

Geothermal Comfort Systems



turn to the experts™



Frequently Asked Questions

Q: How efficient are geothermal heat pump systems?

A: Actual efficiencies will depend on a number of factors, but generally speaking a geothermal heat pump can be three to five times more efficient at providing heat than a gas, propane or oil furnace based on the amount of energy consumed to provide a given amount of heat. For cooling, a geothermal system is generally 30-50% more efficient than an air conditioner or heat pump.

Q: Why are geothermal heat pumps so efficient?

A: Geothermal heat pumps use the ground temperatures as a “source” for heat energy during heating, and use the ground as a heat “sink” during cooling. The earth acts as a giant, free energy battery, providing an endless, renewable source for heating and cooling comfort. Standard heat pumps use outdoor air for heating and cooling. Because the ground temperature is much more moderate and stable than air temperatures, geothermal system operation is much more energy-efficient, especially at extreme outdoor temperatures.

Q: Are these systems reliable?

A: Yes. Geothermal units are not subject to some of the same forces that cause wear and tear on other types of systems. And earth loops are installed using a special grade of polyethylene pipe with heat-fused fittings designed to last 50 years or more.

Q: What kind of underground loop system is best?

A: It depends on several factors. Homes on larger lots usually have horizontal loops installed. Smaller lots may require a vertical loop. A nearby pond can also be used. If you have a well water system, that may be an option. Your Carrier dealer is trained to determine which loop design is most appropriate for your home. Regardless of the loop system selected, the operating costs are all about the same.

Q: How much space is needed for a closed loop system?

A: The smallest closed loop design, the vertical loop, may require a space of only 15x15 feet, or a line of 3x45 feet, located at least 10 feet away from the home, and 10 feet from property lines. Horizontal loops require considerably more space.

Q: How is the unit size and loop design determined?

A: Carrier dealers use GeoDesigner software to determine the most appropriate sized unit and loop for your home. The software takes many factors into consideration including: the heating and cooling requirements of the home, loop type, depth, soil conditions, earth temperatures, outdoor air temperature extremes, local fuel rates and much more. In addition, the software can demonstrate energy costs for a Carrier geothermal system vs. another type of heating and cooling system.

Q: Will the fluid in the loops freeze during a long, cold winter?

A: No. Antifreeze in the loop fluid eliminates any concerns about freezing.

Q: Can a well be used instead of an earth loop?

A: Yes. Prior to using a well for a geothermal installation, the water quality should be checked. Sufficient water volume is needed for the unit, usually about four to nine gallons per minute during unit operation. A discharge location like a pond or drainage ditch is also required.

Q: How big does a pond have to be for use with a geothermal system?

A: For most installations, the pond should have a surface area of at least a half acre and a depth of 10 feet. Bigger is better.

Q: What is the actual efficiency of a geothermal system and how does it compare to a furnace, air conditioner or heat pump?

A: The efficiency of a geothermal system is rated by an industry standard known as ARI/ISO 13256-1, that specifies a set of conditions by which efficiency is determined. The rating for heating is Coefficient of Performance (COP). It's a ratio of the amount of energy used to operate the unit compared to the amount of energy output. Carrier's highest efficiency geothermal units have a COP in excess of 4.5 (that's 450% efficient), compared to the highest efficiency gas furnace with a COP of 0.95 (95% efficient AFUE) or a high-efficiency heat pump with an average seasonal COP around 1.8. The rating for cooling is called Energy Efficiency Ratio (EER). It's calculated by dividing BTUs per hour output into the watts used. Carrier's highest efficiency geothermal units have EERs around 18-27. That's about 30-50% better than many air conditioners and heat pumps. But because geothermal units are not rated according to the same industry standard as furnaces, air conditioners, and heat pumps, it is difficult to compare, for example, an AFUE and HSPF to COP, or SEER to EER. To get the full energy efficiency story, compare the dollars. Your Carrier dealer can calculate operating cost estimates using Carrier's GeoDesigner software.

Q: Is comfort compromised to get all this efficiency?

A: No. In fact, geothermal systems can provide exceptional comfort without the “cold blow” from an air source heat pump during heating; or short, hot blasts of air associated with standard efficiency gas furnaces. Geothermal units deliver air at temperatures that provide comfort throughout the house. The Carrier dual capacity units with variable speed fans precisely match the needs of the home to deliver comfort no matter what the outdoor air temperature is.

The Carrier® Geothermal Advantage

Throughout Carrier's historic 100-year legacy, the company has provided millions of homeowners with the finest comfort systems available. Using state-of-the-art furnaces, air conditioners and heat pumps, Carrier dealers are experts when it comes to customized home comfort systems. But it doesn't end there. Carrier also offers a complete line of exceptional geothermal comfort systems for your home.

