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ENERGY FOCUS

Residential Geothermal Power Reality, Not Science Fiction

By Adam Wasch

"Was I to believe him in earnest in his intention to penetrate to the centre of this massive globe? Had I been listening to the mad speculations of a lunatic, or to the scientific conclusions of a lofty genius?"

These lines are from the campy adventure novel, "Journey to the Center of the Earth" by Jules Verne. Science is cool, but science fiction is cooler. Writers apprehend the future in their fantasies, often articulating what scientists later invent. Though writing in the 19th Century, Verne appears to have anticipated modern-day air conditioning, submarines, and television.

In Verne's inner-earth journey, readers discover the massive heat and steam buried deep beneath the ground. This energy can be tapped for a variety of uses. In the case of the local Chena Hot Springs Resort, for example, hot water from the ground is used to heat rooms, keep greenhouses warm during winter, and (using turbines) even generate electricity.

Geothermal energy is renewable, non-polluting, and reliable. Alaska might be frigid much of the year, but is brimming with natural energy below. The potential downside to geothermal energy is the difficulty of tapping that energy, which can require a significant investment. Fortunately, geothermal power comes in several forms and can be affordable even for residential use.

In Fairbanks, heat pumps can be used to capture heat from the ground or even bodies of water. Heat pumps are powered by electricity to move heat from these sources to the inside of a home or building. They work similarly to the way your refrigerator does – a compressor pump moves heat from the inside of the refrigerator to the outside through the use of special heat transfer fluid, which collects and releases energy by changing phase from liquid to gas and back to liquid.

Heat pumps are very efficient because they do not have to generate heat; they only have to move heat. Furthermore, heat pumps can move more energy than they require to work, which results in very low operating costs. Roughly speaking, for every unit of energy a heat pump uses, it can deliver two to three comparable units of useable heat.

Chena Hot Springs Resort's naturally occurring hot water is estimated to circulate some 3,000 feet to 5,000 feet below the ground and reaches the surface at about 165 degrees Fahrenheit. However, in the case of residential heat pumps, the differences between above and below ground temperatures do not

have to be so great for a heat exchange to occur. Neither do residential systems have to reach such depths.

The two major types of heat pumps are vertical and horizontal systems. Horizontal systems require the installation of several hundred feet of looped piping 10 feet to 15 feet below the surface. The length of pipe is designed to maximize heat exchange over a large surface area. The relatively shallow ground used by horizontal systems may fluctuate in temperature seasonally more than ground farther below, but is generally less expensive than vertical systems because typically it is easier to install.

In a vertical system, pipes are placed in a narrow loop 150 feet to 200 feet beneath the surface, where the ground temperature remains constant year-round. Vertical systems, which are more compact than horizontal systems, are used where land is limited or obstructions exist, or where ground temperatures nearer to the surface are too cool. Because of the expense of boring holes, vertical systems tend to be more expensive to install than horizontal systems.

Heat pumps can also use bodies of water to work. Water-source systems use pipes that are laid on the bottom of a lake or pond where the water remains unfrozen during the winter. Other water-based systems use wells, if it is permitted by local code.

Something to keep in mind with heat pumps is the possibility that over time more heat could be pumped out of the ground or a body of water than is replaced, causing the heating system to fail. CCHRC is researching the use of heat pumps in Alaska, including the possibility of "recharging" ground-source systems in the summer using solar technology and other ways of storing heat seasonally.

Adam Wasch promotes energy awareness for the Cooperative Extension Service (CES) and the Cold Climate Housing Research Center (CCHRC).
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