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RADIANT FLOOR HEATING FROM SOLAR THERMAL IN MODULAR BUILT HOME

ENEREF INSTITUTE EXAMINES A COLORADO HOMEOWNER'S THOROUGHLY GREEN MODULAR HOME WITH SOLAR THERMAL RADIANT FLOORING

How do you build a home on a plot of land nestled in one of Colorado's most picturesque landscapes with 14,000 ft. mountain peak views? Naturally you build the most earth-friendly home you can.

While researching for a sustainable home to fit his scenic Colorado setting, Dr. Kettering, a well-known Colorado veterinarian, discovered a design for a modular-built, energy-efficient two-story, 3,600 sq. ft. house. Dr. Kettering had two primary criteria; that the home was

DURING THE WARMER SUNNY DAYS, I HAVE BEEN ABLE TO KEEP THE BOILER TURNED OFF 24 HOURS.

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“some form of sustainable building from sustainable materials” and secondly, he said, “we wanted radiant flooring, no matter what the cost.”

The home is inherently green, from the materials to the modularly constructed process.

“When manufactured responsibly, the construction process itself of a modular-built home is inherently earth-friendly because of efficiencies engineered into the factory process” explains Seth Warren Rose, founding director of Eneref Institute (www.eneref.org), a sustainable development research and advocacy organization.

In fact Dr. Kettering’s modular home is a demonstration in Earth stewardship. The home was built to take advantage of its southern exposure. The paint is low VOC. The siding is made from fast-growing sustainable wood. The deck is from recycled plastic; the

countertops from recycled glass with binding resin from corn oil; and the carpeting is from recycled post-consumer plastic water bottles.

SOLAR THERMAL RADIANT FLOOR

In Colorado, attacking heating costs was an obvious first step in energy savings. Dr. Kettering chose to install a solar thermal system to cover much of their domestic hot water needs. However, Kettering chose to go even further and use the same solar thermal system to heat a radiant floor.

“Radiant floor heating is becoming one of our fastest growing markets” declares Rex Gillespie, Caleffi’s marketing director. Caleffi is the nation’s leading supplier of hydronic components to the HVAC industry.

While radiant floors are growing increasingly popular, the choice of solar thermal as the source of

energy to heat them is less common. As with many solar thermal systems, the solar energy preheats the water, and additional heating can come from traditional sources, such as electricity or natural gas. However, radiant floors don’t require especially hot water.

Dr. Kettering was also in good hands with Infloor and its owner, Michael Willburn. Infloor was one of the first companies in Colorado to carry radiant flooring systems. Because of the quality of the home, Willburn chose top-of-the-line equipment with established reputations.

For example, for the crucial hydronic components that are at the heart of any radiant flooring system, Willburn chose Caleffi’s easy-to-install Z-One™ universal motorized zone valve, which has become an industry standard because of its compact design, economical operation and high-torque close-off pressure.

“I personally believe Caleffi is one of the best made products on the market today,” said Willburn, noting that he has had almost no failure rate with any Caleffi components.

HOW IT WORKS

While many solar collector panels use propylene glycol as the fluid that runs from the panels to the tanks to carry heat, this system

SUSTAINABLE MODULAR HOME

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contained 50% biodegradable corn glycol. Corn glycol is non-toxic and transfers heat better than propylene glycol.

The system's innovative dual-function implementation demanded an innovative design. The original plan specified a single 500-gallon tank to store the home's hot water. However Willburn was concerned the four collectors wouldn't offer the large tank enough energy to guarantee a constant supply of domestic hot water. Instead, Willburn decided to use two separate 164-gallon capacity multi-energy tanks — one primarily for the domestic hot water and the second

for the radiant floor heat.

The solar thermal panels were configured to first heat the domestic hot water tank to at least 130° and then the radiant floor tank. When the first tank is satisfied, the second tank heats the radiant floor pipes. That way the shower and sinks are always hot. And the plan called for enough hot water collected during the day to carry through to the following morning's sunrise.

The system employs evacuated solar tubes for the domestic hot water and radiant floor heat, backed up by an electric boiler. Two Triangle Tube/ACV-SmartLine

600 multi-energy tanks are at the heart of the system, holding 60 gallons of domestic hot water per tank, 100 gallons of boiler heating water per tank, and 4 gallons in each solar coil per tank, totaling 328 gallons of storage capacity. Approximately 2,900 feet of tubing was installed to heat the 2,595 sq ft of Infloor radiant floor on the main floor level. And 5 oversized panel radiators, sized to run at the same temperature as the radiant floor, for heating the upper level 888 sq ft.

A DisCal™ high-performance micro-bubble air separator, also from Caleffi, was specified

COLORADO SPENDS \$14 BILLION A YEAR ON ENERGY. \$2 BILLION OF WHICH ON FOSSIL FUEL FOR HEATING.

Space heating offers Colorado an opportunity to lead since indoor air heating is the largest energy load for Colorado buildings. In residential spaces, when hot water and indoor space heating are combined, heating accounts for three fourths of the energy consumption.

because it resists corrosion from oxidation and acid. And a Mix-Cal™ thermostatic mixing valve was specified because the unique design prevents scaling on internal sliding parts and compensates for temperature and pressure fluctuations. SolarFlex™ flexible stainless steel pre-insulated piping reduced installation time. TwisTop™ thermo-electric actuators are used to precisely control the temperature of the radiant floor zones in response to room thermostat settings. Tiles were laid on top of the radiant floor because of tile's low insulation value, or R-value. Under the floor was a fully insulated crawl space.

HOT ENOUGH FOR YOU?

For much of the year, there is enough solar energy beaming down on the roof to heat all of the home's hot water as well as the radiant floor. But even during the coldest days of winter — sometimes as cold as 30°F below zero — the home still uses far less fossil fuel than it would otherwise.

Both Dr. Kettering and the project's designers call the solar thermal radiant floor a great success.

“During the warmer sunny days, I have been able to keep the boiler turned off 24 hours” says Kettering. “The heat from the solar collectors maintains a good house temperature and provides adequate hot water.”

Research and reporting compiled and provided by Eneref Institute. (www.eneref.org)