

# Geothermal Heat Pumps

Renewable Energy for a Better Environment and Economy



## Geothermal Heating and Cooling Works in Harmony with the Earth

Geothermal Heat Pumps quietly and reliably harness the renewable energy generated by the Sun that is stored in the ground near the Earth's surface. They make significant contributions to a cleaner environment by saving energy, cutting our use of fossil fuels, and reducing carbon emissions.



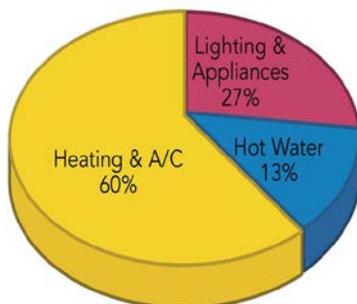
## Buildings Dominate U.S. Energy Use

### Geothermal Heat Pumps Can Slash Energy Use in Buildings

Geothermal heat pumps effectively address one of the biggest consumers of U.S. energy — buildings. Indeed, buildings dominate our nation's energy use, devouring over half of our electricity and natural gas. More than 70% of average energy demand for a typical single family home is to meet heating and cooling (thermal) needs. With a geothermal heat pump, that energy use can be cut by 40% to 70%, reaping significant savings on electricity and natural gas utility bills.

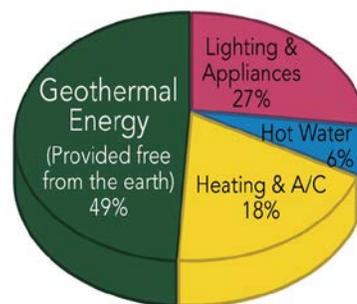
### Residential Energy Use is Cut in Half Using a Geothermal Heat Pump

Conventional Heating and Air Conditioning



Over 70% of the energy consumed by a typical single-family detached home is used to meet thermal loads

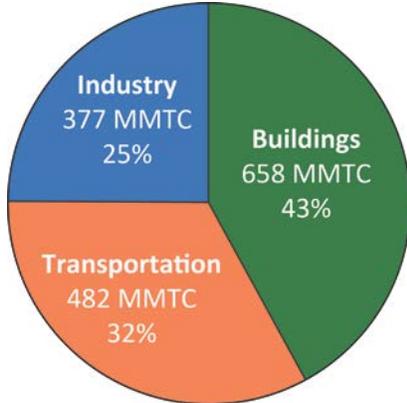
Geothermal Heat Pump System



Total residential site energy consumption is cut in half using a Geothermal Heat Pump System

## Geothermal Heat Pumps Can Cut Carbon Emissions from Building Energy Use by ~50%

Building Energy Use Emits 43% of U.S. Total Carbon Emissions



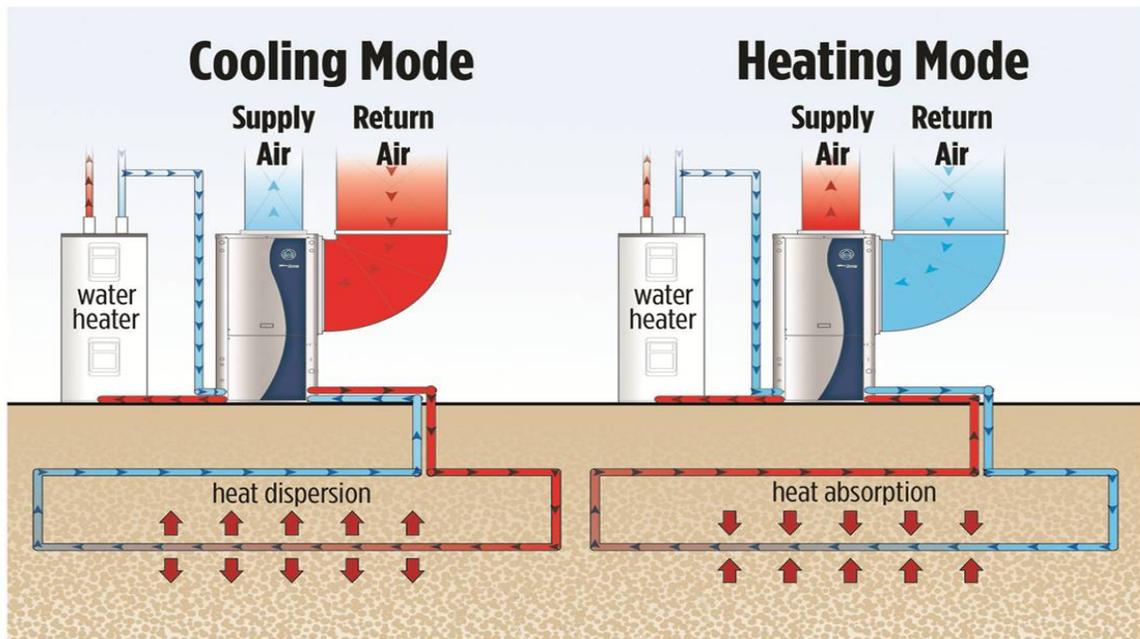
Geothermal Heat Pumps Cut Carbon Emissions from Buildings

