Cost-efficient geothermal technology for building heating and cooling

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Buildings account for about 40% of the total energy use and over 70% of total electricity consumed worldwide. Further, over 50% of the energy use in a building goes towards heating and cooling purposes. It is clear that use of more energy efficient technologies for indoor space conditioning would go a tremendous way towards reducing our energy costs, reliance on foreign oil sources, and carbon footprint. Enter the Geothermal Heat Pump System (a.k.a., ground-source heat pumps, or GeoExchange), a viable, yet often overlooked, technology being used everywhere to this end.

A GeoExchange system consists of a heat pump, an air delivery system (ductwork) and a heat exchanger-a series of buried pipes (loops) or wells, depending on the type of geology, installed using a drilling rig. GeoExchange technology can be used anywhere people live, and can supply the heating and cooling needs of a building. In the winter, the heat pump removes heat from the ground via the heat exchanger and pumps it into the indoor air delivery system. In the summer, the process is reversed, and the heat pump moves heat from the indoor air and releases it back into the ground via the heat exchanger. During the summer, the heat removed from the indoor air represents a "free" source of energy for heating water.

Simply put...the Earth replaces your boiler for heating; and the cooling tower, chiller or central air system for cooling. A single mechanical system replaces the two separate systems that are part of a conventional HVAC system. GeoExchange can be suited for any type or size building, including commercial, institutional, religious facilities, and schools, and private homes. There must be open land area accessible to a drilling rig to install the loops or wells in the ground. It may not be a good fit at every site and there are many things to consider. Commercial or institutional owners should assemble a strong team of architects, engineers, and geologists, ideally experienced with GeoExchange systems (although there aren't many). Proper due diligence of subsurface conditions is also advisable.

Homeowners should research and engage an experienced mechanical contractor and driller. In some instances, it is advisable to consult with a professional geologist or engineer regarding ground conditions and sizing the well or loop field.

There is usually a higher first cost for a GeoExchange system over a conventional system, on the order of $20,000 to $30,000 for an average 2,000-3,000 s/f home regionally. However, the USEPA and Department of Energy have both concluded that a GeoExchange system is the cleanest, most energy-efficient heating and cooling system on the market, and studies have shown they have the lowest life-cycle cost of all other HVAC systems.

Payback will vary for each project, but can be as soon as 3-5 years and is typically under 10-12 years. Paybacks may be higher in urban areas with higher labor costs and where electrical costs are high. In some instances the monthly energy cost savings can be greater than the loan financing

fee for the installation. After the initial investment is paid off, the owner will reap the benefits of lower utility costs...and being off fossil fuels.

Federal legislation was passed on October 3, providing tax credits to homeowners up to $2,000 towards defraying the cost to install a ground-source heat pump system. Most states and utilities also offer rebates for a percentage of the installation cost, for both residential and commercial applications.

The best application probably right now is schools. Schools have high heating and cooling demands, usually have large land areas accessible to drill and install the loop field, and of course will be around through the payback period to recoup their initial investment. The cost savings from lower energy usage can be allocated to more important uses like teacher salaries, books, and computers.

An ideal application is to marry solar or wind for electric generation to run the geothermal system. This conceivably allows one to get off the electrical grid entirely...to become carbon neutral...that's our ultimate goal.

John Rhyner, P.G. is senior project manager for P.W. Grosser Consulting, Bohemia, N.Y.