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## Futurehaus

A local company is building a house you can heat with a blow-dryer.

BY JOHN MINERVINI



MILOS JOVANOVIC: "We're on the verge of rediscovering what houses are."

IMAGE: [leahnash.com](http://leahnash.com)

"These aren't your grandma's storm windows."

Bjorn Nelson holds up a wicked-looking window casing. Sourced from Germany, it features triple thermal glass panes, three rubber gaskets, six insulating air chambers and a protective Plexiglas laminate. It looks like it came off a space shuttle, but it's headed for a single-family home in Hood River.

"Problem is," says Nelson, "you can't put these windows on just a regular house. They'd be more energy-efficient than the walls."

The man makes a good point. The casings have an R-value (insulation strength) of 5.9 kelvin square meters per watt, whereas the outer walls of most Portland single-family homes come in at only 4.6. On most houses, they'd be about as useful as an iron padlock on a cardboard box. But for this project, they're essential.

Nelson is an architect at Portland-based Root Design Build, and the windows are for Root's Shift House, a project that has the potential to change the way the Northwest (and maybe the United States) thinks about green architecture. Due to break ground in July, Shift House packs a lot of innovative technology, but one thing you won't find in it is a

furnace. That's because, even in winter, you can heat the whole house with a blow-dryer.

When it is completed in September, Shift House will be one of only seven homes in the United States certified to German Passivhaus standards of energy efficiency, and the first such project on the West Coast. To build it, Root is eschewing what company officials say is a lengthy and ineffectual LEED checklist. Instead, through intensive design and super-insulating technology, they're planning one of the most energy-efficient buildings in the country, a home that consumes heating and cooling energy at one-tenth the rate of the average American residence. Even for a town as ostensibly eco-conscious as Portland, that's a big step.

"Portland likes to think of itself as a green city," says Zac Blodget, an engineer and developer who consulted with Root on the project. "But the bar's not high enough. Right now, Portland's Bureau of Development Services is giving thousands of dollars to builders who achieve a 15 percent reduction in energy use. That's nothing. Shift House totally eclipses those standards."

Milos Jovanovic is a principal and co-founder at Root, and Shift House is his baby. But when he emigrated from Serbia to Beaverton at age 14, he never dreamed he'd be pioneering sustainable technologies. He was thinking about other things.

"I think I actually hit puberty on the plane ride over. It was like, bam!"

Jovanovic's parents were keen on his becoming an engineer, but he wanted to be an artist. So they compromised. Jovanovic got his degree in architecture from the University of Oregon. And it was there that he found his life's calling, sustainable design, a paradigm shift that he likens to the advent of cars, television or the Internet.

"It's the way we're remaking the world," says Jovanovic. "We're on the verge of rediscovering what houses are."

The future site of Shift House is a 0.4-acre lot on a windy bluff in Hood River. On either side of the property are ranch-style homes that have stood for 30 years, but just up the hill lies the Mountain View Ranch subdivision—minimum home size: 2,500 square feet. It's the largest new housing development in the area and a veritable orgy of McMansions, McChalets and McVillas. Green design or no, that's what people want, isn't it?

Jovanovic disagrees. Striding vigorously around the empty hillside lot, he points to the fact that in 1997, when Germany was in the grips of a financial recession, there were still only 10 passive homes in that country—even though Passivhaus technology had been available for nine years. But as prosperity returned the movement flourished, and

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today there are more than 15,000 passive homes in Germany and around Europe.

“That was their recession, this is ours,” says Jovanovic. “There’s no doubt that Passivhaus is the future. We just want to have a product ready for when the orders start rolling in.”

Jovanovic’s unorthodox design strategy and his aggressive leadership style have created opportunities for the firm. In 2008, Root made news by designing Portland’s first LEED platinum-rated home.

But he has also raised eyebrows.

Jonathan Cohen is the co-owner of Imagine Energy, a Portland-based energy consulting and contracting firm, and he’s got his doubts about Shift House.

“When it comes to Passivhaus, Root is definitely ahead of the curve with their commitment and expertise,” says Cohen. “But the reality of execution is often harder than the concept.”