Annual CO <sub>2</sub> e Emissions			
2000 Sq. Ft. Existing Home			
Census Region	Housing Units (millions)	Baseline CO <sub>2</sub> Emissions (Mtons/yr)	Geothermal CO <sub>2</sub> Emission: (Mtons/yr)
Northeast	19.6	16.5	7.7
Midwest	24.5	20.6	12.9
South	38.9	16.0	7.6
West	22.5	18.5	9.3
<b>Weighted Average</b>		<b>17.7</b>	<b>9.2</b>

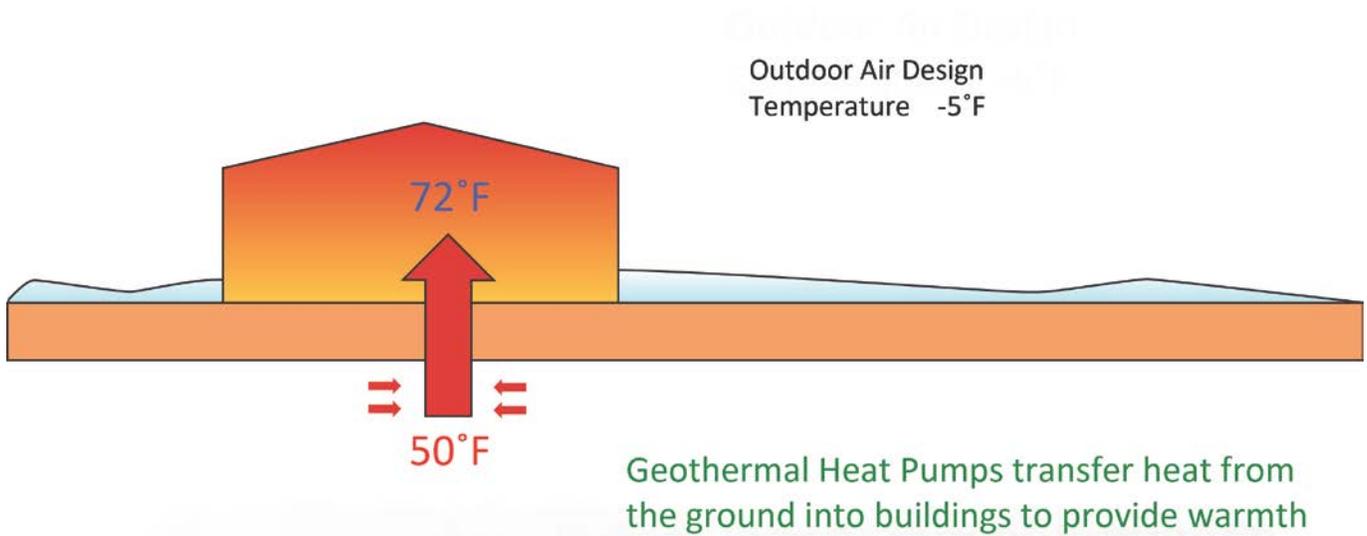
## Geothermal Heat Pumps Harness the Earth's Renewable Energy



