GEO JOURNAL

All the latest news regarding Geothermal Heating and Cooling Systems

Residential geothermal tax credit now available

Recent legislation makes geothermal even more attractive

On Tuesday February 17th, 2009 the American Recovery and Reinvestment Act of 2009, H.R. 1, was signed and became law.

The bill further expanded the incentive for geothermal heat pump use by eliminating the tax credit limit established in H.R. 1424 signed in October of 2008.

Both H.R. 1 and H.R. 1424 contain long-term tax incentives to encourage the use of renewable energy technologies, such as geothermal heat pumps, in homes and businesses. The tax credit was increased to a tax credit of 30% of the total investment for all residential ground loop or ground water geothermal heat pump installations until the year 2016.

While the credit can only be claimed once per tax year, it can be claimed again if another geothermal system is installed later. To qualify for the 30% tax credit, the heating and cooling system must meet or exceed EnergyStar requirements and be installed after December 31, 2008.

The tax credit may be claimed for spending on "qualified geothermal heat pump property" installed in connection with a new or existing dwelling unit located in the United States and used as a residence by the taxpayer. It does not have to be the primary residence.

The term "qualified geothermal heat pump property" means any equipment which:

1) Uses the ground or ground water as a thermal energy source to heat the dwelling unit or as a thermal energy sink to cool the dwelling unit, and

2) Meets the requirements of the Energy Star program which are in effect at the time that the equipment is installed.

Spending for labor costs properly allocable to the installation of the geothermal heat pump property and for any associated piping, wiring, and interconnecting ducting are included.

> *"The tax credit was increased to a tax credit of 30% of the total investment..."*

The credit cannot be claimed on spending for equipment used solely to heat a swimming pool or hot tub, or on previously used equipment.

The credit can only be claimed on spending for property that is "placed in service" during the period from 2008 to 2016. In general, property is considered to be placed in service when the original installation is completed.

However, if the geothermal heat pump property is part of the construction or reconstruction of a house, it is considered to be placed in service when the taxpayer takes up residence in the new or renovated house.An individual can claim a tax credit equal to 30% of spending on qualified geothermal heat pump property.

For property placed in service after January 1, 2009, there is no limit on the amount of the tax credit that can be claimed.

The tax credit can be used to offset both regular income taxes and alternative minimum taxes (AMT).

If the tax credit exceeds the income tax liability, the remaining balance can be carried forward into future years.

For more information regarding geothermal heat pumps and tax credits, go to climatemaster.com.

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A beginner's guide to geothermal

How geothermal heat pump technology keeps your heating and cooling costs low while being Earth-friendly

According to the U.S. Environmental Protection Agency (EPA) geothermal systems are, "the most energy-efficient, environmentally clean, and cost-effective space conditioning systems available today."

Extremely high levels of efficiency are possible because a geothermal heat pump only uses electricity to move heat, not produce it.

A geothermal unit typically supplies 4 to 5 kilowatts of heat for every kilowatt of electricity used.

Three to four of these kilowatts of heat come directly from the earth itself, and are clean, free and renewable. The other kilowatt is used to power the compressor, fan, and controls.

Geothermal heat pumps also take advantage of the mild ground temperature for extremely high efficiency cooling. Most systems also include a hot water generator, which diverts a portion of the supplied heat to the domestic water heater.

This provides a substantial portion of a family's hot water needs at a very low cost. Overall, geothermal technology offers the highest cooling and heating efficiencies of any system available today.

Geothermal systems transfer heat from your home to the earth in the cooling mode, or from the earth to your home in the heating mode.

Water is used as the heat transfer medium through a closed loop piping system buried in the ground.

By using this stable thermal source, geothermal heat pumps provide energy efficient comfort year around with a factory-tested and sealed packaged unit, and without the need for a noisy outdoor fan, or a flue.

The environmental advantages of geothermal systems have caught the eye of governmental agencies such as the Environmental Protection Agency (EPA) and the Department of Energy (DOE).

Because geothermal technology is lowest in CO_2 emissions, it provides a solution to global warming by primarily using the natural energy of the earth.

EarthPure® (R-410A) zero ozone depletion refrigerant is available for ClimateMaster geothermal heat pumps for an even friendlier system.

There are two types of geothermal systems commonly installed in North America, closed loop (geothermal), and open loop (well water systems).

Both types of systems work well and achieve very similar operating costs. An open loop system is less expensive to install, but over time could require more maintenance. A closed loop system is more expensive up front, but requires almost no maintenance.

Closed loop systems use a network of buried high-density polyethylene (plastic) pipe, circulating a water/antifreeze solution from the ground to the heat pump. These systems are sealed and pressured, and thus recirculate the fluid, eliminating any water usage.

Polyethylene pipe is always utilized to insure long life and system reliability. Milk jugs are made from polyethylene.

Polyethylene is a very tough plastic, especially when considering the wall thickness of a milk jug (pipe wall thickness is many times greater), but it is also extremely flexible, which allows the pipe to avoid damage even as the ground shifts.

All connections are heat fused, which is a welding process, whereby the pipe and fitting are heated up to the melting point, around 500°F (260°C). The two pieces are joined together while the plastic is still in its molten state.

Once cooled, the joint is stronger than the pipe itself. Therefore, leak potential of the in-ground piping is nearly nonexistent. Properly installed, loop piping will last more than 50 years!

Closed loop systems may be installed in a variety of configurations, depending upon the size of the yard and local excavation costs. A horizontal loop is typically installed with a trencher or backhoe. Trenches are normally four to six feet deep [1.2 - 1.8 meters].

One of the advantages of a horizontal loop system is being able to lay the trenches according to the shape of the land. As a rule of thumb, 125 - 300 feet of trench is required per ton of heat pump capacity [11 - 27 meters per kW of capacity], depending up geographic location.

