Energy-Efficient and Cost Effective

Although installing a geothermal heat pump system is more expensive than installing an air source system of the same heating and cooling capacity, you can recoup the additional costs in energy savings in 5 to 10 years. An average geothermal heat pump system costs about $2,500 per ton of capacity. If a home requires a 3-ton unit, then it would cost about $7,500 (plus installation and drilling costs). A comparable ASHP system with air conditioning would cost about $4,000, but the energy costs could easily equate to the extra cost of installing a geothermal heat pump. Additionally, geothermal heat pump systems installed in new or existing homes by Dec. 31, 2016 are eligible for a 30% federal tax credit. See the *Financial Incentives* box for more information.

Geothermal heat pump systems have an average 20+ year life expectancy for the heat pump itself and 25 to 50 years for the underground infrastructure. Additionally, they move between three and five times the energy they consume between a building's interior space and the ground.

To determine the energy efficiency of a geothermal heat pump, look for: the Energy Efficiency Ratio (EER), and the Coefficient of Performance (COP). The cooling capacity is indicated by the EER while the heating capacity is indicated by the COP.

Geothermal heat pumps are among the most efficient and comfortable heating and cooling technologies available because they use the earth's natural heat to provide heating, cooling, and hot water—**no fossil fuel is required.**

Financial Incentives

Tax credits, incentives, and rebates may be available in your area. For more information., please visit **www.energysavers.gov/taxcredits**

Further Resources

DOE Energy Savers: Geothermal Heat Pumps
www.energysavers.gov/ geothermal_heat_pumps

Energy 101: Geothermal Heat Pumps
www.eere.energy.gov/multimedia/ video_geothermal_heat_pumps.html

Your local Go2 Green Guide:

Geothermal - **Milt Hetrick**
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Guide to Geothermal Heat Pumps:

heating & cooling without burning fossil fuel

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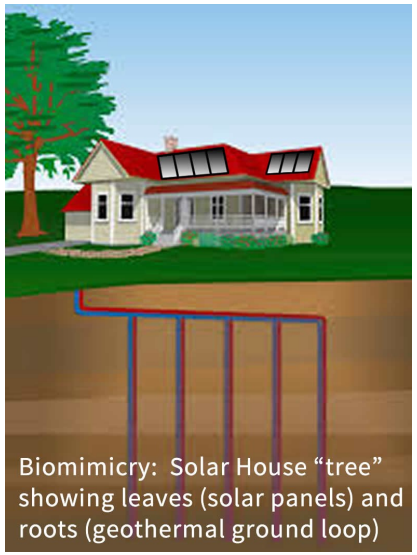


Biomimicry: Solar House "tree" showing leaves (solar panels) and roots (geothermal ground loop)

About Geothermal Heat Pumps

While many parts of the country experience seasonal temperature extremes – from scorching heat in the summer to sub-zero cold in the winter – a few feet below the earth's surface the ground remains a relatively constant temperature. The natural ground temperature is cooler than the natural air temperature in summer, and warmer than the natural air temperature in winter. While the margin of variation is small, seasonal changes in ground temperature give geothermal heat pumps a dependable and permanent wintertime heat source and summertime heat sink.

Geothermal heat pumps, also known as ground source heat pumps, geoexchange, earth-coupled, and earth energy heat pumps, take advantage of this resource and represent one of the most efficient and durable options on the market to heat and cool your home.

How Geothermal Heat Pumps Work

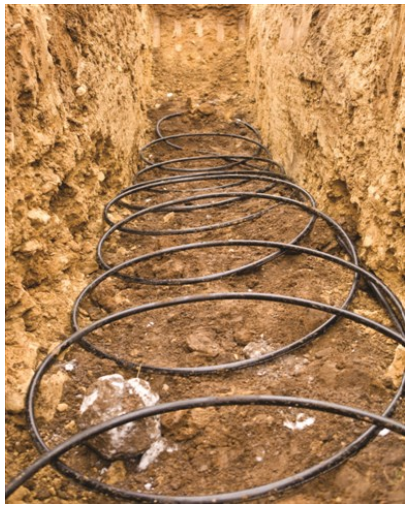
Using a heat exchanger, a geothermal heat pump can move heat from one space to another. In summer, the geothermal heat pump extracts heat from a building and transfers it to the ground for cooling. In winter, the geothermal heat pump takes natural heat from the ground and transfers it to the home or building for heating.

Installing a geothermal heat pump system can be the most cost-effective and energy efficient home heating and cooling option. Geothermal heat pumps are a particularly good option if you are building a new home or planning a major renovation to an existing home by replacing, for example, an HVAC system.

Geothermal vs. Air-Source Heat Pumps

While geothermal heat pumps operate similarly to the far more common air-source heat pump (ASHP), geothermal heat pumps are substantially more energy-efficient than even ASHPs because they take advantage of the relatively consistent ground temperatures, which are far more uniform than air temperatures. Geothermal systems can reduce energy consumption by approximately 25% to 50% compared to air source heat pump systems. Geothermal heat pumps reach high efficiencies (300%-600%) on the coldest of winter nights.

Geothermal heat pumps are able to heat, cool, and, if so equipped, supply the house with hot water **with no burning and zero emissions**. Relative to ASHPs, they are quieter, last longer, need little maintenance, and their performance is not affected by the temperature of the outside air.



Types of Geothermal Heat Pumps

Geothermal heat pump heating & cooling systems come in two types of ground loops that transfer heat to or from the ground and your house - horizontal, and vertical. Choosing the one that is best for your site depends on the climate, soil conditions, available land, and local installation costs at the site.

Horizontal: This type of installation is generally most cost-effective for residential installations, particularly for new construction where sufficient land is available. It requires trenches at least four feet deep.

Vertical: This is often used for larger scale geothermal systems (such as in commercial buildings) where land is limited, or where the soil is too shallow to bury the horizontal loops in the trenches and some form of drilling into the bedrock is necessary. Vertical loop systems can be more expensive, but they use less land and also minimize disturbance to the existing landscape.