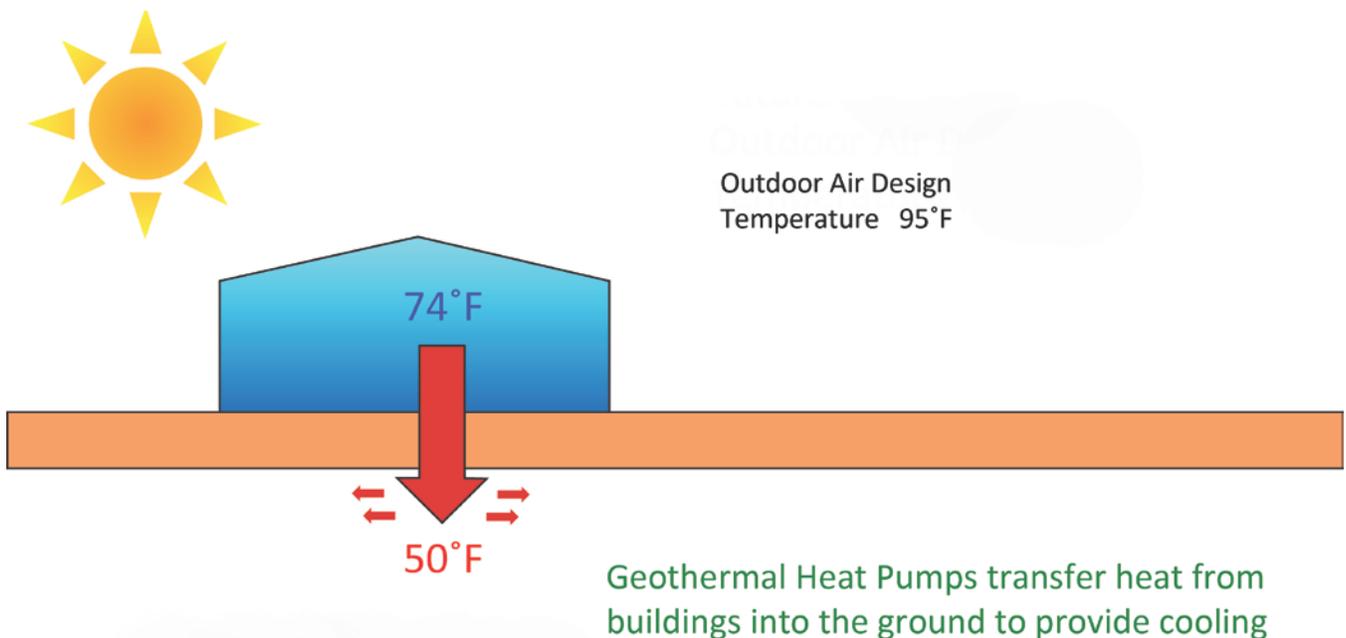
Geothermal Heat Pumps are self-contained units that efficiently heat and cool homes and commercial buildings while providing hot water. They use standard electronic thermostats and duct systems, making them appropriate for retrofits of standard heating, ventilation and air conditioning (HVAC) systems. Geothermal Heat Pumps can be sized to heat and cool any building in any climate.



# The Earth is a Source of Heat During the Winter Months...

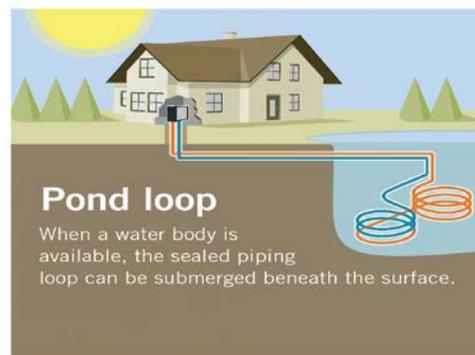
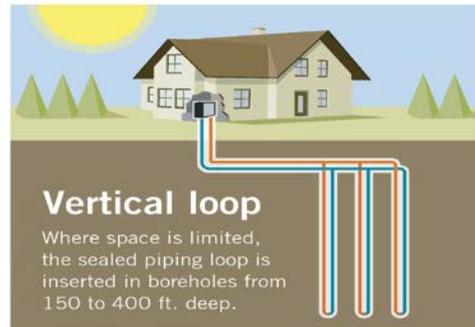
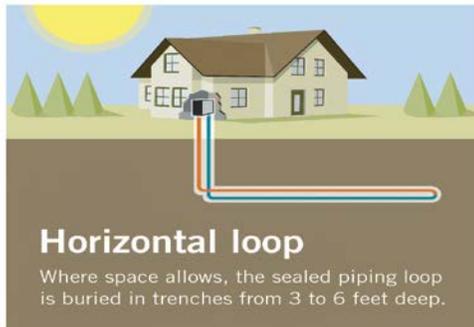


