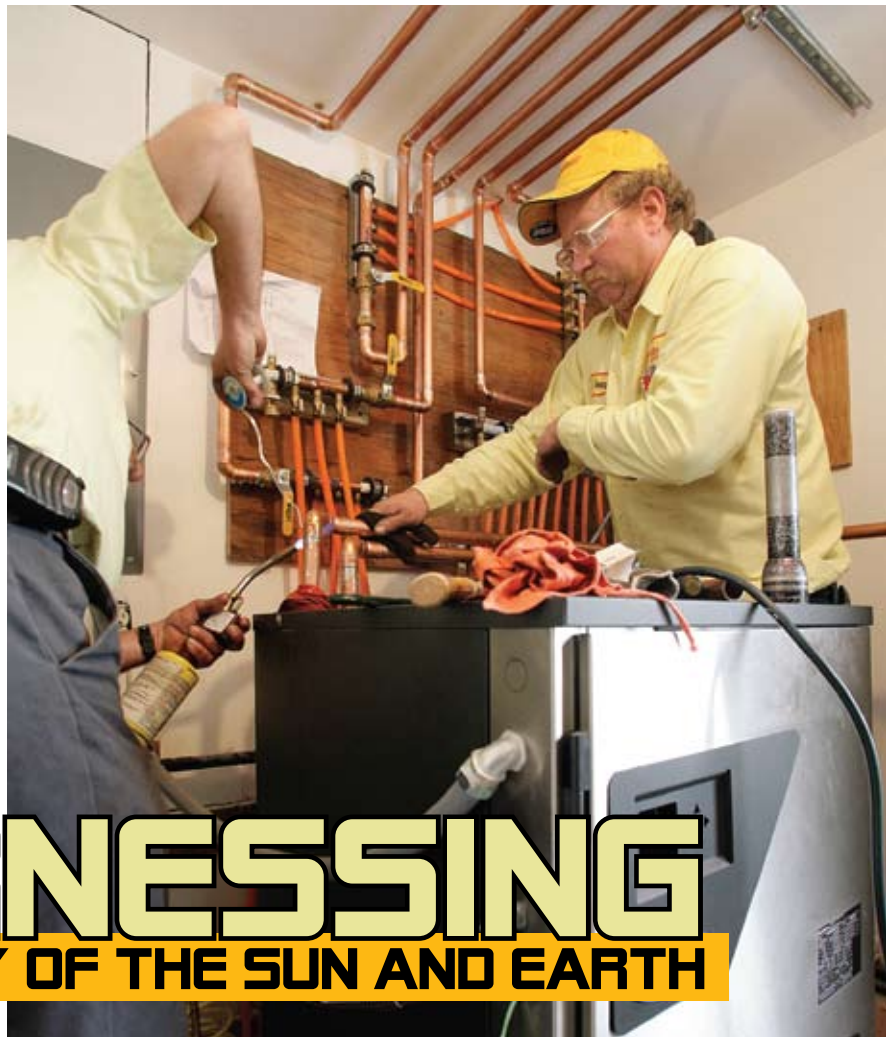


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RADIANT HEATING REPORT 2008

HARNESSING THE ENERGY OF THE SUN AND EARTH

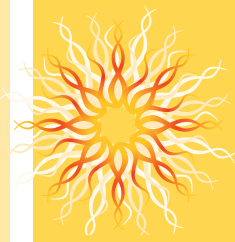
- Ferguson's Fab Shop
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BY KELLY JOHNSON
johnsonk@bnpmedia.com



The controls and components board for the solar thermal system at Humboldt State's Campus Center for Appropriate Technology, including the pump block, pumping station and thermal actuators.

RADIANT SYSTEMS that use collected energy from the sun through solar panels and from the ground through geothermal heat pumps are becoming more popular, especially with the state of today's fuel prices. The fact that a radiant heating system works well with low-temperature water makes it a good match with lower-temperature heat sources like heat pumps and solar.

Solar photos courtesy of Terrence McNally

HARNESSING THE ENERGY

Of The Sun And The Earth

SOLAR RADIANT

Solar radiant heating systems are the specialty of one California contractor. **Stephen Bohner**, owner of Alchemy Construction (www.alchemyinc.com) in Arcata, Calif., is a certified green building professional, a member of the Radiant Panel Association and a recently nominated RPA All-Star.

