# **How do geothermal heat pumps work**

**What it is**

An electrically powered heating and cooling system that transfers heat between your house and the earth using fluid circulated through long loops of underground pipes.

**How it works**

An indoor heat pump uses a basic refrigeration cycle—evaporation, compression, condensation, and expansion—to capture and disburse heat from and to the ground to warm the house in winter and cool it in summer.

**Why you'd want one**

Cuts home heating and cooling bills by 30 to 70 percent. Eliminates noisy outdoor compressors and fans. Reduces greenhouse gas emissions by the equivalent of planting 750 trees or taking two cars off the road.

**What to look for**

For federal tax credits, pumps must meet Energy Star efficiency standards. For closed-loop systems, you need an EER of 14.1 and a COP (coefficient of perfor­mance) of 3.3.

**Where to get it**

To find manufacturers, visit the [Geothermal Heat Pump Consortium](http://geoexchange.us/) website. To find trained installers and designers who know the local geology and how to size systems for maximum efficiency, go to the [International Ground Source Heat Pump Association's](http://www.igshpa.okstate.edu/)website.

**What it costs**

$15,000–$20,000 installed for the system, including ground loops, heat pump, and controls. The Database of State Incentives for Renewable Energy (dsireusa.org) provides up-to-date information on state incentive programs.

**How It Works**

Given all the attention being paid to solar power these days, you might be surprised to learn that one of the most promising solutions to high energy costs isn't up in the sky but buried deep under your lawn. Superefficient geothermal heat pumps provide clean, quiet heating and cooling while cutting utility bills by up to 70 percent. "With this technology, everybody could be sitting on top of their lifetime energy supply," says TOH plumbing and heating expert Richard Trethewey.

In principle, a geothermal heat pump functions like a conventional heat pump, by using high-pressure refrigerant to capture and move heat between indoors and out. The difference is that conventional systems gather their heat—and get rid of it—through the outside air. Geothermal systems, in contrast, transfer heat through long loops of liquid-filled pipe buried in the ground.

As our cave-dwelling ancestors discovered long ago, if you go far enough underground, the earth's temperature stays at a constant 50 degrees or so, no matter how hot or cold it gets outside. So while a conventional "air-source" heat pump struggles to scavenge heat from freezing winter air or to dump it into the summer swelter, its "ground-source" counterpart has the comparatively easy job of extracting and disbursing heat through the 50-degree liquid circulating in its ground loop. That's why it takes only one kilowatt-hour of electricity for a geothermal heat pump to produce nearly 12,000 Btu of cooling or heating. (To produce the same number of Btus, a standard heat pump on a 95-degree day consumes 2.2 kilowatt-hours.) Geothermal systems are twice as efficient as the top-rated air conditioners and almost 50 percent more efficient than the best gas furnaces, all year round.

Another advantage is that there's no need for a noisy outdoor fan to move air through the compressor coils. Geothermal units simply pump liquid, so they can be parked indoors, safe from the elements. Most come with 10-year warranties, but they can last much longer.

From: https://www.thisoldhouse.com/ideas/geothermal-heat-pump-how-it-works