# ... and an Efficient Place to Reject Heat During the Summer Months

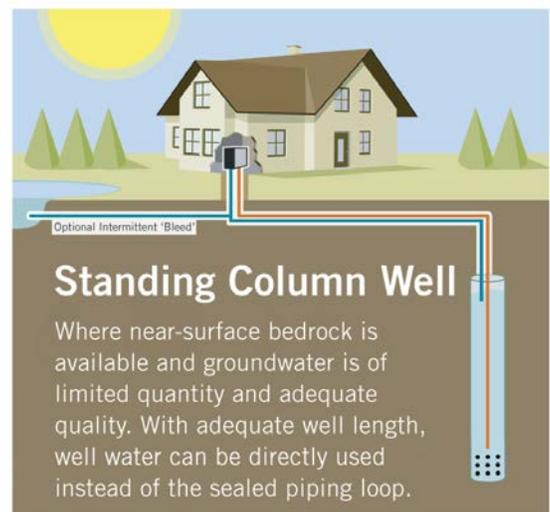


# Ground Loops Connect Buildings to the Earth's Heat

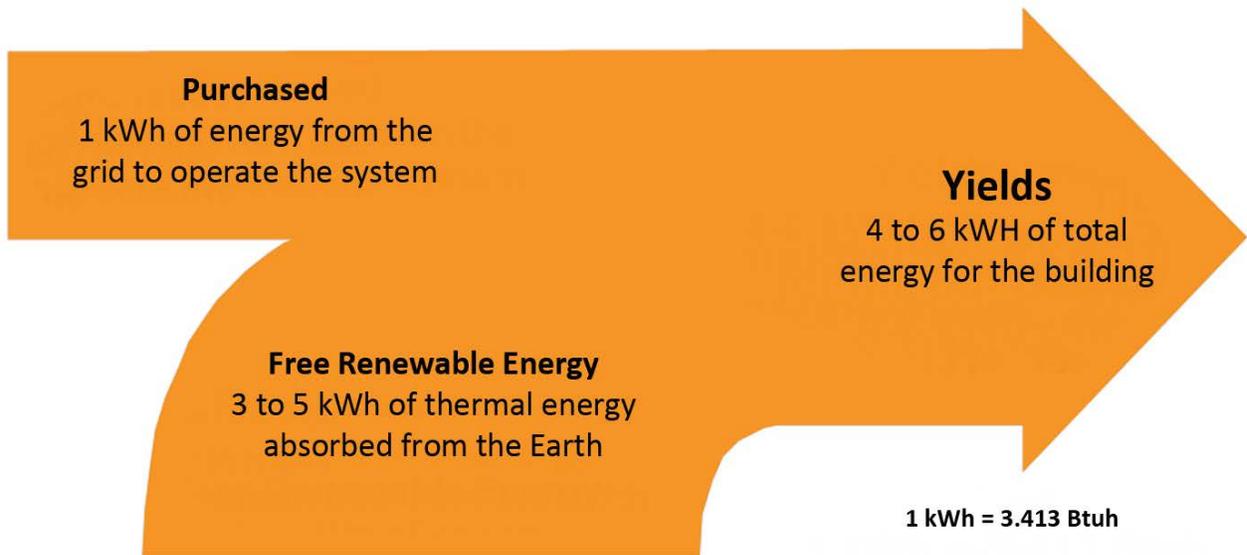
Unlike conventional heating and air conditions systems that use the outside air to absorb and release heat, Geothermal Heat Pumps transfer heat from and to the ground. They do that through closed loops of plastic pipes buried either horizontally or vertically in the ground below the frost line where the temperature is consistently between 40° to 80° F depending on where you live. Called ground loops, the pipes are sealed tight, and connected to the geothermal heating and cooling system inside the building. Water circulates through the underground pipes of the ground loop.



During the summer months in cooling mode, unwanted heat indoors is transferred outside through the water in the pipes for cooling by the earth. The cool water is then circulated to the geothermal system indoors to provide efficient air conditioning. During the winter months, the process is reversed in heating mode. The earth heats the water circulating through the pipes, which is transferred to the geothermal system to provide indoor space heating. Hot water can also be provided for little or no additional monthly energy cost. Another type of loop is the Standing Column, where heat exchangers are inserted into cased water wells.