Anywhere from 1 to 6 pipes per trench may be used, depending upon the optimal design for the yard. More pipe per trench shortens the total amount of trench required.

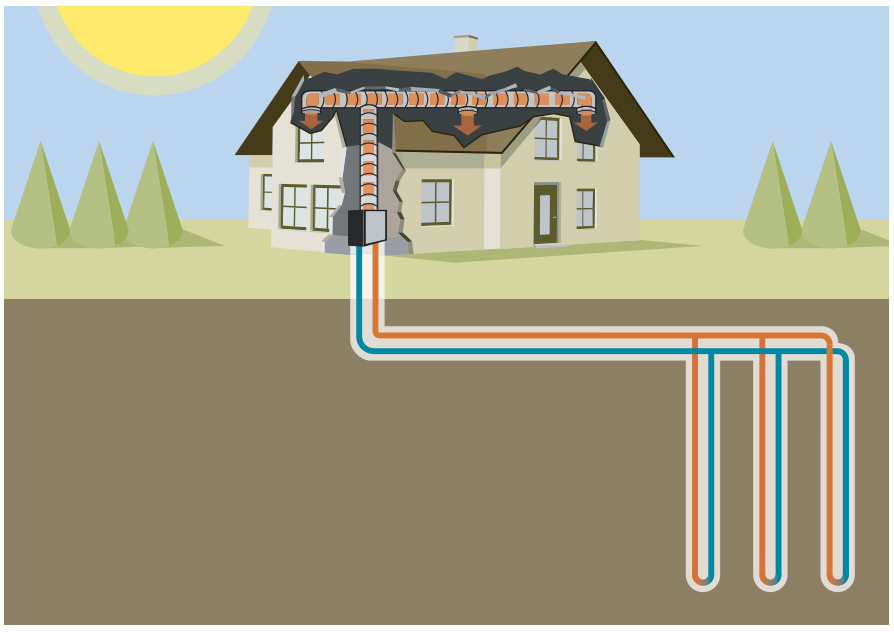
For smaller yards, the loops can be installed vertically using a drill rig, much like a water well installation.

Holes are bored to about 150 - 300 feet per ton of heat pump capacity [13 - 27 meters per kW of capacity]. U-shaped loops of pipe are inserted in the holes.

The holes are then backfilled with a sealing solution (grouting material). Vertical and horizontal loops perform very similarly, and therefore are selected based upon the individual preference and yard layout.

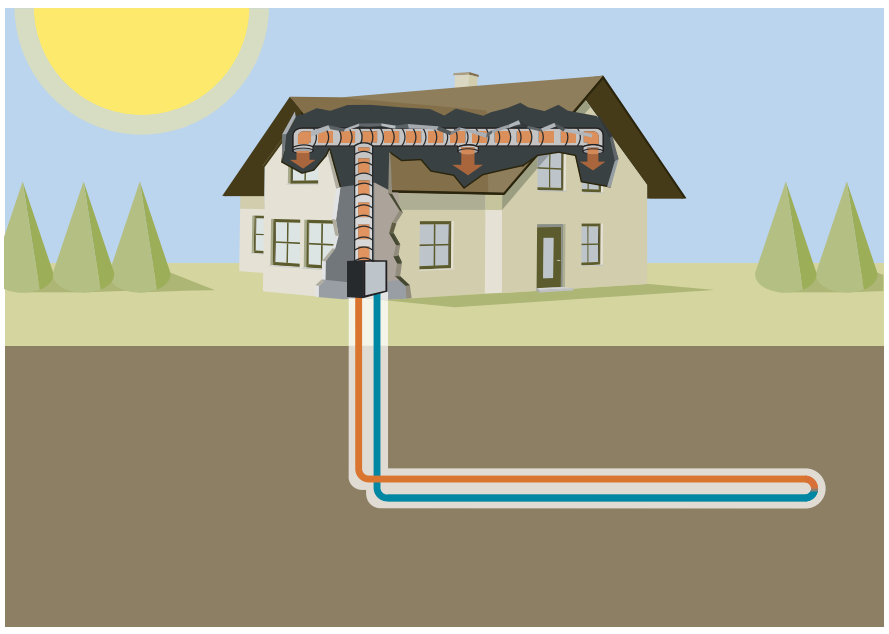
Pond or lake loops are another type of closed loop system, which is very cost effective, since excavation is limited to the trenching between the home and the pond/lake. Pond loops are still closed loop systems. Polyethylene pipe is sunk at the bottom of the pond, and fluid is circulated through the pipe to exchange heat between the geothermal heat pump and the body of water.

