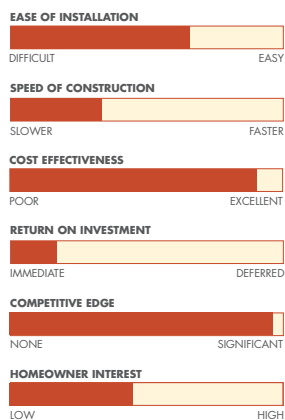


In the Loop: Rising Fuel Costs Power Geothermal Heat Pumps

Contractor's Experience



Challenges: Limitations in retrofits with old or small ducts; terrain conditions

Would he do it again? Yes

Geothermal Heat Pump Attributes:

 Energy Efficiency

Contractor Tips: "In retrofits, use a two-speed system to match the GHP to the airflow capacity of the duct system."

Contractor:

Dan Green
Water Source Heating & Cooling
Eau Claire, Wisconsin

The Technology:

Geothermal Heat Pumps

The Project:

A 3,000-plus-square-foot ranch house, with 1,800 square feet of finished space, was converted from an oil-based heating and cooling system to a geothermal system.

"Most of our work comes through word-of-mouth referrals, especially once customers start seeing the big savings in their energy bills."

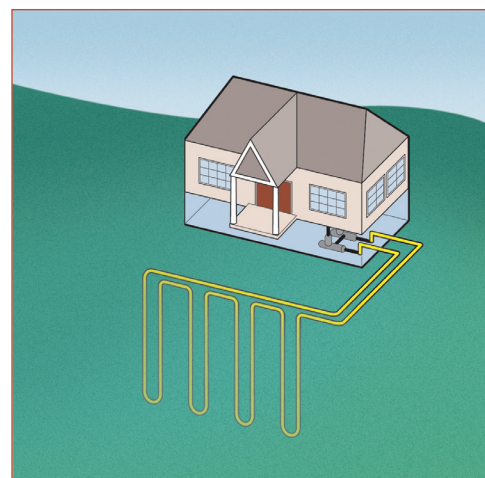
— Dan Green

GREEN'S STORY

"We were asked to install a GHP system in a house in Alma Center, Wisconsin, where the homeowner had been using around 1,500 gallons a year of fuel oil for heating," says Green. "At current market prices, that puts the HVAC operating costs at about \$3,700 a year. That's pretty expensive for anyone, especially an older woman on a fixed income. We had installed a geothermal heat pump in her daughter's home a couple years ago. Because of the savings, she wanted us to look at installing GHP in her mother's house."

"Most of our work comes through word-of-mouth and referrals, especially once customers start seeing big savings in their energy bills. Word spreads fast when that happens."

"We have been working with certain builders who have been putting geothermal in homes for years. After they started seeing how happy their customers ended up, they



If there is enough room on the property, Green prefers to install a geothermal heat pump using horizontal ground loops, which are more economical than vertical. Graphic courtesy of the Geothermal Heat Pump Consortium.

now offer it in all their homes. Plus, it really allows the builders to set themselves apart from their competitors."

