



Radiant Heating Report 2005

GREEN RADIANT

INNOVATIVE
CONTRACTORS
COMBINE RADIANT
WITH GREEN
TECHNOLOGIES

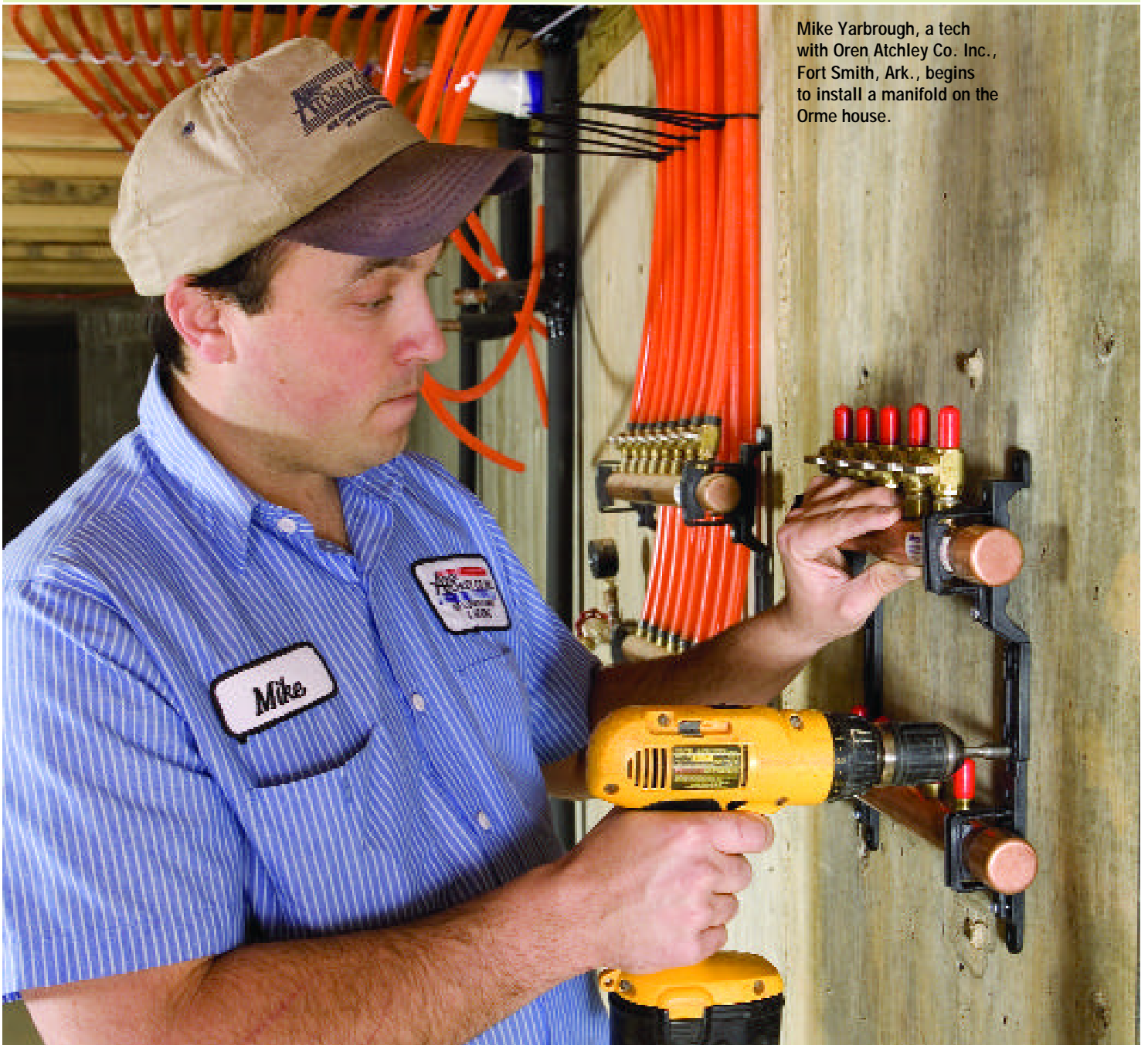
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INNOVATIVE CONTRACTORS COMBINE RADIANT WITH GREEN TECHNOLOGIES

THE HEATING POWER OF THE EARTH AND THE SUN WORK
PERFECTLY FOR RADIANT.