» continued, **PG. 5**



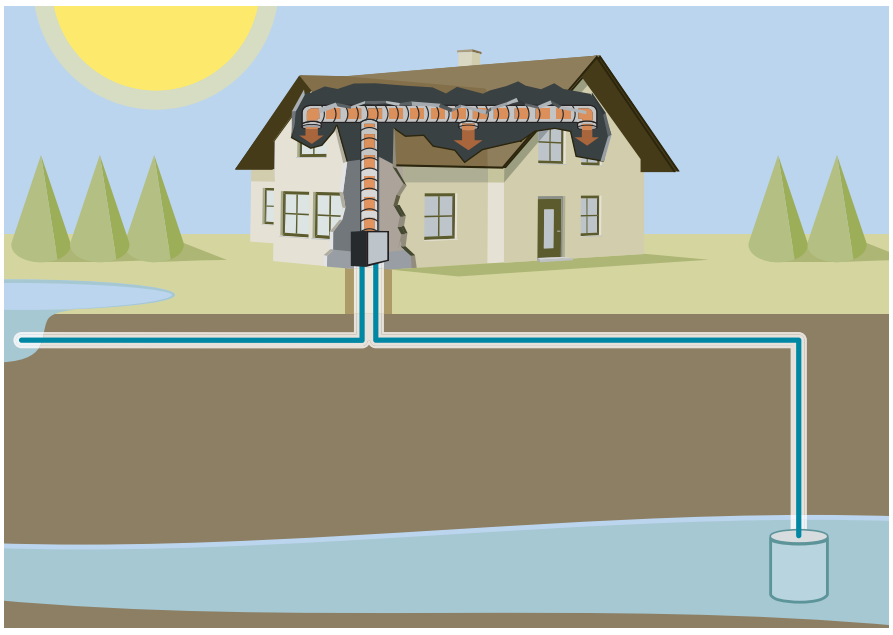
Vertical Loops

Vertical loops are used extensively where land area is limited or soil conditions prohibit digging horizontal loops. A pair of pipes with a special U-Bend assembly at the bottom are inserted into a bore hole that averages between 150 to 300 feet deep per ton (13 to 27 meters per kW) of equipment. These holes are then backfilled with a special grout solution to ensure good contact with the earth.



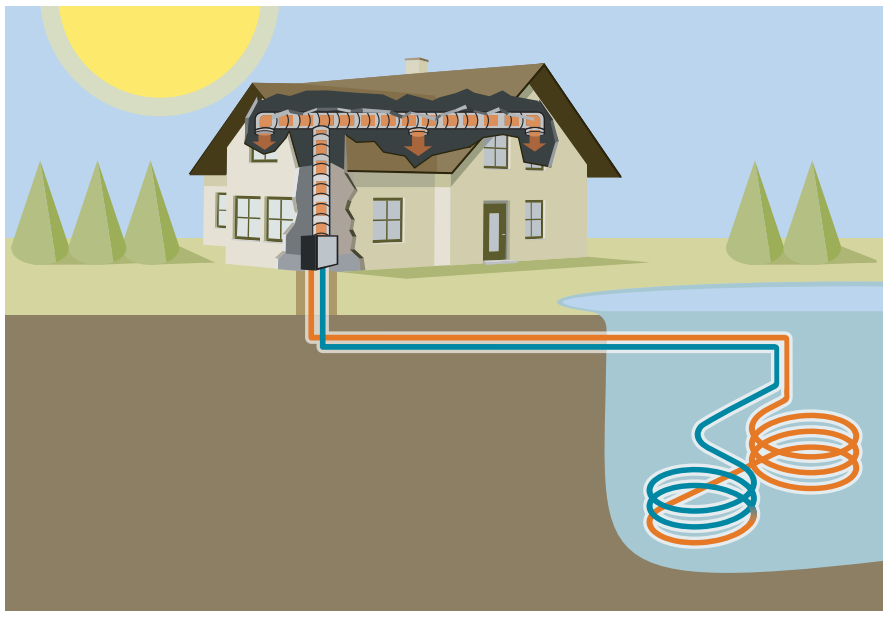
Horizontal Loops

Horizontal loops are installed where the soil conditions allow for economical excavation. Taking up more land area than any other loop type, they are used where space permits. Trenches are normally about 4 to 6 feet (1.2 to 1.8 meters) deep with multiple pipes placed in the trench at different depths. Normally, several hundred feet (over 100 meters) of trench is required, but where space permits these loops are considered desirable.



Open Loop

Open loop installations actually pump water from an underground aquifer through the geothermal unit and then discharge that water to a drainage ditch or pond. The geothermal unit processes the heat energy from the water just like a closed loop installation. Discharging water to a "return" well is sometimes effective, but sending water to a pond or lake is considered more reliable.



Pond Loops

Pond loops are usually very economical to install. If a pond or lake at least eight feet (2.5 meters) deep is available, pond loops can utilize the water (rather than soil) to transfer heat to and from the pond. A coiled pipe is placed in the body of water, which should cover about 1/2 acre (0.2 hectare). An average home would require about 900 feet (27 meters) of pipe. Reduced installation costs and high performance are characteristic of this type of loop.

WORTH KNOWING...

The system installer and you

How to find the right dealer for your residential geothermal heat pump system installation

Geothermal systems are not difficult to install by trained professionals.

However, they are also not "do-it-yourself" projects. Finding the right geothermal dealer for installing a geothermal system is important to insure that the system will operate at its peak performance and provide years of trouble-free performance.

Several qualifications should be considered when selecting a heating and cooling dealer.

The following guidelines should help homeowners when deciding upon a local dealer:

- **Go With A Professional:** Professionals who follow the procedures established by the manufacturer or the International Ground Source Heat Pump Association (IGSHPA) will do the best job of installing your system.
- **Check Training Credentials:** Installers should be trained by the manufacturer or accredited by IGSHPA or other acknowledged authorities at recognized institutions.
- **Ask For References:** Be sure to ask about other homes or communities where the contractor has installed geothermal systems. Ask for the names of some of their homeowner customers. Visit or call these references to check customer satisfaction firsthand.
- **Expect A Home Evaluation:** A good contractor should examine your home to make the best recommendation for you. He or she should check ducts, insulation and other features for energy efficiency.
- **Ask Questions:** Inquire about the contractor's experience installing geothermal systems. Question anything you would like to about the recommendations for your home. Ask if the contractor has installed a geothermal system in his or her own home or business.
- **Get Several Cost Estimates:** Talk to two or three contractors. Get a cost estimate in writing. Be sure you are comparing "apples to apples." If you have any questions, ask the contractor for clarification.
- **Get A Guarantee:** You wouldn't think of buying a system that wasn't backed by a warranty. Ask for a guarantee, in writing, on installation work as well.
- **Insist on a Written Contract:** Be sure to include all terms, including costs and start-stop dates.

