



Green Government

An initiative of the National Association of Counties

Geothermal Energy in County Facilities

● Introduction

Geothermal energy is found underground in reservoirs of steam, hot water, and hot dry rocks. According to the U.S. Environmental Protection Agency (USEPA), geothermal energy is the most energy-efficient and cost-effective space conditioning available today.

Geothermal heat pumps act similarly to traditional heat pumps, but do not pull heat from the outdoor air. Rather, heat is pulled from the Earth. Below grade, the ground temperature is relatively constant, creating an excellent heat source, or “sink,” for a geothermal heat source system. This is the same effect that keeps residential basements relatively cool in the summer, and which has traditionally been used to store perishable goods underground. According to the U.S. Department of Energy, there are over 40,000 geothermal heat pumps installed in the U.S. each year.

● Uses and Benefits

Using geothermal heat pumps as a building's heating and cooling system can save up to 50% of energy as compared to traditional systems. Geothermal sources or heat pumps may also be used to supply hot water in residential settings. ENERGY STAR qualified geothermal heat pumps, use about 40% to 60% less energy than a standard heat pump and are quieter than conventional systems, allowing this form of heating and cooling to rank among the highest of all HVAC systems for occupant comfort.

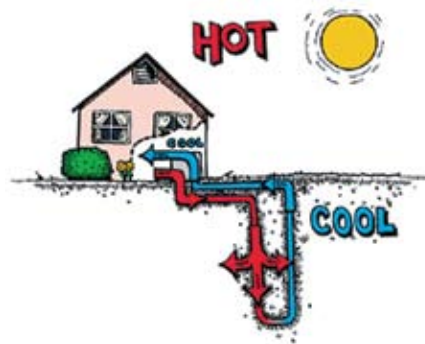
Geothermal energy can be used in new construction as well as in renovations to existing buildings. Some local governments use geothermal energy to heat the buildings of whole communities, and some use it under roadways and sidewalks to melt snow and ice.

Geothermal sources are also used by power plants to produce electricity. Prime locations for this kind of geothermal power, according to the National Renewable Energy Laboratory, are found in the western states,

Alaska, and Hawaii. GeoPowering the West is an initiative through the U.S. Department of Energy to increase the use of geothermal energy in those areas.

Benefits of geothermal heat pumps include:

- Use of 100% renewable energy source
- Reduction of greenhouse gas emissions
- Reduction of fire insurance rates because there is no longer a need to use combustible fuels
- Reduction of the size of equipment rooms by about 30%, thereby lowering construction costs
- Potential elimination of the need for boilers, chillers, cooling towers, water treatment, and condenser pumps
- Potential elimination of rooftop equipment and saving of roof-wear
- Access to free hot water use in warmer months and reduced costs in cooler months



● How it Works

Geothermal energy comes directly in the form of hot water and steam to heat buildings or generate power. Several feet below the surface of the earth the temperature is a constant 45 to 75 degrees. A geothermal heat pump, also known as a ground source or water source heat pump, moves this heat from the earth into a building in the winter and pulls heat from the building into the ground

in the summer. This is accomplished through a series of pipes, also known as a loop, buried in the ground vertically or horizontally. A liquid, in most cases water, travels through the pipes absorbing heat or dispelling it into the soil.

● Installation

Geothermal heat pump systems may be installed in several different forms and are arranged vertically or horizontally below ground (pipes are either side by side or above and below each other). The most common for county buildings and any other larger commercial buildings is the vertical system, where water is circulated to depths up to 400 feet below ground.

With new advances in drilling technology, horizontal bore fields have become popular in recent years and are proving to be as efficient as vertical units. This type of installation allows for piping to be installed horizontally under parking lots, green spaces, and buildings. With new directional boring heads and digital locators, installers can place horizontal loop fields in areas inaccessible to vertical bores.

Other types of bore fields include closed loop slinky systems in large bodies of water (such as lakes or rivers), hydro systems that use a combination of bore fields and cooling towers, and open loop systems (commonly called pump and dump) where water is circulated from a large body of water (lake, river) through the heat pump system and then returned to its source.

● Get Started!