As solar energy concepts increase in popularity around the country, Bohner says he is glad to see more people finally getting on board with these energy-saving concepts.

Bohner states on his company's Web site that he believes every home should provide it's inhabitants with the ultimate in comfort and safety, and that his company has proven that this can be achieved through the use of techniques such as architectural concrete floors, radiant heating systems and harnessing the sun's energy.

Alchemy Construction is celebrating its 10-year anniversary in 2008, Bohner says. It is a general contracting firm with five employees, including Bohner; his wife **Amy** — project manager, secretary, treasurer and vice president; **Jeremy McCullough**, superintendent; **Art Thompson**, lead framer and concrete foreman; and **Mike Donohoe**, electrician and radiant journeyman.

"Alchemy is the sum of our parts," Bohner says. "I view the company as a band. Without good players, your music will be uninspiring."

The music Alchemy specializes in these days is composed of alternative building ideas and implementation that usually encompass radiant heating systems, solar hot water systems and green building techniques. The employees are certified by Build It Green (www.builditgreen.org) as Green Building Professionals and are also listed as Green Point Raters.

"Build It Green is a California-based green building certification/third-party group," Bohner explains. "It's kind of LEED for residential, since LEED has commercial scoring wrapped up, but they didn't really have a residential certification. They are just coming out with it this year." He adds that he and his contractors chose to go with Build It Green to have a residential LEED-type certification.

**TWO GREEN BUILDING PROPONENTS FIND UNIQUE WAYS TO INCORPORATE
SOLAR AND GEOTHERMAL ENERGY TO FUEL RADIANT HEATING SYSTEMS.**

HARNESSING THE ENERGY Of The Sun And The Earth

Gaining Popularity: Bohner says he thinks the solar radiant market has tremendous potential, especially as fuel prices continue to climb and American consumers become more interested in hedging fuel costs. Solar hot water systems also are becoming much better looking, he says, and are appealing to a wider market through mainstream magazines and TV shows.

“As a general contractor who works closely with some great architects in our area, I’m excited to see more pleasing roof lines with solar hot water systems,” he says.

Arcata, according to Bohner, is a “pretty liberal area.” He has been told that Arcata has the most per capita solar installations in California, an impressive achievement.

“We usually have clients approach us saying they are doing a green building,” he says. “We’re general contractors, and we also advertise that not only do we do radiant heat and solar thermal, but that we do green building as well.”

Bohner says the clients will either come to him for the whole project, or perhaps just the radiant side. “Most

RADIANT HEAT FOR A DESERVING HERO

by Tom Loder Sr.



Jimmy and Pam Benoit arrive at their completed home.



The radiant flooring being installed.

One day in the spring of 2007, I got a phone call from a good friend, **Bob Huber**, proprietor of Bob Huber Plumbing and Heating Co., Blairstown, N.J. He was very excited about a project that he had become involved with. The group “Homes for Our Troops” (www.homesforourtroops.org), a nonprofit organization that builds homes for soldiers injured in the line of duty, was building a house in Wharton, N.J., for **Jimmy Benoit**, a soldier who had served and been injured in Iraq. Benoit returned from the war without the use of his legs after coming in contact with an IED (roadside bomb).

When I heard about the venture, I, too, felt eager to become part of the mission.

Huber Plumbing committed to providing all of the plumbing labor. Then Huber and I contacted the network of fellow plumbers, wholesalers, the Thermco rep firm I work for, as well as manufacturers we had developed a relationship with over the years. I made a phone call to a friend at Watts Radiant, **Rich McNally**, Thermco’s district sales manager. He consulted **Mike**

Chiles, president of Watts Radiant, about taking part in the building project. The company quickly agreed to provide all of the radiant materials for the house.

I worked with Huber, along with his crew and members of the Lakeland (N.J.) Master Plumbers Association, to complete the rough-in on the plumbing fixtures and radiant heat. Then in mid-December, the crew completed the radiant installation, which included Watts Radiant’s ONIX tubing, stainless-steel manifolds with flow controls, and Hydronex control panels, providing seven full zones of comfortable radiant heating for Benoit and his wife, **Pam**.