EarthPure®, the refrigerant choice for the future

EarthPure, a refrigerant available in ClimateMaster geothermal heat pumps, allows homeowners to install the most environmentally-friendly heating and cooling system available today.

EarthPure (R-410A) is a non-chlorine based (HFC) refrigerant with zero ozone depletion potential.

Most heat pumps and air conditioners still use R-22 (HCFC) refrigerant, which can no longer be used in air conditioners and heat pumps (including geothermal heat pumps) after January 2010.

Although R-22 will still be available for service, production will be reduced each year, potentially causing the cost of R-22 refrigerant to increase in the same manner as did R-12 for automobile air conditioners in the 1990s.

EarthPure is the refrigerant of choice for the foreseeable future, and is more earth friendly than the older R-22 refrigerant, giving even more advantages to homeowners with EarthPure geothermal systems.

Habitat for Humanity's green neighborhood, thanks to donation

Hope Crossing in Oklahoma City, Okla., looks like any other housing development.

But look closer. It's green.

By 2012 the Habitat for Humanity community will have 217 homes. Currently, 80 homes have been built. Each is furnished with a ClimateMaster geothermal heat pump and some have solar panels. All are LEED-certified.

ClimateMaster, Guaranteed Watt Saver and OG&E donated services and supplies to make Hope Crossing energy efficient.

"We thought it was time for us to get involved in our community a little more," ClimateMaster President Dan Ellis said.

Ellis donated the systems and in March 2008 OG&E bought solar panels for two Hope Crossing homes. Each house had 12 solar panels installed at a cost of $25,000.

Ann Felton, chairman and CEO of Central Oklahoma Habitat for Humanity, said she did not think Habitat could afford the $10,000 ClimateMaster systems at Hope Crossing.

"I wanted to see what else we could do," Ellis said. "I talked with OG&E and asked them to partner with us to not only do geothermal but upgrade the windows, insulation and lighting and make these state-of-the-art, energy-efficient homes."

Guaranteed Watt Saver performs the LEED inspections and waives all administrative fees for Habitat homes.

Energy-efficient insulation and Low E glass are additional features that help homes save even more energy.

Ellis said the Hope Crossing houses use about 80-percent less energy than other Habitat homes.

"We're giving the homeowners that savings for the rest of their lives," Ellis said.

The homes at Hope Crossing sell for around $85,000.

Felton said she is considering future green Habitat neighborhoods. She said she is also proud that Hope Crossing holds a unique distinction.

"We're the most energy-efficient builder in the state right now," Felton said. "Our houses are where we've really focused on the environmental and energy-efficiency issues."

The site's uniqueness caught the attention of Habitat CEO Jonathan Reckford in June 2009 when he was in town for Hope Crossing's second Builders' Blitz. The event, part of a national Habitat program, brings in local builders to construct homes in about a week.

"Hope Crossing is going to be the largest green-build Habitat community in the United States when it's completed," Reckford said. "That's something that is setting the tone and path for the rest of the country as well."

ClimateMaster President Dan Ellis speaks at the dedication of Hope Crossing

Best of Both Worlds

National Historic Landmark Achieves Silver LEED Certification

A home in Salem, Mass., is among the first in the country to be a certified "green" building while also being listed as a National Historic Landmark.

The Joseph Story House in Salem, Mass.

The Joseph Story House was built in 1811 for Joseph Story, the youngest justice ever appointed to the Supreme Court. Renovations took place in 2006 when Neil and Martha Chayet bought the red-brick house while working with the Historic Commission to keep the house's historical integrity.

During this time, the Chayets submitted to the tedious application process for Leadership in Energy and Environmental Design (LEED) certification from the U.S. Green Building Council. The Chayets were awarded LEED's silver rating in March 2009.

"We take the energy problems of the planet very seriously," said Neil Chayet.

Among the chief improvements to help the Story House gain LEED certification is a state-of-the-art, geothermal heating and cooling system that heats and cools the 9,000 square-foot home while using no oil or gas.

The heating system also supplies radiant heating to the floors of the five most frequently used rooms in the house.

How was the system installed? Seven 500-foot wells were drilled into the ground in the front yard to house the loops used in the system.

"It's a zero carbon footprint," Neil said.

The LEED certification system allots points based on a long list of criteria that ranges from energy savings to water efficiency.

For instance, it factored in the 88 new custom-fitted thermal pane windows, cell foam insulation installed through the house and timers for bathroom fans.

What makes the LEED certification so impressive is that it was achieved while preserving a home almost 200 years old.

Neither the U.S. Green Building Council nor the National Historic Landmarks program cross-check each other's databases, but the Story House is thought to be one of the first private homes to earn both distinctions.

A Building Council spokeswoman said she wasn't aware of any other home that carries both distinctions like the historic Story House.

During construction and renovation, elements and materials were measured against certain LEED criteria. Marble used in bathrooms and kitchens was quarried in Vermont instead of thousands of miles away. Low-volatility flooring materials and organic compound paints were also used.

The LEED certification scale also considered the location of benches by doors so people can remove their shoes and not track dirt inside and the distance of shrubs from the house to decrease moisture. The house was also vacuum-tested for air leaks.

"It raises your awareness of a lot of things," Martha said.

The couple said renovating a very old home to earn LEED certification while staying true to historic preservation was much more expensive and difficult than constructing a new home would have been. They were able to defer some costs through a federal tax credit.

"People can get very discouraged because it's an enormously complicated process," Neil said. "A few times we asked ourselves, 'Why are we doing this?'

"But it was the right thing to do, and we're glad we did it."

Add-on heat pump makes more sense with geothermal systems

Add-on heat pumps have been around for years, but most people are not aware of the same option for geothermal systems.