BY STEVE SMITH



Mike Yarbrough, a tech with Oren Atchley Co. Inc., Fort Smith, Ark., begins to install a manifold on the Orme house.

Lead-edge contractors are harnessing the warmth of the sun, or abundant thermal energy stored below the ground. Here's how a few do it.

Oren Atchley Co. is one of the leading plumbing and mechanical firms of Fort Smith, Ark., and a runner-up in last year's Radiant Panel Association System Showcase Awards. In 2004, the company began work on a substantial residential project that links, as its primary heat source, six

direct-exchange geothermal heat pumps, with an extensive, eight-zone, continuous-circulation radiant heat system with all the bells and whistles.

"As experts, we owe it to our customers to offer the best, most efficient technology available," says **Tom Atchley**, one of the firm's owners. "We also see it as stewardship of the earth's resources. And when a system can deliver 400 percent to 450 percent operational efficiency, we owe it a close look."

The Atchleys have recently learned to rely on direct-exchanger geothermal

systems, a more efficient and less property-invasive alternative to the traditional water-sourced heat pump system.

Direct-Exchange Geothermal: The type of system the Atchleys chose for the Orme home is offered by two firms, ECR Technologies Inc., and American Geothermal DX.

The Orme home's systems used a system manufactured by Lakeland, Fla.-based ECR Technologies, to tap the earth's abundant energy in the most efficient means possible. The system harvests heat directly from the earth,

SOLAR SOLUTIONS

Another approach to delivering super high-efficiency is to harness the sun's energy. Long-time RPA member **Mike Tierney** who, with his wife, owns Aspen Solar, Aspen, Colo., and has dedicated his life's work to combining solar energy and radiant heat.

Aspen Solar is one of the West's leading "radiant green," or "renewable radiant," firms. Spurred by the Arab oil embargo in the mid-1970s, and fueled by renewable energy rebates offered by the Carter administration, Tierney began his solar installation business in 1982.

"I was quick to see the compatibility of solar with low-temp radiant, perfect for our climate here in Colorado," he says.

Since then, Aspen Solar has installed up to 300 solar/radiant heat systems. Last February, Tierney had checked on a few of his systems and found that, after just two days of sunshine, tanks were comfortably filled with 140-degree F to 150-degree F water. When combined with outdoor reset, his target delivery temperatures are 95 degrees F to 115 degrees F — easily within reach of most solar heat systems, and a good match for most radiant systems, too.

Tierney promotes the value of solar heat as a year-round solution. "Our customers are eager to have solar because they prefer to do what's best for the environment. It also helps



Radiant contractor Mike Tierney has used solar energy to power his radiant installations since 1982.

that there's such a positive financial incentive. It's not uncommon for a customer — say, for instance, with a family of four and year-round residence in a home of 2,500 sq. ft. — to save \$1,500 in annual heating costs. And, in some parts of the state, utilities offer cash incentives to go solar."

Today, Tierney teaches The Art of Solar Heat at nearby SEI (Solar Energy International) — a nonprofit organization focused on a variety of environmental issues and renewable energy for a sustainable future. One topic that truly inspires him is new technology that has enhanced heat delivery to the floor.

"You can collect all the solar energy you want, but if your delivery system isn't efficient, you're just throwing Btus away," he adds.

Tierney explains that, typically, a single day of sun provides enough heat to operate a home's radiant heat system for 24 to 48 hours. This depends chiefly on the volume of hot water storage.

There are three key steps to integrating solar energy with radiant heat, according to Tierney:

- A well-designed radiant system, optimized for lower temperatures. The lower the temperature, the more efficient the solar system will be.
- Solar heat is the primary source of heat. It's backed-up, typically, with a high-efficiency boiler, at the ready during extended periods of extreme cold or overcast skies.
- Outdoor reset is also a key ingredient, assuring that as outdoor conditions change, the system adjusts itself.



Dave Yeager, a tech with Oren Atchley Co. Inc., makes connections between the geothermal heat pumps and the radiant heat system.

which maintains a constant temperature of about 63 degrees F in central Arkansas. The earth's constant temperature provides a much more favorable source for heating and cooling.

Atchley techs have now completed 12 direct-exchange geothermal-to-radiant heat installations, all residential, nine of them with radiant, in-floor heat.

"Our customers are all very satisfied with the systems we've installed — especially when they get a reminder each month how much money they're saving on energy costs," he says. "Our very first ECR customers received an unexpected visit one day by the gas utility. They were anxious to see the gas meter, thinking the meter was malfunctioning, giving the home owners a lot of free fuel."

