

Home Geothermal Energy: The Complete Beginner's Guide

How to heat and cool your home using the earth's natural temperature

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What Is Geothermal Energy?

Geothermal energy is heat that comes from inside the Earth. The ground under your feet stays at a nearly constant temperature year-round -- usually between 45 degreesF and 75 degreesF. A geothermal heat pump uses this stable ground temperature to heat and cool your home far more efficiently than a regular furnace or air conditioner.

How a Geothermal Heat Pump Works

A geothermal heat pump works like a refrigerator in reverse. In winter, it moves heat from the warm ground into your home. In summer, it moves heat from your home into the cooler ground. It uses electricity to run the pump and compressor, but moves 3-5 units of heat for every 1 unit of electricity -- making it 300-500% efficient.

Types of Geothermal Systems

Horizontal Loop (Closed Loop)

Pipes buried in trenches 4-6 feet deep. Needs 400-600 feet of trench per ton of capacity. Requires at least half an acre of open land.

Vertical Loop (Closed Loop)

Pipes inserted into vertical boreholes 150-400 feet deep. Used when yard space is limited. More expensive due to drilling costs.

Pond/Lake Loop

Coils of pipe sunk to the bottom of a pond or lake at least 8 feet deep. Often the least expensive option when a suitable body of water is available.

Open Loop (Well Water System)

Uses actual groundwater from a well. Requires adequate water flow and good water quality. Check local regulations before installing.

Materials List by Project Size

Tier 1 -- Hobbyist / Experimenter (\$30-\$100)

Item	Cost	Where to Buy
Small aquarium pump (120 GPH)	\$10-\$15	Amazon, Walmart, pet stores
Clear plastic tubing (1/2 inch, 10 ft)	\$5-\$10	Home Depot, Lowe's, Amazon
Small cooler or bucket (5 gallon)	\$5-\$15	Walmart, Dollar General
Thermoelectric Peltier module (TEC1-127)	\$5-\$10	Amazon
Small 12V DC power supply	\$8-\$15	Amazon, electronics stores
Thermometer (digital, 2-probe)	\$8-\$15	Amazon, hardware stores

Tier 2 -- Weekend Warrior / Camper (Earth Tube, \$200-\$800)

Item	Cost	Where to Buy
6-inch PVC pipe (50-100 feet)	\$80-\$200	Home Depot, Lowe's
Inline duct fan (6 inch, 240 CFM)	\$30-\$60	Amazon, HVAC supply
PVC primer and cement	\$15-\$25	Home Depot, Lowe's
Gravel for drainage (2-4 bags)	\$10-\$30	Home Depot, Lowe's
Trenching rental (1 day)	\$60-\$150	Home Depot Tool Rental

Tier 3 -- Single Person, One-Bedroom Home (\$4,000-\$10,000)

Item	Cost	Where to Buy
1-ton geothermal heat pump unit	\$2,000-\$4,000	ClimateMaster, WaterFurnace dealers
1-inch HDPE pipe (400 feet)	\$150-\$300	Ferguson Plumbing, Amazon
Propylene glycol antifreeze (5-10 gal)	\$50-\$100	Amazon, HVAC supply
Circulator pump (1/25 HP)	\$80-\$150	Grainger, Amazon
Trenching (DIY with rented trencher)	\$150-\$400	Home Depot Tool Rental
Permits	\$100-\$500	Local building department

Tier 4 -- Small Family Home (\$12,000-\$25,000)

Item	Cost	Where to Buy
2-3 ton geothermal heat pump unit	\$4,000-\$8,000	ClimateMaster, WaterFurnace, Bosch
HDPE ground loop pipe (800-1,800 ft)	\$300-\$700	Ferguson, Hajoca, plumbing supply
Antifreeze (20-30 gallons)	\$100-\$200	Amazon, HVAC supply
Circulator pump (1/6 HP)	\$150-\$300	Grainger, Amazon
Air handler / ductwork modifications	\$1,000-\$3,000	Local HVAC contractor
Trenching or drilling (professional)	\$3,000-\$8,000	Local excavation contractor

Federal and State Incentives

The federal Investment Tax Credit (ITC) provides a 30% tax credit for geothermal heat pump systems installed through

2032. Claim it on IRS Form 5695. Check dsireusa.org for state incentives. Many utilities offer rebates of \$500-\$2,000.

How to Estimate System Size

- Well-insulated home, mild climate: 400-500 sq ft per ton
- Average insulation, moderate climate: 300-400 sq ft per ton
- Poorly insulated or extreme climate: 200-300 sq ft per ton

Example: A 1,500 sq ft home with average insulation needs approximately $1,500 \div 350 = 4.3$ tons. Round up to 5 tons.

Where to Find Certified Contractors

- IGSHPA Contractor Finder: igshpa.org
- Geothermal Genius: geothermalgenius.org
- ClimateMaster dealers: climatemaster.com
- WaterFurnace dealers: waterfurnace.com

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