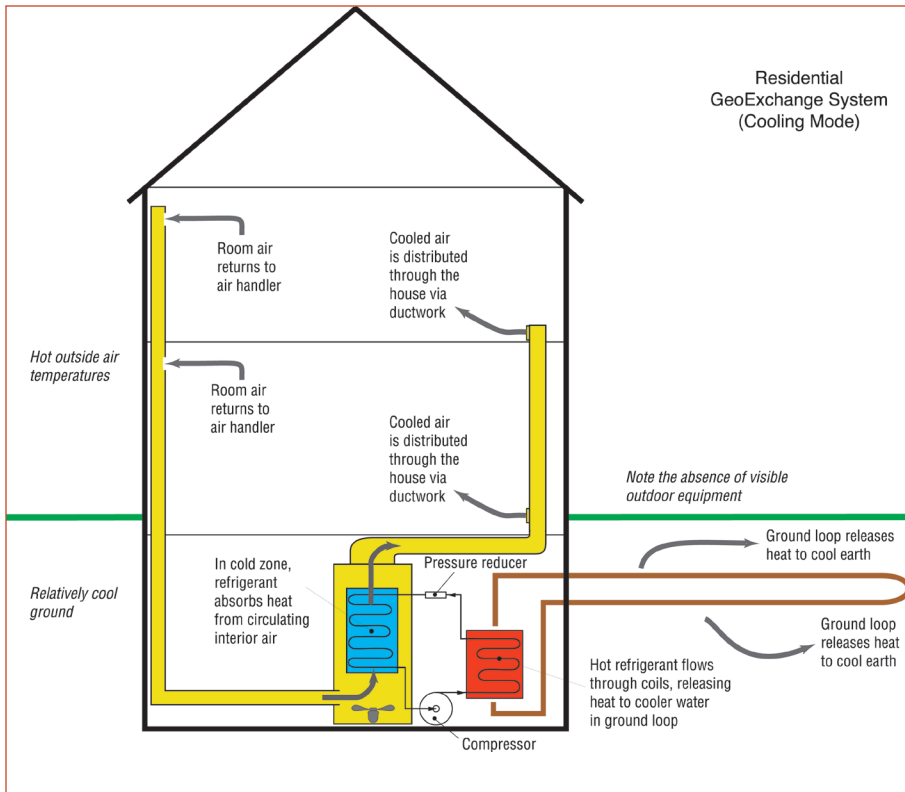
COSTS

"In the previous winter, the mother had paid about \$2.50 a gallon for fuel oil. She's now saving over \$3,000 a year, which means the entire system can be paid for with less than five years of energy savings. The net operating cost of the geothermal heat pump is about six to eight times cheaper than a conventional HVAC, which is about \$500 per year. The client now only burns about 50 gallons a year in oil as a backup system during extreme temperatures."

Dan Green, owner of Water Source Heating and Cooling, has been in the heating, ventilation, and cooling business since 1983. Geothermal heat pumps (GHPs) make up 90 percent of his business, with 60 to 80 GHP installations a year.

Why he uses GHPs:

With high temperatures in the summer and near-zero in the winter, the Midwest is an ideal market for GHPs. Green started installing GHPs for clients who wanted a more efficient alternative. With the increasing cost of energy, GHP has become his primary source of business.



"The project, ground loops included, cost her about \$14,000. Right away, people always say it's too much money. But, when you explain how the system works, how much money clients save on their energy bills, and that these systems—particularly the expensive loops—last a long time, people start to come around. Geothermal loops can last hundreds of years."

"Switching from oil-based to electricity-based heating was simplified by the fact that the local electric cooperative already had her on an interruptible rate. Like most of the local co-ops, this coop had the right to interrupt the power supply for the home's electric heating, cooling, and hot water by radio signal during peak-load conditions to reduce peak demand. As compensation for this periodic inconvenience, the company cuts the price of electricity during peak periods to specific interruptible mechanicals in half."

HOW IT WORKS

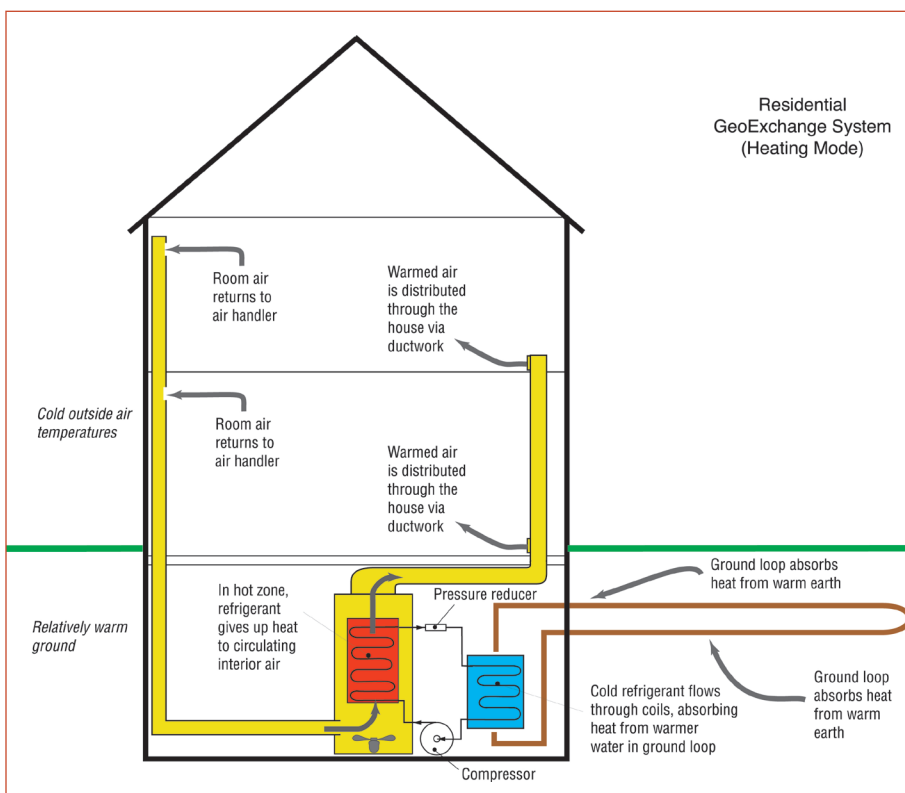
A GHP system consists of indoor heat pump equipment, a vertical or horizontal ground loop, and a flow center to connect indoor and outdoor equipment.