Watts Radiant has expressed a firm commitment to assisting with future projects for Homes for Our Troops, and all of us involved with this worthy organization hope to elicit the support of many more contractors, wholesalers, rep firms and manufacturers.

About the author: Tom Loder Sr. is inside technical sales rep for Thermco, a manufacturers rep based in Clifton, N.J.

HARNESSING THE ENERGY Of The Sun And The Earth



Stephen Bohner of Alchemy Construction with the newly installed solar water heater, which provides hot water storage and boiler back-up to CCAT's solar thermal space-heating and domestic hot water systems.

people in our area are already well-informed on the benefits of radiant heating and solar thermal, and they have made a commitment to go with radiant," he says. "If they have to make a sacrifice, maybe they're not doing the granite countertops, but they know they want radiant heat."

However, it's not always easy to be a proponent of radiant, he notes. "Sometimes it's a hard sell, especially if I have people that are comparing us to forced air," he says. "But then I just tell them what the differences are: indoor air quality benefits, comfort, the quietness, the efficiency. Usually people jump aboard."

Solar Tax Credits: Bohner says he is all for the solar tax credits being available on a long-term basis. However, he sees a bit of a gap between the credits for solar electric versus solar thermal. He'd like to see the same amount of credit being offered for solar thermal as for solar electric in California and the rest of the nation.

In California, he explains, the system's credit is based on the kilowatts it can produce, and the system's efficiency has to be proven. But a solar thermal system can be rated on kilowatts also, he says, so a higher rebate for solar electric still pushes the solar electric industry. "I feel solar hot water should be much more bang for your buck, so not only would I like to see the rebates not go away, but I'd like to see them increase," Bohner says.

As for Bohner's own special interests in solar and green technologies, he has been following the development of some unique concepts.

"I like the idea of building integrated solar hot water systems," he says. "Solar hot water's big brother, solar electric, has really taken a good lead on this." He says the company is just getting up to speed on a solar thermal product by Velux (www.veluxusa.com) that mounts to the roof deck and flashes with the company's flashing systems for Velux skylights.

"When the installation is finished, if you are looking from the street, it would be hard to tell that the solar panel was actually not a skylight," Bohner says. "Some of our clients are interested in what the roof looks like, not just necessarily about having solar, but the aesthetics also."

Bohner mentioned other areas in which he has been excited to see increased development for radiant heat, such as systems that incorporate preheated solar thermal and ground source thermal storage. He also has been following the move toward district heating, where one boiler and one large solar thermal system would feed a group of different houses from a central location. "It's something that interests me and that I've been reading about," he says.

Currently, Alchemy Construction is working on a project involving a 105-year-old schoolhouse. "We're adding radiant heat, with kind of a new application. We're using Warmboard structural subfloor on the walls, and we've been working with Warmboard to figure out the pitfalls," he says.

The existing structure wasn't capable of having any flooring height added, he says, so they decided to try using radiant panels on the walls. "We have a combination of thin-slab on the ground structure, the second structure is what I call 'warm walls' from Warmboard, and then radiators in certain rooms, and we do have a little bit of staple-down and some lightweight concrete in one room."

Another "alternative use" project Bohner and Alchemy were recently working on involved the installation of a Viessmann cast-iron boiler that is running off waste vegetable oil for a local bio-diesel producer, Footprint Recycling. The company goes around to all of the restaurants and collects grease, Bohner says, and they heat the grease to fuel the process they use to produce bio-diesel.

"One of their large costs was they needed process heating to heat that grease up, and they had pretty high fuel bills with either propane or No. 2 fuel," he says. "We got them off fossil fuels and they are using the waste vegetable oil that can't be used to produce bio-diesel to produce the heat needed to produce bio-diesel."

In Action: Recently Bohner says he and Alchemy completed a job that was close to his heart for Humboldt State University's Campus Center for Appropriate Technology, also in Arcata. When CCAT decided to remodel its live-in demonstration home and educational center for technology and resource conservation, Bohner and Alchemy Construction were consulted for the solar radiant design and installation.