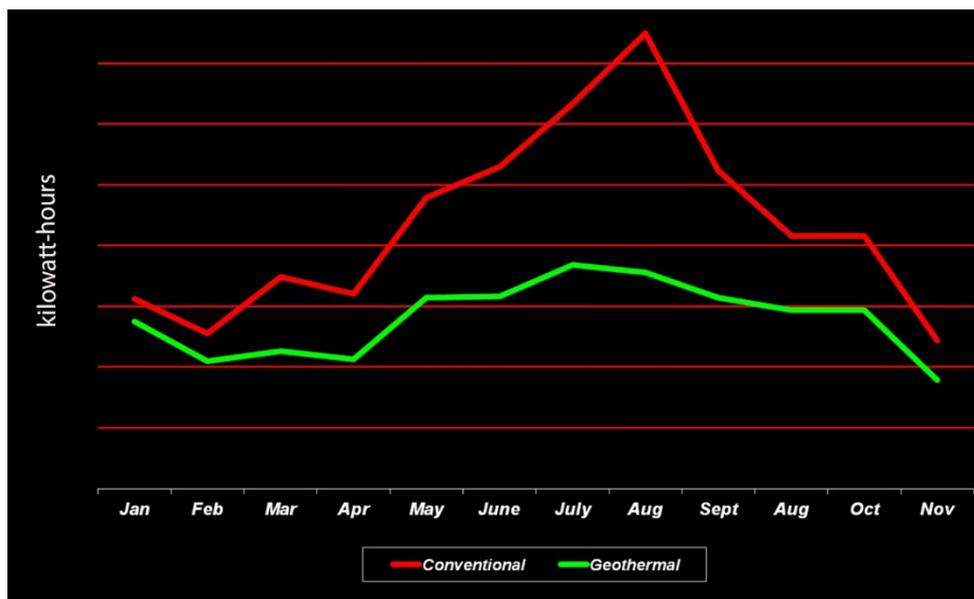
# Geothermal Heat Pumps Are Efficient



## Geothermal Heat Pumps are Cost Effective

### Geothermal Heat Pumps vs. Conventional HVAC

A comparison of a geothermal heat pump system and a conventional heating, ventilation and air-conditioning system installed at identical fast food restaurants in Pensacola, Florida shows 47% less power consumption at the geothermal restaurant compared to the conventional system facility.



## Energy Savings Offer Fast Payback of Installation Costs



Though there is a higher "first cost" for Geothermal Heat Pump systems associated with excavation or drilling for installation of ground loops, energy savings can quickly make up the difference in system cost compared to installation of conventional systems. Energy savings "payback" for typical residential Geothermal Heat Pump installations compared to standard heating and air conditioning equipment is usually 4 to 7 years, and even less time than that with federal, state and utility rebates.

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## Geothermal Heat Pumps Don't Need Costly Infrastructure



For utilities, energy savings from Geothermal Heat Pumps help level out electricity demand, and facilitate baseload power delivery in the winter and shaving peak loads in the summer. Energy savings generated by Geothermal Heat Pumps go a long way toward reducing the need for new fossil-fueled or nuclear power plants. And Geothermal Heat Pump systems don't need new power lines because they are a distributed energy source available under every building, saving money and freeing up capacity on the grid.



## Geothermal Heat Pumps are "Made in the USA"

Geothermal Heat Pumps are manufactured right here in the United States, with American labor and parts, and that spells Jobs. From innovative manufacturing through system design, systems for residential and commercial use

are distributed and installed with local labor, creating an engine for economic growth. Geothermal systems create skilled, well-paid jobs across the nation everywhere they are installed. Thousands of jobs can be created with increased deployment of Geothermal Heat Pumps.



# Geothermal Heat Pumps Can Be Deployed Everywhere



Geothermal Heat Pumps harness on-site renewable energy from the Earth and are a readily available technology that can be used everywhere. Geothermal Heat Pumps are truly a “50-State” renewable technology that provide large energy savings and complementary environmental benefits to both new building construction and retrofits for older structures.

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## Geothermal Heat Pumps Are Good for America

### Benefits of Retrofitting U.S. Housing Stock with Geothermal Heat Pumps

Estimated National Benefit	Market Penetration Rate of GHP Retrofit				
	20%	40%	60%	80%	100%
Primary Energy Savings (Quadrillion BTU)	0.8	1.7	2.5	3.3	4.2
Percent Energy Savings (Quadrillion BTU)	9%	18%	27.1%	36.1%	45.1%
CO2 Emissions Reduction (MM Ton)	54.3	108.7	163.0	217.3	271.17
Percent Decrease in Carbon Emissions	9.1%	18.1%	27.2%	36.2%	45.3%
Summer Peak Electrical Demand Reduction (GW)	43.2	86.4	129.5	172.7	215.9
Percent Reduction in Summer Peak Electrical Demand	11.2%	22.4%	33.6%	44.9%	56.1%
Energy Expenditure Savings (Billion \$)	10.4	20.9	31.3	41.7	52.2
Percent Reduction in Energy Expenditures	9.6%	19.3%	28.9%	38.5%	48.1%

Source: Oak Ridge National Laboratory - August 2010



The Voice of the Geothermal Heat Pump Industry

Advocacy • Partnerships • Public Outreach • Quality Standards

To learn more about Geothermal Heat Pump technologies and the **Geothermal Exchange Organization**, visit [www.GeoExchange.org](http://www.GeoExchange.org), or call (888) 255-4436.