A geothermal "split system" consists of the compressor section of a geothermal heat pump, which can be connected to an existing fossil fuel (natural gas, fuel oil or propane) furnace to create a "dual fuel" heat pump.

Unlike traditional add-on heat pumps, which depend upon the outside air for a heating source, a geothermal add-on heat pump uses the warm ground temperature as a heat source.

Traditional add-on heat pumps typically have only enough capacity to heat the home when the outdoor air temperature is above 32 or 35ºF (0 to 2ºC). The furnace must take over below the cut-off (or switch-over) temperature.

Geothermal add-on heat pumps have higher heating capacity, since the earth is a constant 50 to 70ºF (10 to 21ºC), and provide a larger percentage of the total heating needs. In some climates, the geothermal heat pump can handle the entire heating load without the furnace as backup.

Benefits of an add-on geothermal heat pump are many. Reduced initial installation costs is the biggest advantage (the indoor unit can be reused). Plus, the electrical service normally will not need to be upgraded, saving additional costs.

An add-on heat pump also gives the homeowner "fuel flexibility." If electricity remains inexpensive, the switch-over temperature can remain low, allowing the geothermal system to do most of the home heating; if fossil fuels become less expensive, the switch-over temperature can be increased, allowing the furnace to do a larger percentage of the heating. *Just like today's hybrid automobiles, a dual-fuel system can save consumers money.*

In addition to heating cost savings, an add-on geothermal heat pump provides air conditioning at very low operating costs in the summer.

An optional hot water generator provides up 50% annual savings on water heating.

Add-on geothermal heat pumps are available in two configurations. The indoor version is installed next to the furnace or in a closet, basement or garage.

ClimateMaster's outdoor version (the Genesis Outdoor) replaces the old outdoor air conditioner or heat pump, saving even more on installation costs. Ductwork modifications are minimal (if needed at all) although in most cases the indoor evaporator coil will need to be replaced.

Add-on heat pumps allow owners of existing homes to experience the advantages of a geothermal system without completely removing their old system.

Typical Dual-Fuel Installation

Geothermal, the answer for comfort

Geothermal heating and cooling systems are popular mostly due to the low operating costs and environmentally responsible operation. Comfort is an advantage that is often overlooked in the initial purchasing process. Most homeowners purchase the system for the operating costs savings, but once the system is installed, they notice an additional benefit, improved comfort.

In heating, geothermal heat pumps provide warmer air temperatures (typically 95-105ºF, 35-41ºC) than conventional air source heat pumps (typically 85-95ºF, 29-35ºC), but because they are sized to run more than a fossil fuel (natural gas, fuel oil or propane) furnace, they don't "blast" hot air followed by an extended time when air is not being circulated. Most fossil fuel furnaces deliver hot (125 - 140°F [52 - 60°C]), air when operating. The steady, warm air provided by a geothermal heat pump provides the most comfortable heating system available.

In cooling, a geothermal heat pump provides better dehumidification than conventional air conditioning systems, causing the indoor humidity to be lower, thus more comfortable. A special dehumidification mode is available for ClimateMaster systems when the variable speed (ECM) fan motor is installed. ClimaDry, ClimateMaster's whole house dehumidifier option for geothermal heat pumps, provides even more dehumidification for high humidity locations.

In heating and cooling, advanced technology utilized in today's geothermal systems enhance comfort even more. Two-stage compressors "match" the heating or cooling needs to the outdoor weather conditions. Ninety percent of the time, these systems run in first stage, increasing comfort by automatically adjusting the capacity to the needs of the home. Variable speed fan motors allow different fan speeds for heating, cooling, dehumidification and continuous fan operation. Plus, variable speed fans speed up or slow down to maintain airflow.

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Quality: First & Always

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AHRI CERTIFIED

The smart, responsible choice for families and homes

As energy costs continue to rise, and with no relief in sight, families are having to make tough financial decisions between their day-to-day expenses and home comfort.

Fortunately, there's a simple solution to handle these costs.

A new geothermal heating and cooling comfort system can help reduce your family's heating and cooling costs by as much as 50 to 60%.

Plus, in many cases, your operating cost savings will pay the loan payment, especially with a new home loan.

Most heating and cooling dealers have software to calculate energy cost savings and simple payback.

Utilizing the natural stored energy within the earth, geothermal heating and cooling systems efficiently provide safe, clean, and environmentally responsible comfort for your home.

An optional hot water generator can help provide your family's domestic hot water needs at a fraction of the cost of electric or gas water heaters.

In areas where humidity is an issue, whole house dehumidification, such as ClimateMaster's ClimaDry™ option, can enhance comfort by operating as a dehumidifier even if cooling is not required.

All of these features and benefits from a compact, quiet unit that's so intelligent, it can inform you of potential performance problems before they arise.

The need to harness more domestic, replenishable energy sources continues to grow not only for the current generation, but future generations as well.

Geothermal systems provide families the perfect indoor environment, while protecting our natural environment.

To learn more, contact your local ClimateMaster Geothermal Installer or visit ClimateMaster online at climatemaster.com.

CLIMATEMASTER®
Geothermal Heat Pump Systems

Beginner's...

Page 2, Continued:

Using pond water directly is never recommended. A minimum of 8 - 10 feet [2.5 - 3 meters] in depth at its lowest level during the year is needed for a pond to be considered. Generally, a minimum of 1/2 acre [0.2 hectare] pond is required to provide adequate surface area for heat transfer.

The antifreeze solution in the closed loop system will keep it from freezing.

In the U.S. and Canada, three types of antifreeze solution are acceptable: propylene glycol, methyl alcohol, and ethyl alcohol. Some states/provinces may require one type over another.

The term "Open-Loop" is commonly used to describe a geothermal heat pump system that uses groundwater from a conventional well as a heat source in winter and a heat sink in summer.

