

## HOW DOES A GEOTHERMAL HEAT PUMP WORK?

Don Otto, DPO Construction  
www.dpoconstruction.com

In short, just like your air conditioner, except that the heat exchanging tubes are in the ground, instead of in the air. In a geothermal system, water-filled tubes buried in the ground pick up the ground's heat—about 50° to 55° year round—and circulate that water to the heat pump. But how do you warm your house with 50° water?

You have to use an intermediate device that can concentrate the heat—a compressible gas. When you compress the gas from a large volume to a small volume, you also compress the larger volume's heat, so by definition, there's a lot more heat *per unit* in the smaller volume. In simpler terms, it's hotter. Not surprisingly, the surface of what's holding the compressed gas gets hot, too. Now, if you blow air across that hot surface, you can heat your house. (If you've ever pumped up a car tire with a bicycle pump, and felt the metal connector between the hose and the barrel, you know it can get hot!)

But how does the heat from the water get transferred?

When you blow air across the hot surface, you take the heat out of the compressed gas (cooling it), and the gas turns into a liquid. In order to turn it back into a gas, you have to warm it up and take the pressure off (give it a place to expand into). At this point in the cycle the fluid is now just about freezing temperature (32°), so the 50° water from the ground has plenty of heat to warm it up.

When you want to cool your house, the system runs in reverse: heat from the house expands the liquid into a gas and the warmed water in the ground loops stores its heat in the earth.

Ground source (geothermal) heat pumps have several advantages over fuel-burning furnaces. They're environmentally friendly and efficient. Since the energy to heat your house comes from the sun and the earth's core, all you pay for is the electricity to run the compressor, the blower and the water pump. It's common to get 3 to 5 times the energy out of a heat pump than what you put into it.

Geothermal systems help heat your hot water. Compressors are not 100% efficient and produce a little "waste" heat (called "superheat", since the compressor's job in the heat pump is to make gas hot). Today's geothermal systems have a water-filled jacket, called a "desuperheater" which takes that extra heat and pumps it into your water heater. Every time the compressor runs to either heat or cool your house you're getting "free" hot water.

Geothermal systems are versatile and quiet. It's really easy to have forced-air heating and cooling, or radiant in-floor heat, say, in your basement or garage.

Geothermal systems are affordable. While they're more expensive up front—roughly twice what a natural gas system costs, the lower monthly utility bills offset the increased mortgage payments. ***A 3,000 conditioned-sq. ft. home in Solon I built in 2004 is heating for \$0.86 a day, even including the sub-zero January weather!***