A geothermal heat pump can be a significant upfront expense due to equipment costs, but costs very little to maintain and operate. For instance, it reduces the need to use fossil fuel



County Case Study:

Story County, Iowa

The Story County Board of Supervisors, along with Facilities Management, have a strong commitment to the environment, producing fewer pollutants, and saving both energy and taxpayer dollars without compromising comfort.

Al Hahn, Director of Facilities Management for Story County, Iowa first learned about geothermal technology at the World Energy Engineering Conference in Atlanta, Georgia in 1996. Mr. Hahn reported his findings to the Story County Board of Supervisors, which was in the process of designing a new 30,000 square foot Human Service Center. It was determined that the new construction design should incorporate geothermal technology.

Ten years later, Story County has expanded its use of geothermal to a 90,000 square foot Justice Center, a 42,500 square foot Administration Building, and a 15,500 square foot Community Life Program Building. Geothermal energy replaced the need for a boiler room and cooling tower which resulted in large space and insurance savings. This feature, combined with good management allows Story County to use approximately

40% less energy without compromising comfort or services and to reduce greenhouse gas emissions over the next 50 years by nearly 9 million pounds.

Throughout its community, Story County has assumed responsibility in educating others on the benefits of geothermal. The county has shared its findings with other counties throughout Iowa and Minnesota, where many are now designing with geothermal. The City of Ames, Iowa and the city's electrical municipality began a rebate program to encourage the use of geothermal. Additionally, Ames Community and Nevada Community Schools have both recently added geothermal heat pumps to their new facilities, along with area churches and businesses.

Story County has received numerous awards for its geothermal efforts, including: USEPA ENERGY STAR designations, the Iowa Governor's Environmental Excellence Award, Special Recognition in Energy Efficiency/Renewable Energy, and the 2005 NACo Center for Sustainable Communities, Center Partner Award. The County has also been rewarded with a \$164,000.00 rebate from Alliant Energy for recognizing the need for energy management through geothermal design.

for heating. These systems are also extremely durable. Underground piping can come with a warranty of 25 to 50 years, and heat pumps last more than 20 years.

Common considerations if your county is looking to install a geothermal heat pump system include:

- The county's climate
- The composition of the soil and rock in the area
- The availability of land and ground or surface water

Once your county has decided to install a geothermal system, you will want to make sure it is the right size for your facility so as

not to waste energy. The actual size should be within 15% of the calculated load. The EPA ENERGY STAR program evaluates geothermal heat pumps for energy efficiency standards. More information can be found at: www.energystar.gov/index.cfm?c=geo_heat.pr_crit_geo_heat_pumps.

Whoever your county selects for the installation, insist on a performance guarantee on the entire system in addition to the manufacturer's warranty on the equipment. In residential settings, ensure that hot water is included. To find a reliable contractor to install your county's geothermal heat pump you may want to start your search at the Air Condition Contractors of America Contractor Locator website: <http://payments.acca.org/ContractorLocator>.

● Performance Contracting

Performance contracting can be a key to achieving green government, and can assist a county looking to implement a variety of green upgrades, including installation of geothermal heat pumps.

A performance contract is an agreement between the county and a private company that evaluates the county building's performance, recommends improvements, and pays for it through future savings. This is accomplished without upfront cash expenditures because it uses future savings for collateral. The performance contract guarantees that savings will be achieved or the company pays the difference.



Visit www.greencounties.org

● Additional Resources

● Air-Conditioning and Refrigeration Institute

www.ari.org

The Air-Conditioning and Refrigeration Institute (ARI) is the trade association representing manufacturers of more than 90 percent of the air conditioning and commercial refrigeration equipment installed in North America.

● American Society of Heating, Refrigerating and Air-Conditioning Engineers

www.ashrae.org

American Society of Heating, Refrigerating and Air-Conditioning Engineers' (ASHRAE) mission is to advance the arts and sciences of heating, ventilating, air conditioning and refrigerating to serve humanity and promote a sustainable world.

● Database of State Incentives for Renewable Energy

www.dsireusa.org

The Database of State Incentives for Renewable Energy (DSIRE) is a comprehensive source of information on the status of state programs and incentives promoting renewable energy, including information on financial incentives, net metering policies, and awareness and investment programs.