The groundwater is pumped through the heat pump where heat is extracted (in winter) or Rejected (in Summer). Then the water is disposed of in an appropriate manner. Since groundwater is a relatively constant temperature year-round, it is an excellent heat source/heat sink.

There are a number of ways to dispose of water after it has passed through the heat pump in an open loop application.

The open discharge method is the easiest and least expensive. Open discharge simply involves releasing the water into a stream, river, lake, pond, ditch or drainage tile.

Obviously, one of these alternatives must be readily available and must possess the capacity to accept the amount of water used by the heat pump before open discharge is feasible.

A second means of water discharge is the return well. A return well is a second well bore that returns the water to the ground aquifer. A return well must have enough capacity to dispose of the water passed through the heat pump.

A new return well should be installed by a qualified well driller. Likewise, a professional should test the capacity of an existing well before it is used as a return.

No matter which type of geothermal system is installed, homeowners benefit from the most comfortable system available, while saving money on operating costs and helping to save the environment.

Today's geothermal systems are unmatched in comfort. State of the art two-stage compressors, variable speed fans and microprocessor controls adjust the heating and cooling capacity based upon the current weather conditions.

No matter what the temperature is outside, geothermal systems are always taking advantage of the mild ground temperature year-around.

Radiant floor heating, the ultimate in comfort

Geothermal systems have been in use for many years, although the vast majority of applications have been installed with forced air duct systems (water-to-air geothermal heat pump).

Radiant floor heating has also been popular for a long time. Typically, however, radiant floor systems have utilized fossil fuel (natural gas, fuel oil or propane) boilers as a source for heated water. Combining a water-to-water geothermal heat pump with a radiant floor installation provides unmatched comfort and efficiency.

The combination of geothermal and radiant floor heating results in a system which not only has the benefits of both technologies independently, but also has some distinct advantages as a result of the combination. To illustrate this point, table 1 lists the benefits of geothermal heating; table 2 illustrates the benefits of radiant floor heating.

TABLE 1	TABLE 2
BENEFITS OF GEOTHERMAL HEATING:	**BENEFITS OF RADIANT FLOOR HEATING:**
• Highest efficiency of any system	• Less drafts and cold spots
• No outdoor equipment	• Energy savings over forced air
• All electric (no flue, fumes, combustion)	• Quiet operation
• 20+ years average life expectancy	• Clean operation
• Low maintenance costs	• No filters to change
• Quiet operation	• No air movement (less dust)
• Clean operation	• Flexibility of zoning
• Environmentally responsible	• Can use any heat source
• Can also provide cooling	• Comfortable at lower temperatures
• Can also provide domestic hot water	• Takes up less space

Savings experienced with geothermal heating and cooling compared to traditional systems is in the 40% to 60% range, depending upon electricity and fuel rates. It is an accepted fact in the industry that radiant floor systems typically operate for 20% less than forced air systems. Therefore, the combination can result in substantial savings.

Floor heating systems have several benefits in residential, commercial and industrial heating applications. In a building with a radiant floor heating system, the entire floor acts as a heat source for the room.

In residential applications occupants in a space feel comfortable with lower air temperatures if their feet are warm.

Typically the space will feel comfortable with air temperatures as low as 65°F (18°C). Lower thermostat settings equal lower operating costs.

Air temperatures in a room with a forced air heating system tend to be warmer near the ceiling than the floor. The hot air rises and creates a greater pressure imbalance between the inside and outside. Air temperatures in a room with floor heating tend to be warmer at the floor than the ceiling, helping keep heat where it is needed, at the occupant level. The combination of geothermal systems and radiant floor heating provides the ultimate in home comfort with the added benefit of even lower operating costs than geothermal forced air systems.

How efficient is your heating and cooling system?

Heating and cooling system ratings can be confusing when comparing geothermal heat pumps to air source heat pumps, furnaces and air conditioners.

The cooling Seasonal Energy Efficiency Ratio (SEER) rating for air source equipment is based upon Air Conditioning and Refrigeration Institute (ARI) standard 240, which includes assumptions regarding Outdoor Air Temperature (OAT), a cycling degradation coefficient and a part load factor.

SEER is the total cooling Btu's during the normal annual usage period for cooling divided by the total electric power input in Watt-hours during the same period. The average OAT is 82°F (28°C), using weather data similar to Washington, DC.

For geothermal heat pumps, Air Conditioning and Refrigeration Institute/ International Standards Organization (ARI/ISO) standard 13256-1 uses Energy Efficiency Rating (EER) for cooling efficiency. EER is calculated at a single data point (i.e. entering water temperature, EWT) with assumptions included for pumping Watts and fan Watts.

For example, the EER for geothermal (ground loop) applications is based upon 77°F (25°C) EWT. Because ground temperatures, outdoor air temperatures and loop lengths change with every job, an EWT cannot be assumed to correlate to an OAT, such as 82°F (28°C).

SEER and EER ratings are not directly comparable, since ARI 240 (SEER) uses outdoor air temperature, and ARI/ISO 13256-1 (EER) uses entering water temperature. Also, SEER is seasonal and EER is at a specific condition.

Heating efficiencies between air source and geothermal heat pumps are equally difficult to compare. The Heating Seasonal Performance Factor (HSPF) is based upon assumptions regarding OAT, defrost cycle, auxiliary heat, and cycling degradation coefficients.

Temperatures used in calculations vary from 17°F (-8°C) to 62°F (17°C) OAT. The HSPF is the total heating Btu's during the normal annual usage period for heating divided by the total electric power input in Watt-hours during the same period.

For geothermal heat pumps, ARI/ISO standard 13256-1 uses Coefficient of Performance (COP) for heating efficiency. Like EER, COP is calculated at a single data point with assumptions included for pumping Watts and fan Watts.