"I graduated from Humboldt State University, so as an alumnus, I felt pretty good about being able to bring something back to CCAT, which is a good organization," Bohner says about the project. "We donated all the labor, so it was just nice to give something back to HSU."

The project involved a one-story home, called the Buck House, likely built in the 1920s and in recent years displaced by the HSU Behavioral and Social Sciences Building. In the spirit of sustainability, the house was lifted from its site and "recycled" by moving it down the road to a new foundation that will also be used as a room for lectures and training.

HARNESSING THE ENERGY Of The Sun And The Earth

CCAT, an authority on sustainable building for more than 30 years, knew that the move provided the perfect opportunity to add new, green amenities to the home. Early on, the CCAT committee decided to use radiant under-floor heating and took the first step of having PEX tubing installed

in the newly poured basement slab. This tubing, manufactured by Uponor, would eventually carry warm water from a yet-to-be-determined heating source to warm the slab, the people and environs above.

Once the tubing was in place, CCAT called in Bohner and Alchemy

Construction to help decide how to heat not only the lecture-library room in the basement, but also the upper level, which would provide living quarters for the director of CCAT and the HSU students who live and work there.

Selecting The System: Bohner had recently learned of Heat Transfer Products's new Phoenix Solar water heater, which combines domestic hot water storage (from a solar collector panel) with a 97 percent-efficient, gas-fired backup in one unit.

Working with CCAT co-directors **Zachary Mermel** and **Beckie Menten**, Bohner finalized a design for the new heating system, built around the Phoenix Solar, which would feed both the 1,550-square-foot basement with its radiant floor heating, as well as the radiators that would heat another 1,550 square feet upstairs. In addition, the unit provides domestic hot water for the entire house.

The Phoenix Solar incorporates a dedicated, high-output solar heat exchanger at the base of the unit. Made of finned cupronickel, this exchanger can transfer up to 175,000 Btus per hour of heat energy from the solar panels to the water in its storage tank. The solar heat exchanger and the secondary gas-backup heat exchanger are encased in a corrosion-resistant tank made of 316L stainless steel.

During periods when solar power cannot meet demand, the Phoenix Solar uses the latest in modulating and condensing technology to pick up the slack. Two components are key to this secondary heat source: the load-matching burner, limiting its firing to current demand and saving energy in the process, and the corrosion-resistant combustion heat exchanger, which extracts all the latent energy from the backup combustion process, and that in turn drives the unit's ultra-thermal efficiency rating.

The old Buck House used a solar system to provide domestic hot water, so it was paramount that the new system also incorporate solar.

"If a manufacturer could not offer both solar thermal harvesting and a boiler backup in the same system, they were out of the race," Bohner says.

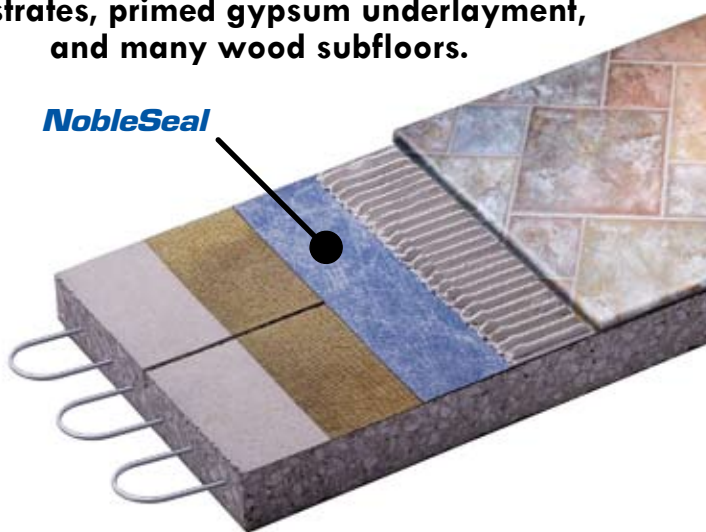
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Installation Relatively Easy: With the committee sold on the Phoenix Solar, Heat Transfer sales representative **Morgan Muir** of Hydronic Specialties Co. in Oakland, Calif., arranged for one of the first units produced to be shipped to CCAT. Installation proceeded with relative ease: When Bohner first filled the new Phoenix Solar with cold water, the tank temperature read 64 degrees F. Within only eight minutes, he says, the Phoenix stopped humming and the tank temperature read 119 degrees F.

