



## “SUV” Green Home Activated by Oregon Sunshine

Three years in the making: Oregon über-green superhome breaks all the traditional rules of high efficiency homebuilding. Any way you look at it, it's over the top, energy-wise. When David Maul of 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. 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's generally considered feasible for a house its size.

“The 4,000 to 6,000 sq. ft. 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 sq. ft. 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. We didn't really get close to the design we settled on until shortly before construction began,” said Maul.

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.

The Mauls 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, their sole focus since 1995.

### Tapping Geothermal Energy

“Building the Maul's home was a learning experience,” said Cindi O'Neil, co-owner of SolAire. “It combined everything we knew about green building, with the energy efficient systems Maul wanted.”

Maul's geothermal system was the first one that SolAire had incorporated into a residential project. Although geothermal installations are now commonplace across the Midwest and the eastern part of the country, some of the Western states have been slow to adopt the technology.

The home's ground-source, water-to-air geothermal system consists of five vertical, four-inch bore holes at 200 ft. deep, each fully grouted. According to Darryl Knabe, service

# MAUL HOME

manager at Mountain View Heating in Bend, it was the first vertical installation in Central Oregon. Mountain View installed the Maul's ClimateMaster system.

An additional 100 ft. 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 five-ton ClimateMaster Tranquility 27® water-to-air system. HVAC delivery in the home is divided into six zones for maximum comfort and efficiency. Maul's geothermal system has a two-stage scroll compressor and a variable speed air handler.

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. The second system is an ERV.

## Solar With Geo. Why Not?

Fortunately, the town of Bend is smack dab in the middle of Oregon's high desert region, a huge advantage to the Mauls because of its extreme 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 gal. electric water heater.

The geothermal system also incorporates a desuperheater to provide additional heat for domestic water during the summer months. The device is an auxiliary

heat-recovery system that provides up to 60 percent of a home's domestic hot water. In essence, it's a second condenser located in the cabinet and connected to a standard electric water heater via a coaxial fitting. It delivers more heat in summer, but it helps in winter, too. A desuperheater is well worth the cost; without it, the Maul's would need a large geo-exchange field underground to dissipate the extra heat.

## Pushing the Envelope

To achieve LEED greatness, the Maul's home needed an ultra-efficient building envelope. SolAire used an 8" 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, both insulated for amazing 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 ACH at 50 Pascals, which is 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% of the incoming summer heat. There is an outdoor solar sensor that triggers the shade operation, lowering them whenever the sun strikes that wall, reducing heat gain.

The shades can easily be switched to winter operation so that they stay up during the day to embrace the sun's energy. At night, the shades drop to further insulate the window and reduce heat loss.

The geothermal and solar systems combined with an extremely well insulated envelope made for



ClimateMaster 5 ton Tranquility 27 geothermal heat pump system.

# RESIDENTIAL CASE STUDY



The Maul's grand entrance.

astounding energy savings, especially considering the size of the home. "My utility bill for January was \$135 for electric, and \$19 for gas. In February, my electric bill dropped to \$95," said Maul. "Last summer, my August electric bill was \$39 and my gas bill was \$4, and the house stayed a cool 68-72 degrees."

## 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 that 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-geothermally 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 mostly native, drought resistant species that rarely need watering."

## An 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 a 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. The majority of the house has bamboo flooring, carrying on the Asian motif. The bedrooms have wool carpeting, and 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 great condition.

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



The Maul's unique landscaping style.



**Maul Home:**  
Bend, OR

**Architect:**  
Earl Seamen/Chad Phillips

**Contractor:**  
SolAire Home Builders

**Geothermal Heat Pump Equipment:**  
Tranquility 27® Packaged Water-to-Air (TTV)

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