For example, the COP for geothermal (ground loop) applications is based upon 32°F (0°C) EWT.

Because ground temperatures, outdoor air temperatures and loop lengths change with every job, an EWT cannot be assumed to correlate to an OAT, such as 47°F (8°C). HSPF and COP ratings are not directly comparable, since ARI 240 (HSPF) uses outdoor air temperature, and ARI/ ISO 13256-1 (COP) uses entering water temperature. Also, HSPF is seasonal and COP is at a specific condition.

Just as ARI lists EER/COP for geothermal equipment and SEER/HSPF for air source equipment, Gas Appliance Manufacturer's Association (GAMA) rates fossil fuel appliances (gas, oil, and propane). The Annual Fuel Utilization Efficiency (AFUE) is similar to the COP, in that the efficiency is the ratio of the output capacity to the input capacity.

The difference is that the COP is a whole number, whereas the AFUE is a percentage. For example, a gas furnace with an output capacity of 90,000 Btuh and an input capacity of 100,000 Btuh has an AFUE of 90% (or 0.9 COP). The AFUE rating is based upon steady-state testing (100% run time), and does not include electric use for the fan motor, inducer motor or control circuitry. Therefore, SEER does not equal EER and HSPF does not equal COP which does not equal AFUE.

With all this said, how does one compare the SEER to EER or AFUE to COP? The answer is, "You can't." There is an easy method, however, for comparing operating costs for heat pumps and furnaces and air conditioners, ClimateMaster GeoDesigner software. The printouts put all technologies in the same format, and compare Dollars, not EER/SEER or COP/HSPF/AFUE. This allows for an accurate comparison without getting into the technical aspects of ARI or GAMA standards. ClimateMaster dealers are familiar with the software, and can quickly make comparisons between the various systems.

The ClimaDry™ dehumidification system

"It's not the heat, it's the humidity!"

This age-old phrase has a significant impact on today's heating and cooling systems. Typical air conditioning systems utilize about 20-30% of the cooling capacity for moisture or humidity removal.

As houses have become tighter, this amount of moisture removal may not be enough, especially when the outdoor temperature is not hot enough to keep the air conditioner running a high percentage of the time.

For example, when it is raining on an 80ºF (27ºC) day, the air conditioning will run very little, since the outdoor temperature is not much higher than the indoor temperature.

If the air conditioner is not running, it is not dehumidifying. ClimateMaster's revolutionary patented design for whole-house dehumidification, ClimaDry™, dehumidifies the air even when there is no requirement for cooling.

The ClimaDry™ option is available on Tranquility 27® and Tranquility 20™ series equipment.

Unlike other dehumidifiers, which require an external unit and an additional compressor ("the box"), all ClimaDry™ components are inside the ClimateMaster unit. Plus, ClimaDry™ uses heat that would have been rejected to the ground for reheating the air (see figure 2), making ClimaDry™ the most efficient method for dehumidification available today.

Along with the ClimaDry™ option, ClimateMaster has introduced a new line of thermostats, which are designed to control heating, cooling and humidity (see figure 3).

Why is dehumidification important? Figure 1 shows the potential health effects of excess humidity. Structure or furnishing damage may result from high humidity levels, as well.

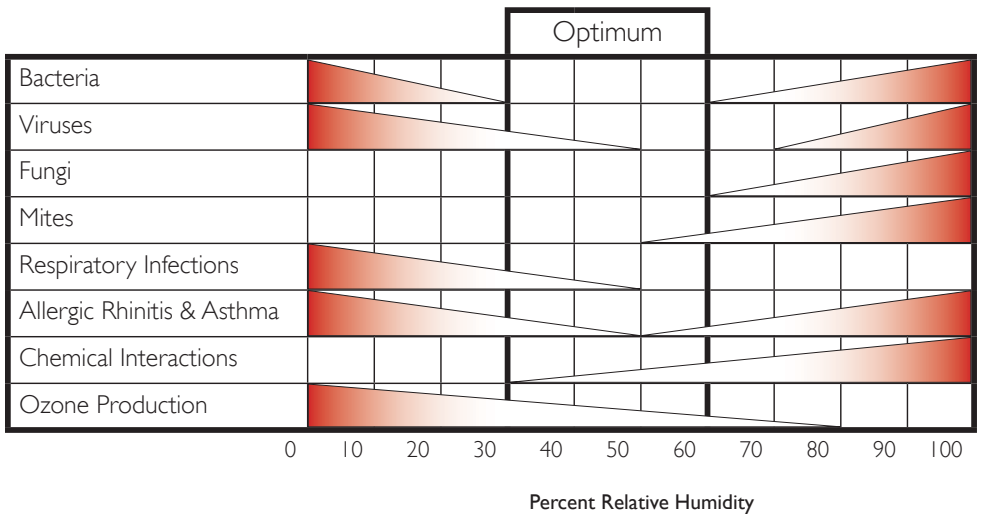
Indoor air quality is a major concern of experts with today's construction techniques. Tightly-built homes usually require some amount of fresh air to dilute pollutants from carpeting, furnishing and people. Even when fresh air is introduced, the indoor air quality may suffer in the summer time due to the added humidity of the outside air. Few residential air conditioning systems are designed to handle these conditions.

ClimaDry™, on the other hand, can operate as a whole house dehumidifier, or it can operate in the air conditioning or heating modes as required by the thermostat. ClimaDry™ is so effective, a typical system can remove nearly nine pounds (4.0 kilograms) of water per hour out of the air!

The benefits of ClimaDry™ drastically improve comfort, and indoor air quality. A ClimateMaster system equipped with the ClimaDry™ option provides year-round control of temperature and humidity. Features include . . .

