

SUV Green Home Powered by Sunshine

Oregon Über-Green Home Breaks all the Rules of High-Efficiency Homebuilding

When David Maul, Maul Energy Advisors in Bend, Ore., decided to build his new home, he was determined to have something unique and uniquely green. What he ended up with is a home fit for entry as a project in the Solar Decathlon.

The certified LEED Platinum house was completed in June of 2009, nearly a year after breaking ground. Combining a ground-source heat pump for cooling, heating, and domestic hot water assist, along with solar photovoltaic and domestic solar hot water technologies, the home pushes the energy-efficiency envelope beyond what is generally considered feasible for a house of its size.

"The 4,000- to 6,000-square-foot range is considered the 'SUV' of the housing market," explained Maul, "otherwise known as 'energy hogs.' I wanted to show everyone that there is such a thing as a truly green 'SUV.'" Maul's home, one of six LEED Platinum Homes in Bend, is 4,316 square feet of lush, green living space.

"I wanted the classic Pacific Northwestern feel, and my wife, Beverley, prefers an Asian design theme," said Maul. Both styles intermingle easily, inside and out. The Mauls have owned the property that supports the home for about 16 years. "From the beginning, we planned to build a sustainable and energy-efficient home," he said. "We didn't really get close to the design we settled on until shortly before construction began."

Beverley's uncle, Earl Seaman (an architect out of Tacoma, Wash.), drew up the original plan, blending the two design themes. Chad Phillips of Bend created the final plan, with additional style features. The Mauls were very closely involved with all facets of the design process, which took two years to complete.

They didn't have to look far to find a contractor to match the quality they were seeking. For this high-efficiency project, they chose SolAire Homebuilders, an award-winning firm based in Bend that specializes in building green homes; it's been the company's sole focus since 1995.

TAPPING GEOTHERMAL

"Building the Maul's home was a learning experience," said Cindi O'Neil, co-owner of SolAire Home-



COURTESY OF SOLAIRE HOMEBUILDERS

builders. "It combined everything we knew about green building, with the energy-efficient systems Maul wanted."

The geothermal system was the first one SolAire had incorporated into a residential project. Although geothermal installations are now more commonplace across the Midwest and the Eastern part of the country, some of the Western states have been slower to adopt the technology.

"We chose Mountain View Heating, in Bend, to install the geothermal system. Their work is great, and it's guaranteed," said O'Neil, "but more than anything, their service to the homeowner is outstanding. They explain every aspect of the system before it's installed, and if any questions ever arise, they go back and teach the owners how to use the system."

The home's ground-source, water-to-air geothermal system consists of five vertical, 4-inch bore holes at 200 feet deep, each fully grouted. According to O'Neil, it was the first vertical installation in central Oregon.