● ENERGY STAR

www.energystar.gov

ENERGY STAR is a joint program of the U.S. Environmental Protection Agency and the U.S. Department of Energy helping us all save money and protect the environment through energy efficient products and practices. EPA provides strategies, tools, professional assistance, and recognition opportunities to help you meet your county goals and contribute to ENERGY STAR's nationwide challenge to improve the energy efficiency of facilities by 10% or more!

● Geothermal Heat Pump Consortium

www.geoexchange.org

The Geothermal Heat Pump Consortium works to increase the awareness and use of geexchange technology throughout the United States and the world. The site provides information including a list of incentives by state, a search for local contractors, fact sheets and brochures, and more.

● U.S. Department of Energy Geothermal Technologies Program

www1.eere.energy.gov/geothermal/heat-pumps.html

The Geothermal Technologies Program (the Program) works in partnership with industry to establish geothermal energy as an economically competitive contributor to the U.S. energy supply. The program develops innovative technologies to find, access, and use the nation's geothermal resources.

Founding member companies of the NACo Green Government Initiative can help with your exploration and installation of the geothermal energy application. Contact any of the following companies to learn more:

● Edison Electric Institute (EEI)

The Edison Electric Institute (EEI) is the association of U.S. shareholder-owned electric companies. Members serve 95 percent of the ultimate customers in the shareholder-owned segment of the industry, and represent approximately 70 percent of the U.S. electric power industry. Its member companies work to help county governments with the wise and efficient use of electricity. Many EEI members provide information, technical expertise, and/or incentives for county governments to install high-efficiency geothermal ("geoexchange") heating and cooling systems. *For more information about geothermal programs offered by EEI member companies, please contact Steve Rosenstock at srosenstock@eei.org or 202-508-5465, or visit the following website:*

www.eei.org/industry_issues/retail_services_and_delivery/wise_energy_use/programs_and_incentives/index.htm

● Johnson Controls

Johnson Controls helps county governments get the most from their budgets through a comprehensive approach to sustainable practices - from green buildings and renewable energy to water and traffic infrastructure improvements. As a U.S. Green Building Council board member, recognized champion of supplier diversity, and leader in traditional and hybrid vehicle batteries, Johnson Controls is a valued resource for developing and implementing sustainable practices. *For more information contact Joy A. Clarke at joy.a.clarke@jci.com or 301.621.3609.*

● NORESKO

NORESKO is one of the leading performance contracting companies in the U.S. It is NORESKO's mission and core business to help county governments to find innovative and creative ways to provide energy efficiency in their facilities and infrastructure. These solutions often involve the utilization of green building technologies to help clients reach their energy savings objective and provide environmental stewardship. NORESKO is one of just eleven Energy Service Companies across the nation to hold Energy Service Provider accreditation from the Na-

tional Association of Energy Service Companies (NAESCO). NORESKO has also been a business partner to EPA's Energy Star Program and participate as a valued member of the US Green Building Council promoting sustainable energy solutions. *For more information contact John Hobbes at johbboes@noresko.com or 919.460.9220 ext. 36.*

● Siemens

Siemens recognizes that high performance buildings make for high performance business. Energy is the lifeline of your facility — Energy is vital to your business. From energy procurement to efficient system design and installation, from energy generation to comprehensive auditing and performance reporting — Siemens has the answers. Their innovative energy solutions also are designed with environmental and community responsibility in mind. Today's business and government leaders need a strategic partner and plan to ensure a consistent, efficient, affordable and clean energy foundation. And Siemens strategic energy environmental solutions can help you manage your facility's energy needs throughout a building's life-cycle. *For more information contact Chuck Hall at 847.941.5772 or chuck.hall@siemens.com.*

About the NACo Green Government Initiative

The NACo Green Government Initiative serves as a catalyst between local governments and the private sector to facilitate green government practices, products and policies that result in financial and environmental savings. Launched in 2007, the Initiative provides comprehensive resources for local governments on all things green, including energy, green building, air quality, transportation, water quality, land use, purchasing and recycling.

For more information contact Kelly Zonderwyk, NACo Senior Community Services Associate, at 202.942.4224 or kzonderwyk@naco.org.

