

High-Performance Residential

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Most Wet Heads we profile talk about the energy efficiency of radiant heat. **John Palecek**, energy/technical consultant, Smart Solutions Inc., Kamiah, Idaho, can talk about that, but he's more inclined to bring up concrete form walls or insulated tongue-and-groove flooring systems or even a ventilation system that features a hydrocarbon ionomeric membrane.

While Palecek's knowledge of construction materials had us glad Google was invented, his message is concise: "We evaluate the entire building envelope to integrate building and mechanical systems to form a complete system, one that focuses on the owners' needs using healthy, energy-efficient products."

Healthy? Energy-efficient? Sounds like green building to us.

"Our customers do consider the products we use as 'green,'" Palecek says. "I prefer, however, to call them 'high performance.' Incorporating these types of products into a design can mean dramatic, overall improvements to improvement. When owners can factor in product performance and life cycle costs, the smart decisions become obvious."

Whatever your choice of words, he adds that most of these building products definitely aren't called "traditional" with standard installation techniques.

Palecek has made it his business to find out how green-building techniques can benefit the homeowner and the environment.

“One thing we know for certain is that people want solutions, and no one system is the perfect fit for every building,” he says.

Smart Solutions, in fact, has started turning over the installation work in the field to a select group of independent contractors so the company can focus on the latest building products and design work.

“We would be best described as distributors who provide on-site technical support and specialize in design with the high performance products we offer.”

A former member of the U.S. armed forces, Palecek says: “We’re looking for a few good men - actually as many as we can find to fill the growing need to install such products. Contractors offering such high performance systems can set themselves apart, grow their businesses, and provide much healthier and more energy-efficient homes.”

His philosophy and handiwork are on display at a 7,400-square-foot home built in Lewiston, Idaho. Palecek’s client, Rebecca Armstrong and her family, including her parents, certainly had rising energy prices in mind for the new home. But with a family member suffering from serious health problems due to prolonged metal and chemical exposure, as well as common allergies a concern for others, the extended Armstrong clan wanted a home that minimized toxins and pollutants as much as possible, including those that could arise from any materials used to build the new home.

As a result, they specifically wanted a home with no (or minimal) metal piping for plumbing, no fiberglass insulation and a minimum amount of glued wood products on account of formaldehyde fumes.

Energy Envelope

An ICF wall system provides an energy-efficient envelope for the home.

While most *PM* readers set out to install energy-efficient heating and hot water systems, Palecek sets out to “install” energy-efficient homes.

“More and more contractors in North America are realizing the benefits of a high-quality building envelope,” he adds. “More often than not, even with all your professional knowledge and training as well as building codes, not looking at an entire building as a whole is the downfall to overall efficiency in most buildings.”

While warm water flows through 11,300 lineal feet of PEX tubing in the Armstrong home, the floor, walls and ceilings are where his work starts. Since 1993, Smart Solutions has distributed an insulated concrete form (ICF) wall/foundation system made by Arxx.

An ICF wall is like a sandwich, with expanded polystyrene (EPS) foam surrounding a poured concrete core. Drywall can be added on the inside and most any exterior can be added on the outside.

Palecek says the continuous layer of foam insulation means less air infiltration and fewer drafts than conventional framed homes. The solid concrete core also stabilizes indoor temperature thanks to its natural thermal mass.

“With ICFs, like radiant heat, the end result is a value-added product typically providing a minimum of 50 percent energy savings,” Palecek says. “One reason for offering high performance products is that they make economic sense. All the added costs associated with the product will pay for themselves.”

Additional EPS foam insulates the ceiling and floor. Another interesting ICF/EPS foam building product lies underneath the radiant PEX. Insul-Deck, made by a company of the same name, is another stay-in-place forming system for concrete floors. One of the characteristics of this product is its tongue-and-groove connection that helps ensure continuous insulation.

The product comes complete with pre-formed chases for plumbing, wiring and other utilities. The space came in handy since two 1-inch PEX lines ran through the chases from the mechanical room to a shower/tub on the opposite side of the home to meet the desired flow rate of 20 gallons per minute.

There's plenty more to Palecek's craftsmanship, but another item is particularly noteworthy regarding the PEX for plumbing and radiant. Palecek spec'd 1,500 lineal feet of Uponor's AquaPEX to plumb the home, but also used it for the radiant heating and cooling system. PEX with an oxygen-diffusion barrier would be the expected choice. However, Smart Solutions spec'd only nonferrous heating components - namely brass and stainless steel - so the barrier protection was not needed.

Rather than running the radiant heating system off a boiler, Palecek chose a single 5-ton geothermal heat pump. The Econar unit with a desuperheater and five 800-foot reverse-return horizontal ground loops were used for 100 percent of the radiant heating and cooling, as well as domestic hot water. And a customized control system, created by Smart Solutions, eliminated the need for multiple heat pumps.

A custom heat and energy recovery displacement ventilation system supplies fresh air from vents located low on the walls and near the floor. At the same time, vents located high on walls near the ceiling remove stale air from the room. The system eliminates drafts, controls humidity, maintains consistent temperatures and minimizes dust. It also has the ability to exchange the air completely, while efficiently recovering the energy from that air - and the moisture within it - year-round.

Upon completion in the fall of 2005, the two-story, 23-room Armstrong home was estimated to be at least 75 percent more energy efficient than homes built to the Model Energy Code benchmark, published by the International Code Council.

As a result of Smart Solutions' efforts, the home earned the grand prize in the first annual Uponor Dream Home Competition given last year at the company's Home Comfort Team meeting.

To prepare his entry to the contest, Palecek got the Armstrong family to report on their energy costs for the winter of 2005-2006. The average daily cost: \$4.23, including heating, domestic hot water and ventilation. Palecek figures a similar sized wood-framed home with forced air would have a heating bill three to five times that amount.

SIDEBAR: Energy-Efficient Building Techniques

In addition to radiant floors, Smart Solutions maximized energy efficiency by using some of the following in the Armstrong home's construction:

- An expanded polystyrene insulated concrete form wall provides an airtight envelope and a minimum 50 percent savings in energy. In addition, EPS was used to insulate the floors and ceilings, providing an airtight box.
- To further tighten the envelope, Smart Solutions recommended windows with insulated frames and a nonmetallic foam glass spacer.
- A custom heat and energy recovery displacement ventilation system supplies fresh air from vents located low on the walls and near the floor. At the same time, vents located high on walls near the ceiling remove stale air from the room. The system eliminates drafts, controls humidity, maintains consistent temperatures and minimizes dust. It also has the ability to exchange the air completely, while efficiently recovering the energy from that air - and the moisture within it - year-round.
- Rather than running the radiant heating system off a boiler, Palecek chose a 5-ton geothermal heat pump, which is three to five times more efficient. A customized control system, created by Smart Solutions, eliminated the need for multiple heat pumps. The single heat pump supplies not only 100 percent of the energy for the seven radiant heating zones, but also handles all of the home's radiant cooling and domestic hot water needs.