

Modern Hydronics

News and information about the world of modern hydronics

EPA Tests Verify 400% Efficiency in Commercial Water Heating

Editor's Note: Hot Rod will return next month with a full blown feature on modern hydronics.

The U.S. Environmental Protection Agency (EPA) has released an Environmental Technology Verification (ETV) report confirming 400% efficiency of the EarthLinked® Commercial Water Heating System. The hybrid system combines a high efficiency geothermal heat pump with a standard commercial water heater tank.

The EPA's Greenhouse Gas Technology Center verified that renewable energy from the Earth reduced electric energy consumption for water heating by 75% at a Florida nursing home. The technology has been heating water since 1983, as an optional feature of EarthLinked residential space heating and cooling systems.

The water heating systems, which require little space inside a building, are ideally suited for apartment or condo complexes, motels, colleges and universities, restaurants, health care facilities, food processing operations and a variety of other commercial users.

The EarthLinked water heating system, developed by Lakeland, FL-based ECR Technologies, offers the highest efficiency of any powered water heating system.

"The technology has proven itself over twenty-three years of operation," said Hal Roberts, ECR's CEO. "What's new is the way the geothermal heat pump system is coupled to traditional commercial water heaters and works in tandem to increase efficiency, capacity and reli-

ability to meet high-volume water heating needs."

The most economic water heating application for these systems is to heat or preheat domestic water for large commercial users. The geothermal system can heat the water up to 120 F. It is then stored in, and may be "topped off" by traditional gas or electric water heaters, increasing the heat to any desired higher temperature.

"The systems do not consume energy to create heat," added Roberts. "They extract renewable energy from the earth and thereby reduce the burning of fossil fuels that release greenhouse gases to the atmosphere. They deliver up to four units of heat for each unit of electricity used to operate the heat pump. That's 400% efficiency, while the most efficient traditional water heaters do not achieve 100% efficiency."

A recent Environmental Technology Verification report by the EPA also confirmed that each EarthLinked heat pump water heating system can avoid the emission of up to 7,000 pounds of carbon per year for each ton (12,000 BTUs) of compressor capacity. That eliminates up to 42,000 pounds of carbon a year for a 6-ton unit. This was verified by a one year field test by the EPA at a nursing home in Sun City Center, Fla.

The manufacturer uses standard heat pump components and its own patented refrigerant flow controls. The system is connected to refrigeration grade tubing that is placed in direct contact with the renewable heat source in the upper 100 feet of the earth's surface. The ground temperature is stable year round, and in the United States., ranges from 42 degrees at the Canadian border to 78 degrees in the southern extreme.

Warmth in the ground is continually replenished by the heat from the sun and the earth's core. The heat in the earth evaporates the liquid refrigerant in the buried circuit. The vapor is compressed by a high efficiency scroll compressor and then gives up its heat to the water in a refrigerant-to-water heat exchanger. The optimum high temperature for the system is 120 F. The heated water is then stored in a commercial water heater tank where its temperature is maintained or increased, if desired. That redundancy increases reliability and the thermostat setting on the traditional tank determines the delivered water temperature.

Early versions of the EarthLinked system were used to heat water beginning in 1983 in the smaller quantities needed for single family residences. It was the most efficient system tested by the Florida Solar Energy Center when the electric back-up energy used by solar thermal systems was taken into account. Water heating has always been an optional feature of the EarthLinked space heating and cooling product, which is operating in 41 states and 13 countries.



The EarthLinked system pre-heats water before it enters the holding tank.

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The cost of installing the refrigerant evaporating loop in the earth is a substantial part of the system's price. The excavation cost varies with the installation method, which can use small bore drilling, directional boring, trenching or excavation to install the refrigerant lines vertically, diago-

nally or horizontally, even under a parking lot. But the cost can usually be recovered within 24 to 36 months, depending on usage and energy costs. Escalating energy costs may further reduce the payback period and increase ROI.

Because of high efficiency thermal

exchange with its heat source in the earth, only 100 feet of earth loop per ton of heat pump capacity is needed, and a three-inch diameter bore hole is optimal. This allows the system to be easily adapted to new construction or retrofit applications.

In June 2006, a newsletter published with DOE support, "In Hot Water," reported the results of a project of Public Service Company of New Hampshire where one of these systems was monitored in a condominium building. Even though the electric circuit serving the EarthLinked compressor unit also served common area lighting in the condominium, savings from 50% to 60% were documented.

"Economically, these systems make great sense for high volume hot water users," states Roberts. "And even though the installed cost of an EarthLinked system is greater than that of a traditional water heater, the monthly energy savings for a commercial application are so significant that the system quickly pays for itself."

A commercial user installing an EarthLinked system at a cost of \$17,000, using 2,000 gallons of hot water per day, with an electric rate of \$.10/kWh, an earth temperature of 65 F, using the EarthLinked system to raise the water temperature to 115 F, and the electric resistance element to raise it an additional 10 to 125 F, saves up to \$7,169 annually when compared to an electric water heater. The cost recovery period in that case is 2.5 years, which yields an ROI of 40.01 % annually.

"A payback within thirty months is an opportunity for savings that is hard to pass up. Both of our customers who hosted the testing ordered additional units when they saw the results of the monitoring programs," added Roberts.

The Greenhouse Gas Technology Center is operated by EPA and the Southern Research Institute. It conducts independent performance verification testing of energy efficiency and greenhouse gas emission reducing technologies. The full report may be found at www.epa.gov/etv/verifications/vcenter3-18.html or visit www.EarthLinked.com. ■