- **Total comfort:** Systems with ClimaDry™ provide heating, cooling and dehumidification from one unit. All dehumidification components are inside the ClimateMaster unit.
- **Ultra high efficiency:** ClimaDry™ is unlike any other dehumidifier. Instead of using a separate dehumidifier, the ClimaDry™ option is integrated into the ClimateMaster unit, eliminating additional components and a second compressor. The dehumidification mode operates at the high efficiencies of a geothermal heat pump.
- **Ultimate in flexibility:** No matter what the loop temperature is, ClimaDry™ automatically adjusts the amount of reheat to provide neutral air temperature to the space, avoiding overcooling or overheating the air when only dehumidification is needed.
- **Easy-to-use control system:** When coupled with ClimateMaster's new integrated thermostat/dehumidistat, all of the heating, cooling and dehumidification is controlled by one thermostat.
- **Low maintenance:** The addition of ClimaDry™ to a ClimateMaster Tranquility 27® or Tranquility 20™ geothermal unit adds very few parts, unlike a stand-alone or portable dehumidifier. Fewer moving parts equals less maintenance. Since ClimaDry™ is integrated into the unit, there are no tanks to empty.
- **Better control:** Too much humidity can create environments where mold, mildew and bacteria can thrive. ClimaDry™ maintains lower humidity, helping to improve indoor air quality.

Figure 1: Optimum Humidity Levels for the Reduction of Harmful Contaminants



Studies have shown that keeping your home's relative humidity between 30% and 60% will not only increase comfort, but also limit the effects of potential allergens and contaminants.

Figure 2: Tranquility 27® with ClimaDry™

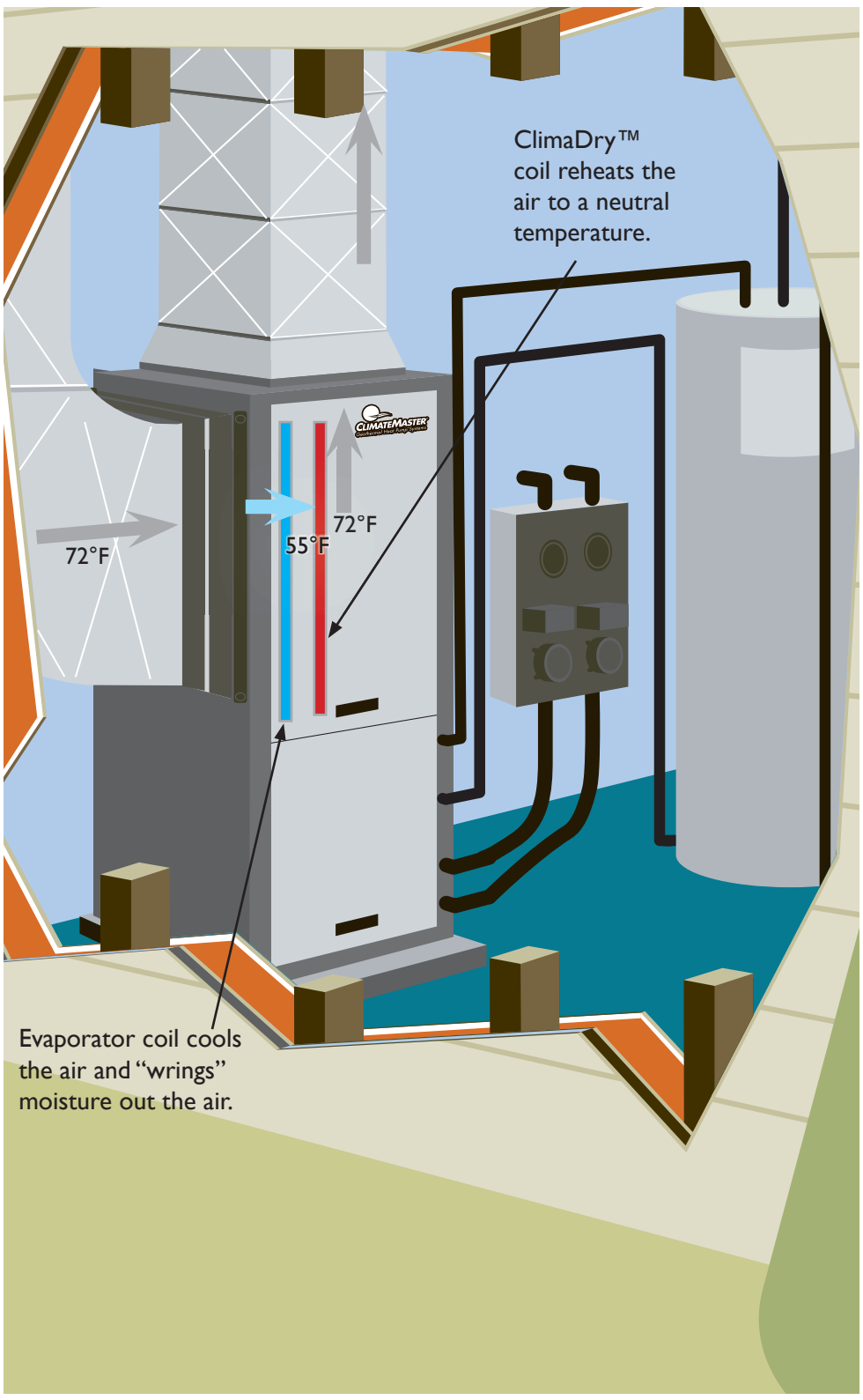


Figure 3: ClimateMaster ATP32U04 Thermostat

The ClimateMaster ATP32U04 thermostat is designed to work with ClimaDry™, avoiding the clutter of an additional dehumidification control on your wall.