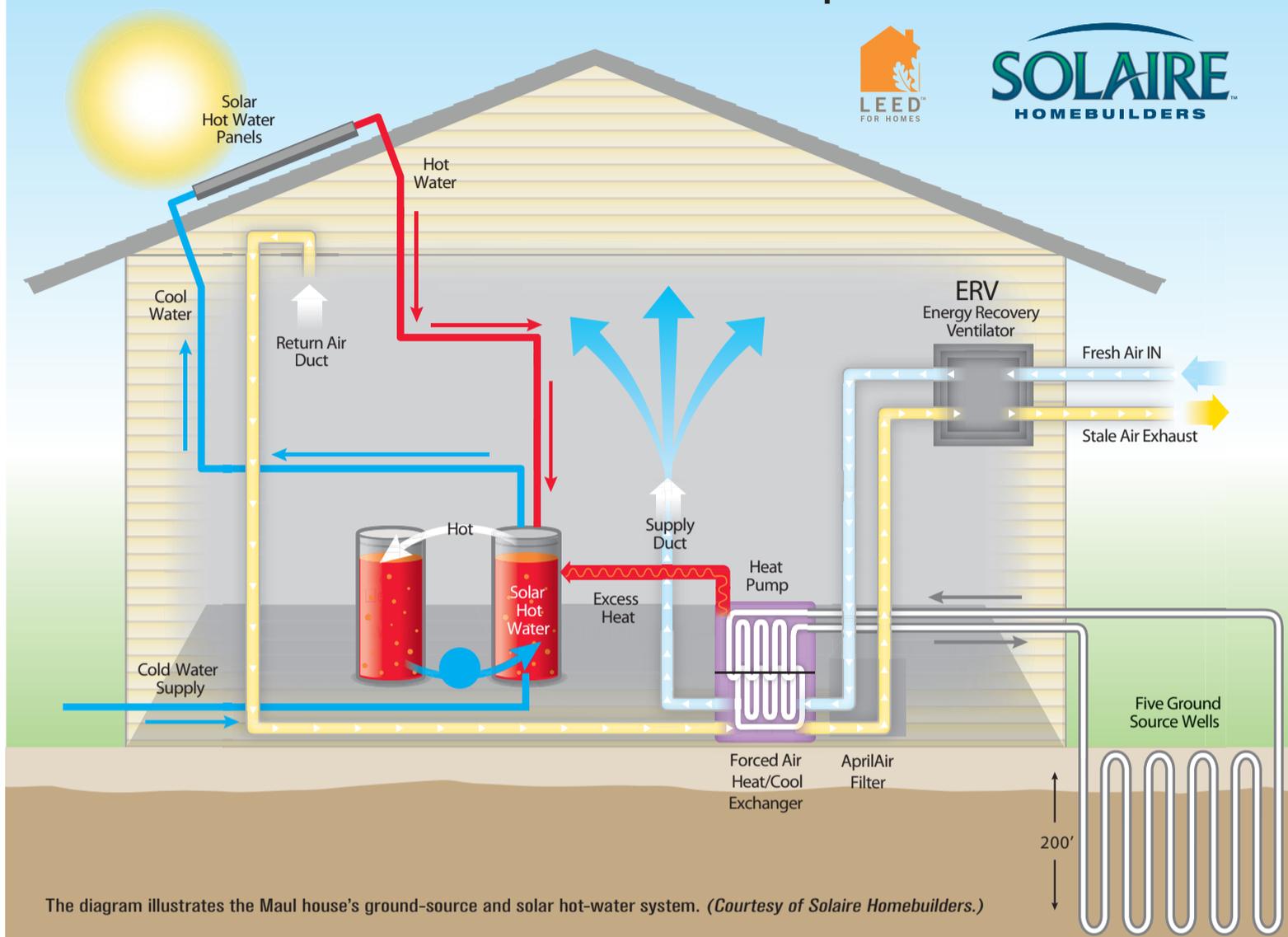
"The amount of rock in the area made drilling a real challenge at the site," said Darryl Knabe, service manager at Mountain View Heating, "but slow and



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TOP: The rear view of the Maul house. ABOVE: Mountain View technician Scott Stewart prepares to open the cabinet of one of the ClimateMaster geothermal heat pumps.

HVAC Ground Source Heat Pump & Solar Hot Water



The diagram illustrates the Maul house's ground-source and solar hot-water system. (Courtesy of Solaire Homebuilders.)

steady won the race. Everything came together without a hitch.”

An additional 100 feet of horizontal trench also serves as part of the system's geo-exchange. The six independent closed loops provide year-round thermal exchange for the 4-ton ClimateMaster Tranquility 27 system. HVAC delivery in the home is divided into six zones.

Maul's geothermal system has a two-stage scroll compressor and a variable-speed air handler. The system also incorporates a desuperheater to provide additional heat for domestic water during the summer months.

“It took us a total of eight months to install the mechanical system. We had to make sure that any and all options were open to the Mauls,” said Knabe. “They made some requests we had never heard of before.” Maul wanted the strip heat in the air handler completely disabled. Efficiency wasn't sacrificed at any cost.

THINKING SOLAR

Fortunately, the town of Bend is smack in the middle of Oregon's high desert region — a huge advantage to the Mauls because of its suitability for solar collectors. The climate provides nine months of

steady sunshine. For a solar application, the other three months are patchy yet still productive.

The Maul's solar array consists of 12 flat panels mounted on the roof. Ten of the panels are photovoltaic, providing a combined capacity of 2.25 kW to the home. The remaining two solar thermal panels account for most of the home's domestic hot water needs.

In winter the collectors still provide hot water, though not as efficiently. Hot water is stored in an insulated, 120-gallon solar storage tank installed upstream of the 80-gallon Bradford White electric water heater.