According to the U.S. Environmental Protection Agency, geothermal systems are "the most energy efficient, environmentally clean, and cost effective space conditioning systems available today." That's because

a geothermal system taps into the earth to capture free, renewable energy.

The earth absorbs about 47% of the sun's energy that reaches it, storing that energy in the ground. A geothermal system extracts that free energy for heating during winter. For cooling, the system removes heat from the home and dumps it into the cooler earth. This transfer of heat energy is done through a series of pipes buried in the ground, or sunk in a pond, or by using well water. Because a geothermal system simply moves heat instead of burning a fossil fuel to generate it, it's more energy-efficient.

Why Choose Geothermal?

Geothermal Systems provide homeowners with a wide range of benefits.

- **Savings:** Generally, no other heating and cooling system offers lower operating costs, with savings up to 60% compared to ordinary systems.
- **Comfort:** These systems provide even temperatures throughout the home year round, with excellent dehumidification during cooling.
- **Environmentally Sound:** Geothermal is a clean, green, and renewable technology to reduce your carbon footprint now and for future generations.
- **Reliable:** Geothermal units last longer than ordinary air conditioners and heat pumps. Since the units contain few moving parts, they operate for years with little maintenance.
- **Quiet Operation:** Unlike ordinary air conditioners and heat pumps, no outdoor unit is required. Carrier geothermal units use heavy-duty, fully-insulated cabinets for quiet operation. Quiet, soft starting variable speed blowers are used in many models.
- **Flexibility:** Heating, cooling and supplemental water heating from a single unit. And a wide variety of models and options to fit most any application.
- **Free Hot Water:** During unit operation, free excess heat is used to supplement the home's water heater.
- **Energy Independence:** Geothermal systems reduce our need to import fuel.
- **Safe and Clean:** No flame, no flue, no odors.

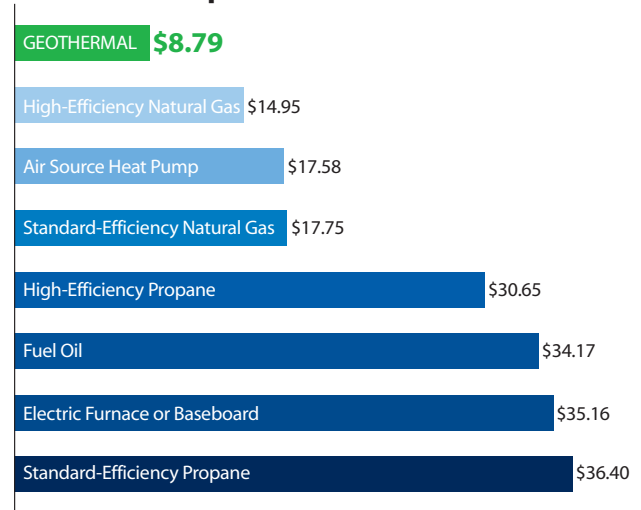
The Energy Efficiency Story

One of the main reasons many homeowners choose geothermal is the benefit of lower operating costs. In most homes, the cost for heating, cooling and hot water combine for about 70% of the total utility costs. Therefore, the biggest opportunity to save a substantial amount in utility costs is to improve those systems. That's where geothermal can help in a big way.

For every one unit of energy purchased to operate a geothermal unit, it delivers four to five units of energy because the energy from the earth is free. In many scenarios, a geothermal system is significantly less expensive to operate than ordinary heating and cooling systems. Geothermal systems can save up to 70% in heating costs, up to 50% in cooling costs, and around 30-50% in hot water costs.

One way to compare efficiency is to calculate the cost for 1 million BTUs of heat transfer. Using a standard formula, an "apples to apples" comparison can be made based on local fuel rates and equipment efficiency. The table at right demonstrates a typical savings opportunity with geothermal. To get the full picture for your home, contact your Carrier geothermal dealer.

Cost Comparison for 1 Million BTUs



Geothermal – 4.0 COP*, \$0.12/kwh
 Heat Pump – 2.0 COP, \$0.12/kwh
 Natural Gas – 95% AFUE†, 80% AFUE, \$1.42/ccf
 Propane – 95% AFUE, 80% AFUE, \$2.65/gallon
 Fuel Oil – 81% AFUE, \$3.80/gallon
 Electric Resistance – 1.0 COP, \$0.12/kwh

* COP – Coefficient of Performance † AFUE – Annual Fuel Utilization Efficiency

Free Energy From The Earth

Geothermal systems can be installed with a variety of loop system configurations. "Closed loops" use re-circulated fluid in a series of pipes installed vertically, horizontally, or in a pond. "Open loops" use well water. Your dealer will determine which design works best for your home.