GHPs are appropriate for retrofit or new homes and can be used for virtually any size home in any region, provided the site has enough room to allow installation of a vertical well or horizontal ground loop.

Ground loops can be installed in a vertical boring or a horizontal trench. Vertical boring holes are usually more expensive and used where limited property is available, and there isn't enough space to run horizontal loops.

Read a PATH Field Evaluation:

- Carl Franklin Homes: The Vista at Kensington Park, Dallas, TX



Geothermal heat pumps use the natural heat storage capacity of the earth or ground water to provide energy-efficient heating and cooling. These graphics show how the system works to make the home more comfortable, regardless of the season. Graphics courtesy of the Geothermal Heat Pump Consortium.

TECHNOLOGY HIGHLIGHTS

This project included the following PATH-profiled technologies:

- Geothermal heat pumps

"With a geothermal heat pump, the client can now take 75 percent of the energy from a free renewable in the earth. Therefore, 75 percent of the homeowner's energy is free, while the other 25 percent is at this reduced rate—roughly 4-cents-per kilowatt. While it doesn't happen everywhere, this isn't an unusual program among the Wisconsin coops."

HORIZONTAL AND VERTICAL LOOPS

"If you have the space, horizontal loops are usually less expensive than vertical loops. The client was in an excellent location for horizontal loops—a low area that was just cropland. It was also adjacent to a low-lying wet area, and the pipes were laid in sand saturated with water. We dug a horizontal trench 12 feet wide, 8 feet deep, and 300 feet long. We put in 600 feet of 3/4-inch polyethylene pipe per ton for a four-ton system. We installed 2,400 feet of pipe and closed the trench back up in one day."

"The loop was almost half the total price tag, around \$5,500 to \$6,000. It's less expensive than a vertical loop and usually easier to schedule. A vertical loop is at least another couple thousand dollars, since we have to call in a driller. Drillers are very busy with the increasing demand due to high fuel costs. It seems like there are a few more companies getting into it, and I think in the next few years, demand is going to expand that market. However, if you have the right piece of property with adequate open space, you can usually do a horizontal loop and not require a driller."

"In a retrofit project such as this, you also have to be concerned with the duct system. It is almost never practical to tear out and re-duct a house. It wouldn't be economically feasible. For as long as we've been doing this in retrofits, we've come across old or small duct systems where you would like a lot of heating capacity, but you don't have a lot of airflow capacity available to install a large cooling unit."

"We then have to match our GHP system to how much airflow the duct



A homeowner in Colorado shows off his geothermal heat pump. Photo courtesy of the U.S. Department of Energy's Office of Energy Efficiency and Renewable Energy.

system can handle. We solve this problem with a two-speed system. You have the flexibility to push a little bit more heating or cooling when it's needed, even though the ducts aren't perfectly sized for the larger load. The system spends most of its time operating at a low speed that the ducts are sized for. That's the beauty of the two-speed: it's like having two units in one."

"On the cooling side, we are required to have a minimum SEER (seasonal energy efficiency ratio) of 13 in Wisconsin," Green says. "With the two-speed unit in her home, the heat pumps run at high speed around 18 SEER, while at low speed they run at about 25 SEER, which is nearly double the state requirement. With any of our geothermal units, the SEER ratings are right off the charts. This is what draws many customers to us in the first place. And with increasing fuel costs, we expect more and more interest."

The Partnership for Advancing Technology in Housing (PATH) brings together builders, manufacturers, researchers, government agencies, and other members of the housing industry. PATH partners work to improve the quality and affordability of new and existing homes. The program is administered by the U.S. Department of Housing and Urban Development's Office of Policy Development and Research.

To learn more about PATH, visit www.pathnet.org.
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