PUSHING THE ENVELOPE

To achieve high LEED status, the home needed an ultra-efficient building envelope. SolAire used an 8-inch-thick, staggered stud wall system with blown-in-blanket (BIB) insulation for all exterior walls. The staggered design removes the gaps in the insulation usually caused by wall studs, eliminating thermal bridging and the subtle wicking away of thermal energy all year long.

The walls have an R-38 insulation value. The subfloor is also BIB and ceilings are blown, and both insulated for R-values of 38

and 49, respectively.

“We spent an entire day going over the building envelope to seal every penetration and crack,” said Maul. The resulting blower door test was 3.3 air changes per hour at 50 Pascals, which is one-half the standard set by the state of Oregon. The double-glazed, low-e windows have foam thermal spacers in place of metal, helping to squeeze down the size of the home's carbon footprint even further.

All of the large, west-facing windows in the house have powered, exterior solar shade screens that block 95 percent of the incoming summer heat. An outdoor solar sensor triggers the shades' operation, lowering them whenever the sun strikes that wall, reducing heat gain.

When the shades are switched to winter operation, they stay open during the day to collect the sun's energy. At night, the shades are lowered to further insulate the windows and reduce heat loss.

The geothermal and solar systems, combined with an extremely well-insulated envelope, made for outstanding energy savings, especially considering the size of the home. “My utility bill for January was \$135 for electric, \$19 for gas,” said Maul. “In February, my

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mostly native, drought-resistant species that rarely need watering.”

ALL-RENEWABLE APPROACH

Wherever possible, the Mauls used local building material.

The blown fiberglass insulation contains recycled glass and is manufactured within 500 miles of Bend. Nearly one-third of the aggregate in the foundation's concrete is recycled fly ash; the concrete and aggregate is locally manufactured.

All the flooring in the home comes from renewable sources. Most of the house has bamboo flooring, carrying through on an Asian motif. The bedrooms have wool carpeting, further insulating the floor. The remainder of the house is tiled.

IAQ IMPORTANT, TOO

Just inside the large, custom-made front doors, there is a small water feature with a black granite waterfall. Beyond aesthetic beauty, the pool adds humidity to the house with misters. The hidden mister line pressurizes with house supply water through an automatic valve and timer. In such an arid region, the humidifier keeps the air inside the home more comfortable, as well as playing a part in keeping all the wood and bamboo in the house in good condition.

Two different ventilation systems can be found in the home. The night-time ventilation system, installed by Mountain View Heating, is a whole-house flush filtering system. It operates based on indoor and outdoor temperature differentials, and has an entirely separate, balanced duct system.

“This system is designed to draw in and filter air from outside the home only when temperatures inside the house exceed those outside, primarily at night,” explained Knabe. “Cooling with outdoor air is more economical than even the most efficient air conditioning systems.” The same system can also be used to recirculate and filter indoor air, without drawing any from outside. The second system is an energy recovery ventilator, and was installed by SolAire Homebuilders.

When the Mauls were younger, green and energy efficient buildings often meant ugly designs and limited conveniences. The home that SolAire built for them proves that green can be beautiful, comfortable, and provide a lifetime of energy savings. ■

electric bill dropped to \$95. Last summer, my August electric bill was \$39 and my gas bill was \$4, and the house stayed a cool 68° to 72°F. Since we first occupied the home in June of 09, the systems have run beautifully.”

WATER CONSERVATION

Because the master bathroom is located a good distance from the hot water tanks, it would take nearly two minutes to reach the shower, wasting lots of water. To remedy the problem, Maul decided to install a small, tankless water heater in a bathroom cabinet to supply the shower until water from the solar tanks reaches the bathroom.

The water heater's intake supply comes from the hot water tank, so when hot water reaches the unit, its heating element is turned off. For the remainder of the shower, only hot water from the solar- and geothermal-heated tanks is used.

To continue the water-saving trend, the bathrooms are all outfitted with dual-flush toilets and low-flow fixtures. A 1,600-gallon cistern was buried below the backyard garden to store filtered rainwater from the gutters.

“I use rainwater for the landscaping outside,” explained Maul, “although the plants we used are

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Visit ClimateMaster's website at www.climatemaster.com and Bradford White's website at www.bradfordwhite.com.