But, just to be safe, they tested the meter and found it to be in good order. Gas use at the home dropped overnight to a fraction of what it had been.

The custom, 8,445-sq. ft. Orme home, now in its 14th month of construction with 10 more to go, is the largest "green radiant" system Atchley has installed to date. The eight radiant zones and back-up geothermal forced-air meets the home's gross heat load of 158,268 Btu/hour. When complete, four of the ECR heat pumps will serve the radiant heat and domestic water needs, with two dedicated to dehumidification and cooling.

No Energy Crisis: Although not yet familiar to everyone, ground-source heat pumps have been installed for more than 30 years.

"Because of the almost perfect compatibility between radiant heat and geothermal technology, an energy-efficient solution can be found for almost any residential or light commercial application," says **Mike Dilling**, Hoosier Energy Associates Inc., Warsaw, Ind. "Thermal energy of sufficient temperatures can be har-

vested from the earth anywhere in the United States and Canada."

Even if a customer has a small patch of land, chances are it is their best hedge against escalating energy costs.

"Newer technology extracts it with greater ease, with little disruption to the surrounding landscape, and at such high operating efficiencies, it makes payback on the investment faster than ever before," Dilling adds.

A ground-source unit works like a conventional heat pump. The key difference between an air source heat pump and ground-source is that the ground-source unit harvests the stable and renewable heat from beneath the earth's surface.

"The equipment transfers virtually endless thermal energy from the earth into the home during the winter months and transfers excess heat from interior spaces into the earth where it's stored during the summer," Dilling says.

Dilling, who has installed all types of

continued on page 10

GREEN TECHNOLOGIES

continued from page 6

geo systems during his more than 25 years in the business, prefers direct-exchange technology because the refrigerant lines are placed in direct contact with the heat source without the need to pump water through an intermediate heat exchanger. These systems are ideal for new construction and retrofit installations with earth loops installed vertically, diagonally or horizontally.

From the variety of loop configurations available for a direct exchange system, many installers and homeowners favor the diagonal method, which disturbs the least amount of earth. For homes where ground space is limited, or especially for existing homes with mature landscaping, this configuration is ideal because all of the small-diameter drilling takes place from a shallow, 6-sq.-ft. pit, with drill holes radiating outward and down at an angle from the base of the pit.

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GREEN TECHNOLOGIES

"Most geothermal systems operate at ranges of 250 to 350 percent efficiency," Dilling says. "With the variety of options available for installation of the earth field, and the highest operational system efficiencies, up into the 400 percent range, conservatively, direct-exchange is a great choice for many homes or buildings."

While some geothermal systems rely on plastic piping to transfer water and antifreeze through a plastic loop and an intermediate heat exchanger, direct-exchange technology circulates a refrigerant through highly conductive copper earth loops that are inserted into bore-holes of 50- or 100-ft. depth, then embedded in a protective thermal grout that enables direct transfer of energy with the earth.

Direct-exchange and water-source geo systems usually run about the same installed cost. However, with direct-exchange you'd see better operating efficiencies and, possibly, something akin to "surgical insertion" of the ground loops.

The process of getting the tubing in place for a direct-exchange system is faster and far less invasive to the property, making it possible to retrofit homes with mature landscaping.

Typically, any geothermal system provides service for up to 25 to 30 years, which is twice the life expectancy of air source heat pumps. This is because the stable heat source avoids thermal stresses to the compressor, the enclosed unit is out of the weather, and no fossil fuel is burned by the system.

Low-Cost Hot Water: In addition to interior heating and cooling, many geothermal systems can provide a third function, which is to heat a home's domestic water by one of two means: through integrated full-time water preheating, or through "desuperheating" water heating.

Integrated water heating (on demand) uses the heat pump system to heat water at any time of the year. Its initial cost is higher, but it provides operating savings all year.

Because this water heating option has the full heat pump system capacity available to heat water, it can provide quicker recovery than an electric resistance water heater.

A **desuperheater** reclaims heat from the air conditioning cycle to heat water. Its initial cost is lower. Savings are realized in the cooling season by transferring waste heat to the hot water storage tank. Even in the heating mode the desuperheater can provide preheating to the water heater, reducing the work required of the electric resistance elements.

A desuperheater provides free water heating throughout the summer season, and typically reduces water heating costs from 40 percent to 60 percent, depending upon the amount of cooling required. RHR