Bohner's crew did encounter one minor glitch when the original rough-in work pitted them against a polysteel wall. "The framing crew had built a hollow concrete wall over the polysteel wall to use as a chase for utilities," Bohner says. "As a result, we were unable to fasten our controls and piping directly to the concrete wall with

concrete screws. So we hung a sheet of formaldehyde-free plywood and mounted our controls to that."

A firm believer in closed-loop systems, Bohner separated the Phoenix Solar's auxiliary heating port for the domestic hot water from the space heating system via a Taco X-Pump Block, a heat exchanger that also is an all-in-one unit.

The auxiliary ports of the Phoenix Solar feed domestic hot water to the X-Pump Block. Using its internal heat exchanger, two pumps and control logic, the X-Pump Block relies on an outdoor reset to control the amount of hot water sent to the radiant tubing loops.

Individual room zoning is accomplished at the radiant manifold via thermal actuators, also made by Uponor. "When a zone calls for heat," Bohner explains, "those actuators pop their heads and warm water flows through the corresponding PEX loops

attached to them. Again, the colder it is outside, the warmer the water delivered to the room needing heat."

Finally, Bohner chose another all-in-one unit, the Oventrop Regusol EL-130 solar pumping station, to move water from the solar collectors to the radiant loops whenever that water is hotter than the water inside the Phoenix Solar. "Pairing the Taco X-Pump Block and Oventrop EL-130 with the new Phoenix Solar was a great way for us to easily integrate a solar thermal system into the newly remodeled CCAT."

To date, the three student-residents, having never run out of hot water, are very happy with the new system. "Although I told the committee that they could expect to see a savings in their energy costs, I didn't claim they'd never run out of hot water. But I knew they wouldn't — especially with a 119-gallon tank."

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GEOTHERMAL RADIANT

CBS News refers to **Chad Pregracke** as The River's Garbage Man. When volunteers, corporate sponsors and media follow in his footsteps, they track him through miles of Mississippi River mud slicks.

Pregracke's been cleaning the great Mississippi for most of his life, a mission now aided by a team of devoted employees and volunteers for an effort that now has a name: Living Lands & Waters.

The East Moline, Ill.-based not-for-profit environmental organization has won the hearts of Americans. Fortunately, the national media has helped make it happen. *National Geographic*, *Time*, the Smithsonian and most of the nation's TV networks have all recognized the uniqueness of its now-expanded mission: chiefly, to aid in the protection, preservation and restoration of the natural environment of the nation's major rivers and watersheds.

Pregracke spent his younger years filled with experiences on the Mississippi. But it was in 1997, at the age of 22, that he kick-started his "cleaning-up-the-river" crusade, quickly winning the hearts of millions through media coverage of his stubborn insistence that one person really can make a difference. And he's proven it's so, though today he's joined by an equally devoted team of 10 employees and armies of volunteers, eager to help wherever they toss their anchor.

Corporate sponsorships sustain their work, though there's never enough because, as far as the eye can see, there are mountains of filth and debris to attend to. In the 10 years since Pregracke formed Living Lands & Waters, the organization and its thousands of dedicated volunteers have collected more than 1,500 tons of garbage from the Mississippi, Ohio, Missouri, Potomac and Illinois rivers, among others.

While attending high school and college, Pregracke worked as a commercial shell diver, a commercial fisherman and a barge hand during the summers. He quickly saw that river conditions were getting worse due to the accumulation of trash.

All The Comforts: The rigors of working on the river can take their toll on employees and volunteers alike, especially when it's cold and wet outside. So it's no surprise that, when Pregracke was compiling his dream-sheet for a new building last year, with office, storage and workshop spaces, energy efficiency and comfort were on the list. Too often, the two are mutually exclusive.

"But not when you can combine radiant heat, which we thought would be wonderful to have for the office spaces, and *necessary* for the shop ... with the greenest of energy sources for the heat: geothermal," Pregracke says.

