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## Frugal consumers opt to harness earth's warmth to heat (and cool) their homes

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Although the technology is more expensive up front, geothermal energy's down-the-road savings are practically unrivaled.

Depending on local geologic conditions, however, one method of harnessing geothermal energy can prove superior to the other, and that's where Barrington-based Ultra Geothermal has made its mark.

Studies have showed geothermal energy to be four to five times as efficient as standard heating oil, making it one of the most long-term cost-efficient energy solutions anywhere. Adding to this outstanding efficiency, geothermal systems may save a homeowner 60% to 70% in heating costs, and 70% to 80% in cooling costs. When federal-sponsored tax incentives and interest-free loans are added to the mix, many price- and sustainability-conscious consumers opt for a geothermal system. Geothermal heat pumps have been in use since the late 1940s, according to Energy.gov. They use the constant temperature of the earth as the exchange medium instead of the outside air temperature. This allows the system to reach fairly high efficiencies (300% to 600%) on the coldest winter nights, compared to 175% to 250% for air-source heat pumps on cool days.

There are four basic types of ground loop systems. Three of these – horizontal, vertical, and pond/lake – are closed-loop systems. The fourth type of system is the open-loop option. Which one of these is best depends on the climate, soil conditions, available land, and local installation costs at the site.

Mineral, sediment, or dirt contamination sometimes found in open-loop systems, however, are proving problematic for many homeowners in Seacoast New Hampshire, southern Maine, and northern Massachusetts, according to Melissa Aho, owner of Ultra Geothermal.

### Types of geothermal heat pump systems

Horizontal installations are generally most cost-effective for residences, particularly for new construction where sufficient land is available. A video on Ultra Geothermal's Web site shows one installation as a series of five trenches each 100 feet long, 8.5 feet wide and 6 feet deep dug, the heat transfer piping placed at the bottom of each trench.

The pipes are filled with about a 25% water-to-ethyl alcohol-water solution that will circulate in the ground and go into the home's heat pump system. In this case, a forced-air system will provide heating and cooling for the home.

But Darren Rice, Ultra's geosystem designer and field manager, notes that with a horizontal closed-loop system "you need a tremendous amount of land mass to do a system like this. ... If you don't have an application or a piece of property in which to do this, then your choice would be to go with a drilled vertical closed-loop system."

Vertical loops are used when the land area required for horizontal loops would be prohibitive or

where the soil is too shallow for trenching. For a vertical system, 6- or 8-inch holes are drilled about 20 feet apart and 150 to 500 feet deep. Into these holes two pipes are inserted that are connected at the bottom with a U-bend to form a loop. The vertical loops are connected with horizontal pipe, placed in trenches, and connected to the heat pump in the building.

The piping "picks up the heat, it is brought inside the house, taken out by the heat pump in the winter, and the reverse happens in the summer," said John Lovering, whose Gladiola Way home in Dover had an open-loop system that Ultra replaced with a vertical closed-loop system. He narrated another video on the Ultra Web site that chronicles the installation.

Lovering notes that, unlike his old open-loop system, no water is being pumped out of the earth and then being dumped back in. Ultra replaced Lovering's old geothermal system because it had contaminated his drinking water with excessive iron deposits.

"The iron level became so high that the water was undrinkable," he said. The problem got so bad that the N.H. Department of Environmental Services included Lovering's old open-loop system as one of 600 to be monitored.

After nine months of being on the closed-loop system, "the iron levels dropped down to normal and he was able to drink from his well again," Aho said.

"Ultra Geothermal's closed-loop vertical and horizontal systems are the best for the environment," Aho said. "Now, you can call a different company, and they think the open-loop system is the only way to go. By all means, an open-loop system does work; it works just fine. In fact, we have it at office with a well dedicated just to geothermal, separate from the drinking well. But in general, depending on where you live, the open-loop system does have problems, and people are trying to switch from them, which is expensive and complicated.

Of the 1,200 customers Ultra Geothermal services, 500 use other systems that often have "a lot of issues," Aho said, because "by using ground water to take in the heat extraction, in the process they not only accumulate minerals, but they also acquire dirt and sediment. Dirt can shut a heat pump down or close a compressor and cost at least \$3,000 to repair, among other problems. And customers are getting real mad when they have to pay \$4,000 to \$10,000 to fix an open-loop system."

Water in an open-loop system also can freeze and immobilize heat exchangers and compressors. Most closed-loop geothermal heat pumps circulate an antifreeze solution through its pipes, so homeowners don't have to worry about freezing their heating system's components.

Finally, contaminated open-loop well water can return to and pollute water aquifers and the ground that surrounds them.

"Geothermal systems, whether open-loop or closed-loop, are complicated, so it's no wonder that customers can get confused. I suggest potential customers ask to speak to a reference for the company seeking their business. You won't find a company that has as many references as we do."

Ultra has installed 750 systems in southern Maine, Seacoast New Hampshire and northern Massachusetts. In particular, the Bay State offers interest-free, uncollateralized loans up to \$25,000 to homeowners who install geothermal systems.

Because of that program, Massachusetts has been Ultra's primary installation area. "I wish New Hampshire would designate some funds for that because there's a real need in this state to install geothermal systems. Geothermal systems, in general, save people a lot of money, and closed-loop systems, specifically, help preserve the environment, which is something we at Ultra Geothermal care very much about."

But potential geothermal customers with homes older than 15 years should get an energy audit, Aho says, because "if your home is losing a lot of heat, you won't experience the kinds of savings you should with geothermal systems. Ultra works with Yankee Thermal Imaging to ensure that homes are insulated properly before installing a new geothermal system.

"When people do it the right way, when their homes are properly insulated and not losing exorbitant amounts of heat," Aho said, "the geothermal system performs wonderfully, and that's what we want to happen."

Ultra Geothermal and Yankee Thermal Imaging are Business Partners of the Green Alliance, a union of local sustainable businesses promoting environmentally sound business practices and a green co-op offering discounted green products and services to its members.

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