Horizontal Loops: Used on larger lots. Installed using a backhoe or trencher.



Pond Loops: Coils of pipe are fabricated and sunk to the bottom of the pond.



Vertical Loops: Used where land area is limited or soil conditions prohibit horizontal loops. Installed using a drilling rig.



Open Loop: Well water from an existing well can be used, then discharged into a drainage ditch or pond.

Geothermal Product Selection Guide



Family Models	GT-PX 50YD(V,H,D)	GT-PG 50YE(V,H,D)
Applications	Ultimate luxury "Best" overall Exceptional comfort and performance	Upscale Great choice for excellent performance and reliability
Sizes	2, 3, 4, 5, 6	1.5, 2, 2.5, 3, 3.5, 4, 5, 6
AHRI Ratings (13256-1) Closed Loop (GLHP)	3.6 - 4.6 COP 16.2 - 27.0 EER	3.6 - 4.2 COP 16.6 - 20.2 EER
Ground Water (GWHP)	4.3 - 5.1 COP 19.9 - 31.5 EER	4.3 - 5.1 COP 21.6 - 28.1 EER
Refrigerant Compressor	Puron® Refrigerant Two stage unloading scroll	Puron® Refrigerant Single stage scroll
Blower	Variable Speed ECM	Variable Speed ECM or PSC
Cabinet Configurations	Vertical upflow Vertical downflow Horizontal	Vertical upflow Vertical downflow Horizontal
Stages (* with aux.)	3 stages heating* 2 stages cooling	3 stages heating* 2 stages cooling
Control	CXM solid state module On-board diagnostics	CXM solid state module On-board diagnostics
Air Coil	E-coated	E-coated
Desuperheater	Optional Internal mount pump	Optional Internal mount pump
Auxiliary Heat	Optional Internal mount on vertical units	Optional Internal mount on vertical units
Zone Control	Optional	Optional
ENERGY STAR rated	All sizes	All sizes (except 070- GLHP)
Dealer Notes		

Go Green: Reduce Your Carbon Footprint

Geothermal systems use the free, renewable energy from the earth, so the technology is one that can have a positive effect on your carbon footprint. In fact, according to the Geothermal Heat Pump Consortium, installing a geothermal system instead of an ordinary system is the environmental equivalent (in emission reduction) of taking two cars off the road or planting an acre of trees. And because of improved electrical energy efficiency, geothermal systems reduce the need to build additional costly, fuel burning power plants. It's clean technology – geothermal units produce no on-site emissions.

There are over 1 million geothermal installations today, resulting in the avoidance of more than 5.8 million metric tons of carbon dioxide and more than 1.6 million metric tons of carbon equivalent annually. In addition, existing geothermal installations are the environmental equivalent (in emission reduction) of taking 1.2 million cars off the road, or planting more than 385 million trees.



GT-PX Indoor Split 50YDS	GT-PE Outdoor Split 50YPS	GT-PW 50YEW	GT-PW 50YER
Versatility Great performance Used with air handler or gas furnace 2, 3, 4, 5	Easy Replacement for conventional AC unit Used with air handler or gas furnace 2, 3, 4, 5	Hydronic High temperature heating performance for radiant applications 3	Hydronic Heating and cooling capable for various applications 3, 5, 10
3.6 - 4.2 COP 15.3 - 24.5 EER 4.3 - 4.7 COP 19.2 - 29.4 EER	3.6 - 4.2 COP 15.3 - 24.5 EER 4.3 - 4.7 COP 19.2 - 29.4 EER	(13256-2) 3.3 - 4.2 COP 4.1 - 5.2 COP	(13256-2) 2.9 - 3.1 COP 15.1 - 16.8 EER 3.7 - 4.0 COP 21.3 - 23.1 EER
Puron® Refrigerant	Puron® Refrigerant	Puron® Refrigerant	Puron® Refrigerant
Two stage unloading scroll	Two stage unloading scroll	Single stage scroll	Single stage scroll
Used with ECM furnace or fan coil	Used with ECM furnace or fan coil	Not applicable	Not applicable
Compact cube	Outdoor unit	Vertical "Euro-style"	Compact cube
3 stages heating* 2 stages cooling	3 stages heating* 2 stages cooling	1 stage heating	1 stage heating 1 stage cooling
CXM solid state module	CXM solid state module	CXM solid state module with interface	CXM solid state module
On-board diagnostics	On-board diagnostics	On-board diagnostics	On-board diagnostics
Depends on air handler selected	Depends on air handler selected	Not applicable	Not applicable
Optional Internal mount pump	Optional External module	Optional External mount pump	Optional Internal mount pump
Depends on air handler selected	Depends on air handler selected	Not applicable	Not applicable
Hybrid Heat option	Hybrid Heat option		
Optional	Optional	Via control panel	Not applicable
All sizes	All sizes	All sizes	All sizes