Gabrilson Indoor Climate Solutions, based in Davenport, Iowa, provided the skills and equipment to fulfill Pregracke's dream. According to Gabrielson Vice President **Gary Stuckel**, it took several days for **Dave Pollitz**, senior service technician, and **Denny Heffe**, residential installer, to connect an extensive radiant heat system to the first-ever commercial installation of Carrier's water-to-water geothermal heat



Gabrilson's Dave Pollitz (left), senior service technician, is soldering the supply line to the Carrier geothermal system; he is assisted by Denny Hesse, senior installation mechanic.

pump — the manufacturer's new, high-temperature, four-ton geothermal unit designed specifically for duty with radiant heat and snowmelt systems. The heat pump is dedicated to heat only and produces an outgoing water temperature of up to 145 degrees F.

"The heat pump's outgoing temperature is remarkable," Pollitz adds. "Typically, ground-source heat pumps produce temperatures of 115 to 120 degrees. When we made the final connections for Chad's facility, the temperature and system performance were right on track and, once the slab was brought up to temperature, the building was perfectly warm inside."

The building rests atop a 40-foot x 60-foot insulated concrete slab. Twenty-eight hundred lineal feet of Watts Radiant's RadiantPEX tubing was installed prior to the slab's concrete pour. Another 1,200 lineal feet of Watts Radiant's Onix EPDM tubing was stapled up to heat portions of the building's second floor.

"When we made the connections between the heat pump and its three 300-foot long geexchange loops, each submerged in its own bore hole, and the radiant heat system, most of the zoning, pumping strategy and system controls were already done," says Pollitz. "A small, self-contained HydroControl panel by Watts Radiant reduced our site work to plug-and-play. Hot water came in on one side from the heat pump, went into the panel, and from there the building's three radiant zones and two temperatures were handled entirely by the panel."

Because the unit was a new design, Carrier's geothermal engineering team monitored its performance for six months with the help of a PC that was set up at the jobsite. The

HARNESSING THE ENERGY Of The Sun And The Earth



Left photo: Chad Pregracke (middle) takes a moment at the project's completion with Gabrilson's Dave Pollitz (left) and Denny Hesse (right). Right photo: Installation of the PEX tubing under the mezzanine area included extruded aluminum plates for optimal heat transfer.

heat pump's control panel was set aside. In its place, sensors fed data to the PC, which steadily communicated real-time information about system performance and efficiency.

"One day last winter, the monitoring personnel was

surprised to notice a substantial change in the energy required to maintain building temperature," says **Kent Kuffner**, a product manager for Carrier's geothermal and IAQ equipment. "They were mystified. So they called Living Lands & Waters to ask about it. How could the energy use have jumped so dramatically?"

Initially, the LL&W staff couldn't find an answer. But eventually they narrowed it down to the partially opened garage door. One of the office staff had opened the door about 2 feet to allow the office mascot — Jib, a 130-pound, dutifully house-trained yellow lab — to come and go. Jib has since learned to scratch at the door when he wants outside.

"The spike in energy use was an odd, but effective way to learn, in real time, that something had changed substantially at the test site," Kuffner adds. "It was a testament to the effectiveness and accuracy of the on-site test equipment, feeding detailed information to us remotely."

All In A Day's Work: Living Lands & Waters hosts community river cleanups each year with the assistance of local volunteers of all ages. Most community cleanups last for about four hours. Volunteers load into the workboats piloted by an LL&W crew and head out to predesignated garbage sites along the shorelines and islands of the river. Then the search for garbage is on.

With trash bags and shovels in hand, volunteers scour the area in search of plastic bottles, barrels, tires, appliances and whatever else doesn't belong there. They drag, carry and haul the garbage to a central point along the shoreline. When the site is clean (and every volunteer is suitably filthy), everyone loads back into the boats and heads back to the meeting site to enjoy snacks and beverages.

Surprisingly, Pregracke doesn't consider himself an environmentalist. "I may be a conservationist, if anything," he says. "I don't like the label of environmentalist because it makes me seem different; I'm just a regular guy. What I really hope for is for people to remember that anyone — anyone — can make a difference."

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