

# Geothermal heat pumps for homes

*The information in this fact sheet is specific to single-family homes in Wisconsin – it doesn't apply to other regions or to commercial buildings.*

## What does MGE recommend?

- Compare alternatives to a geothermal heat pump (such as a high-efficiency furnace) before buying, especially if natural gas is available.
- Make sure your home is well insulated and air sealed, with good ventilation, regardless of what kind of heating system you choose. If your home doesn't require much heat, the type of heating system becomes less important. If building new, see MGE's *New Home Planner* for recommendations.
- Investigate environmental claims carefully before buying.
- If you choose to buy a geothermal heat pump, contact the Wisconsin Geothermal Association to help you find experienced professionals.

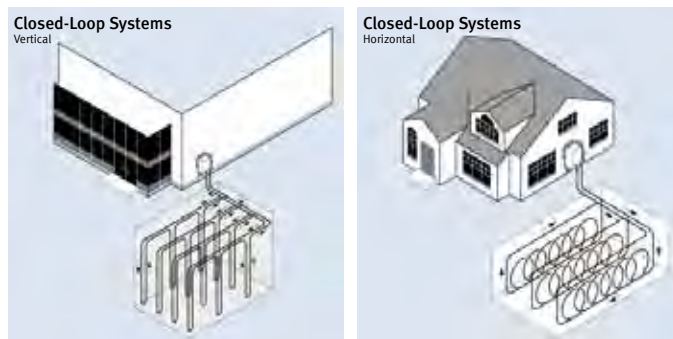
## What is a heat pump?

Heat normally flows from hot to cold similar to the way water flows downhill from high to low. Heat pumps move heat “uphill” against this normal flow. One example of a heat pump is a refrigerator – it moves heat from inside the fridge to the surrounding room so food stays cold. Air conditioners are also heat pumps, moving heat from indoors to outdoors.

## How does a geothermal heat pump work?

Geothermal heat pumps move heat to and from the ground via “ground loops.” In the winter, the heat pump removes heat from the ground loop and pumps it into the house (usually via ductwork). In the summer, the process is reversed, and the heat pump moves heat from the indoor air into the ground loop to cool the house. Geothermal heat pumps not only both heat and cool, they can also provide some hot water if a “desuperheater” is included with the geothermal heat pump.

## Illustrations of the two most commonly used ground loops (vertical and horizontal).



Illustrations courtesy of the U.S. Department of Energy Office of Energy Efficiency and Renewable Energy (EERE).

## What are the advantages of geothermal heat pumps?

- Low noise – no outdoor equipment above ground.
- Very efficient as air conditioners.
- No on-site combustion.
- A single system can provide both heating and air-conditioning (plus some optional water heating).
- If electricity generation becomes cleaner, geothermal heat pumps start to have more clear-cut environmental benefits compared to natural gas.

## What incentives are available?

- **Focus on Energy** has “Cash-Back Rewards” for Wisconsin residents who make energy improvements that meet requirements. (See Resources.)
- **Federal tax credits** are available through 2016 for qualifying equipment. (See Resources.)

## What are the potential disadvantages of geothermal heat pumps?

- **Higher installed cost** (but tax credits and incentives can reduce cost).

*(continued on reverse)*

- **Expected savings on energy costs might not be achieved.** Why not?

- **The price of natural gas vs. electricity has a very large effect on savings.** At \$1 per therm for gas and 13 cents per hour for electricity, a 92% efficient gas furnace costs about the same as a geothermal heat pump to produce the same amount of heat. We recommend comparing different scenarios using the Heating Fuel Comparison Calculator from the Energy Information Administration. (See Resources.)

You'll need to enter the price of the fuel as well as the efficiency of the system. MGE's current electric and gas rates are available on the web. (See Resources.)

Or, call **MGE's Home Energy Line** at 252-7117 and we'll do the comparison for you. Geothermal heat pumps compare more favorably to propane and fuel oil because these fuels typically cost more than natural gas.

- **Geothermal heat pumps are much more complex than typical systems.** Design and installation requires much more care than with a standard furnace. Oversized pumps, improperly sized and installed ground loops or other installation problems can increase electricity use for geothermal heat pumps. It's also important not to ignore the electricity that geothermal heat pumps use for pumps and fans.
- **If backup electric heat is installed, it can be costly to operate.** To avoid high bills, homeowners should make sure they know when the electric backup heat comes on.
- **Some soil types work better than others.** Wet, dense soils conduct heat better. Ground loops need to be designed and installed properly.

- **Expected environmental benefits might not be achieved.** Because geothermal heat pumps use electricity, the fuel used to generate your power determines the environmental impact. Most of the

electricity used in Wisconsin is generated by burning coal.

- A 2009 analysis by the **Energy Center of Wisconsin (ECW)** says, "In the residential and community/multifamily scenarios, CO<sub>2</sub> emissions generally remained constant or increased slightly with inclusion of a geothermal heat pump system."

### **Why is further geothermal heat pump research needed in cold climates?**

The measured cold-climate performance of geothermal heat pumps (in studies that we are aware of) suggests that geothermal heat pumps don't work as efficiently as people would expect (see [mge.com/geothermal](http://mge.com/geothermal) for links to these studies). We have also heard from owners of geothermal heat pumps whose heating costs are higher than they expected. MGE is concerned that homeowners are getting unrealistic expectations of savings and environmental benefits.

### **Help MGE learn more**

Know of a house that's switched from a natural gas to a geothermal heat pump in MGE's service area? Please call us at 252-7117 to tell us the address! We're particularly interested in comparing heating costs before and after the geothermal heat pump was installed.

### **Resources and further reading**

Please visit [mge.com](http://mge.com) or call our **Home Energy Line at 252-7117** if you don't have web access and want us to mail copies of these publications:

Cash-Back Rewards: Focus on Energy (1-800-762-7077) or [focusonenergy.com/incentives](http://focusonenergy.com/incentives)

Federal tax credits: [mge.com/federaltaxcredit](http://mge.com/federaltaxcredit)

Gas and electric rates: [mge.com/rates](http://mge.com/rates)

Geothermal heat pumps: [mge.com/geothermal](http://mge.com/geothermal)

Heating fuel comparison calculator:  
[www.eia.doe.gov/neic/experts/heatcalc.xls](http://www.eia.doe.gov/neic/experts/heatcalc.xls)

Note: Geothermal heat pumps are also known as Ground Source Heat Pumps, GeoExchange® systems, ground-coupled heat pumps and earth energy systems. MGE uses the term "geothermal" because that's what most customers call them. However, "geothermal" traditionally refers to high-temperature energy sources, such as geysers or very hot groundwater.