology offers."

Geothermal Energy Systems

There are three ways to use geothermal power.

Geothermal (Ground Source) Heat Pumps (GHPs): According to the U.S. Environmental Protection Agency (EPA), “geothermal heat pumps are the most energy-efficient, environmentally clean, and cost-effective systems for temperature control.” Despite temperatures above ground changing frequently from day to day and season to season, temperatures in the upper 10 feet of the earth’s crust are nearly constant at 50 to 60 degrees Fahrenheit. For most regions this means that soil temperatures are usually warmer than the air in the winter and cooler than the air in the summer. GHPs harness these constant temperatures to transfer heat from the ground (or water) into buildings in the winter and reverse the process for cooling in the summer.



Courtesy of the Geothermal Education Office

Every year in the U.S. close to 60,000 organizations and individuals install geothermal heat pumps, greatly reducing the fossil fuels their homes and businesses consume as well as reducing their energy bills and carbon footprint.

Utility surveys indicate that consumers are highly satisfied with GHPs and more than 95 percent of all GHP users would recommend them and would buy a GHP again. Although GHPs can cost from \$2,000 to \$5,000 more than conventional heating, ventilation, and air-conditioning (HVAC) systems, investment payback periods range from two to eight years and will presumably continue to decrease as fuel prices and electricity rates increase and GHP technology becomes more common.

Direct Use and District Heating Systems: Hot water from springs or reservoirs near the earth’s surface is piped directly into buildings for heat. Currently district heating accounts for 95 percent of the heating in Reykjavik, Iceland. As direct use and district heating systems must be located directly near a hot spring or geyser, they are uncommon. In the western U.S. there are currently 18 district heating systems and over 270 cities are close enough to geothermal reservoirs to potentially benefit from district heating.

Electricity Generation: Geothermal power plants use steam at temperatures of 300 to 700 degrees to drive turbines and generate electricity. Plants are generally built where geothermal reservoirs are located a mile or two from the earth’s surface. Deep wells are drilled and steam or hot water is piped to the surface. The United States generates more geothermal electricity than any other country, yet the amount of electricity produced from geothermal is less than one percent of the electricity produced nationwide. Only four states have geothermal power plants, California, Nevada, Hawaii and Utah.

Geothermal Energy & the Environment

Geothermal power plants do not burn fuel and therefore produce near-zero emissions (about one to three percent of the carbon dioxide of a fossil fuel plant) and emit 97 percent less acid rain causing sulfur compounds. Additional scrubber systems are used to limit the release of hydrogen sulfide which occurs naturally from the geothermal process. After the steam and water from the reservoir have been used they are injected back into the earth making geothermal electricity generation completely renewable. Geothermal power plants also work continually, making them a reliable base-load power source. Unfortunately geothermal power plants must be built in designated active areas. Sources are usually found along major plate boundaries where volcanic activity is concentrated. As the only way to locate geothermal reservoirs is drilling deep wells, development can be difficult and expensive.

GHPs are more common and have significant environmental benefits. Currently there are over one million GHPs in the U.S. This is the equivalent to reducing oil imports by 21.5 million barrels each year. When compared to conventional HVAC systems, GHPs can reduce emissions from energy consumption by 63 to 72 percent. The National Renewable Energy Laboratory estimates that the installation of 2,000,000 GHPs would reduce greenhouse gas emissions by 1.2 million metric tons of carbon dioxide each year.

Conclusion

Geothermal is an often overlooked but viable source of energy to reduce dependence on foreign sources of energy, cut greenhouse gas emissions, and potentially cut costs to home- and business-owners. Policy makers, businesses, and consumers will benefit from more discussion and greater use of this clean, affordable, abundant, and reliable power source.

About New York AREA: *Founded in November 2003, the New York Affordable Reliable Electricity Alliance (New York AREA) is a diverse group of more than 125 business, labor, and community groups whose mission and purpose is to ensure that New York has an ample and reliable electricity supply, and economic prosperity for years to come. New York AREA helps to educate policy makers, businesses, and the general public regarding the necessity and importance of safe, low-cost and reliable electricity. For additional information visit: www.area-alliance.org.*

On the cover: upper right – one of the 10 geothermal power plants located in the Salton Sea Known Geothermal Resource Area (SSKGRA) in Southern California’s Imperial Valley; middle – geothermal activity, and on the bottom – the Puna Geothermal Venture on Hawaii’s big island. Photos courtesy of the Geothermal Education Office.

Additional Information

International Ground Source Heat Pump Association
<http://www.igshpa.okstate.edu/index.htm>

International Energy Agency – Ground Source Heat Pump Center
<http://www.heatpumpcentre.org/>

U.S. Department of Energy National Renewable Energy Laboratory – Geothermal Energy Basics
http://www.nrel.gov/learning/re_geothermal.html

New York State Energy Research and Development Authority (NYSERDA)
<http://www.nyserd.org/programs/geothermal/default.asp>

Hudson Valley Clean Energy
<http://www.hvce.com/geothermal.htm>

Geothermal Energy Association
<http://www.geo-energy.org/default.asp>

NextEnergy Solutions
<http://www.nextenergysolutions.com/index.html>

ClimateMaster, Inc.
<http://www.climatemaster.com/>

WaterFurnace, Inc.
<http://waterfurnace.com/>