Key Features

Carrier offers a wide range of model options and configurations to fit a variety of applications. Our popular GT-PX series includes the following features:

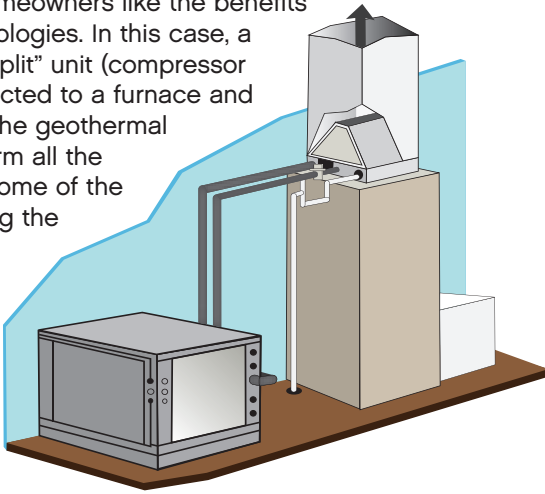
- 1 Copeland Ultra-Tech™ two-stage unloading scroll compressor for exceptional performance, efficiency and reliability
- 2 Variable speed blower motor for comfort and quiet operation
- 3 E-Coated air coil for corrosion resistance
- 4 Foil faced insulation in blower section for easy cleaning. Insulated compressor section for quiet operation
- 5 Filter rack with two-inch MERV 11 filter for indoor air quality
- 6 Stainless steel drain pan for corrosion resistance
- 7 Unit Performance Sentinel microprocessor control precisely sequences and monitors component operation for improved performance and serviceability
- 8 Double spring and grommet compressor isolation for quiet operation
- 9 Heavy-duty cabinet, epoxy powder coated, with stainless steel front panels for aesthetics and long life

Note: Features on other models may vary.

Frequently Asked Questions (con't)

Q: Can a geothermal unit be combined with a gas or propane furnace?

A: Yes. Some homeowners like the benefits of both technologies. In this case, a geothermal "split" unit (compressor only) is connected to a furnace and cooling coil. The geothermal unit will perform all the cooling and some of the heating. During the coldest days, the system switches over to furnace operation. This type of system may be a good choice for a replacement installation.



Q: Can the existing duct work and electrical service be used?

A: Generally, the existing duct work can be used with a geothermal unit without extensive modification. Variable speed blowers used in many of the Carrier geothermal units

can compensate for a less-than-optimum duct system. For the electrical supply, a 200-amp service for the home is recommended.

Q: What about radiant floor heating?

A: A geothermal system can be designed to provide warm water for radiant floor applications. Carrier's water-to-water geothermal units are four to five times more efficient than today's best boilers.

Q: Are geothermal systems more expensive to install, and how long does it take for the extra expense to pay for itself?

A: Geothermal systems are generally more expensive to install than ordinary systems. For replacement installations, the added cost is usually recovered in a few years. In a new home where the added cost of the system is included in the mortgage, the monthly energy savings may be greater than the added cost, providing the homeowner with a positive cash flow from day one. Because every situation is somewhat unique, your Carrier dealer can demonstrate the complete financial scenario for your home using the GeoDesigner software. Many homeowners find that a Carrier geothermal system is a great investment.

Factoids

- With over 1 million geothermal installations, the total estimated annual energy savings is 8 billion kWh of electricity and 40 billion BTUs of fossil fuels. It reduces our reliance on imported fuels by 21.5 million barrels of crude oil per year.
- Homeowners with geothermal systems installed are saving a combined, estimated \$750 million over 20 years.
- Surveys by utilities have shown that more than 95% of geothermal system owners would recommend the technology to others.
- The amount of the sun's energy absorbed by the earth is more than 500 times the energy required for all of mankind every year.
- Geothermal systems installed in schools are saving over \$25 million in energy costs annually, saving more money for books, equipment and teachers.

(Source: Geothermal Heat Pump Consortium)

Incentives, Rebates and Tax Credits

Because geothermal systems can be part of the solution for national energy policy, and for efficiency programs of various utilities, many incentives are available throughout the U.S. and Canada. Check with your Carrier dealer and tax professional to find out what incentives are available in your area.

Limited Warranty

Carrier geothermal units are backed with a 10-year limited warranty on the compressor and major refrigeration components, and five-years on all other parts. Extended warranties providing labor allowances are available. Ask your Carrier dealer for details.



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