Other aspiring American passive homes have run into problems, with leaky concrete walls and uncomfortably warm interior temperatures. But the main challenge for Root will probably be designing and constructing an airtight building envelope—Shift House’s roof, walls and concrete slab foundation.

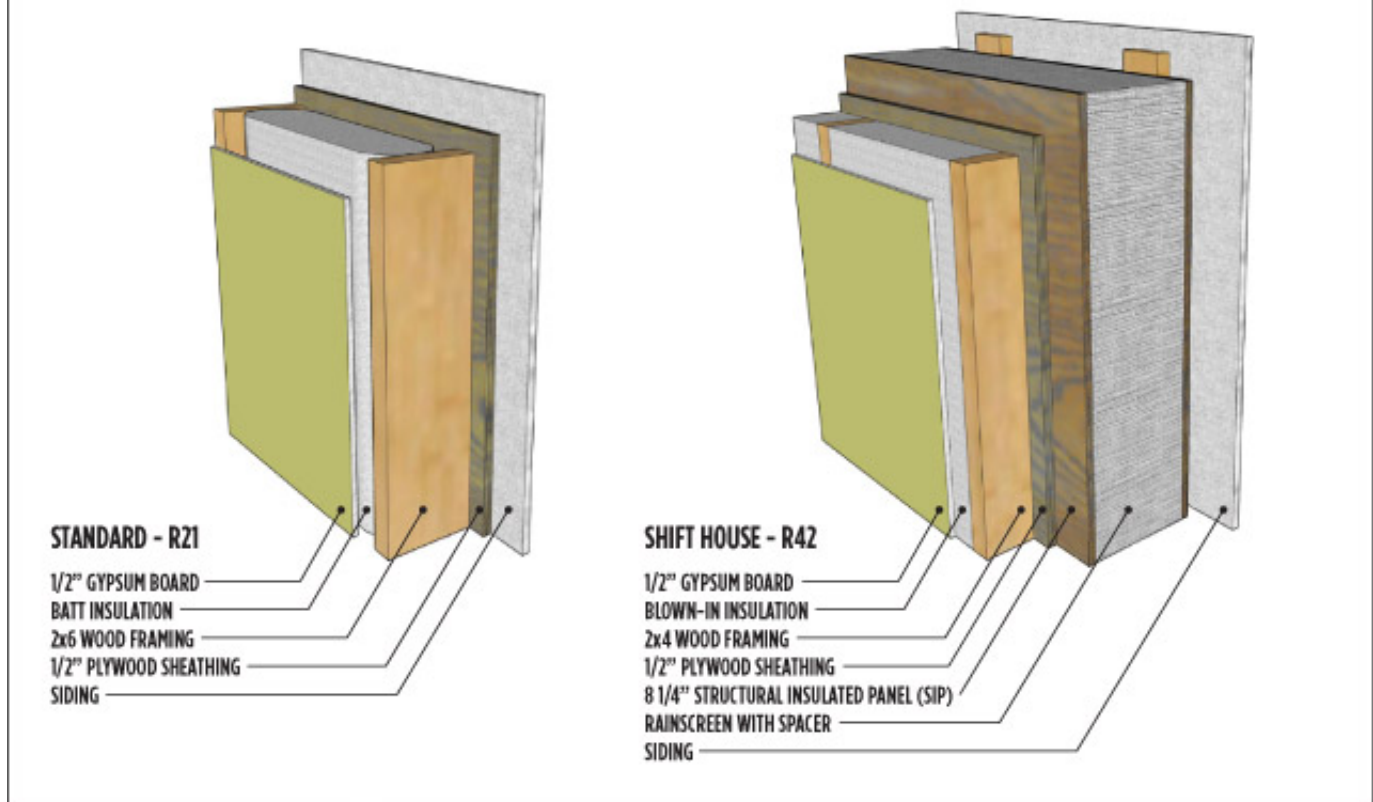
“Passivhaus has an extremely stringent requirement for airtightness—0.6 air changes per hour at 50 pascals of pressure,” says Cohen. “Frankly, I’ve never been in any house that’s achieved those standards.”

That doesn’t scare Jovanovic.

“We expected this. I mean, the claims that we’re making are outrageous. We’re saying that you’re going to have a house with no furnace and save 90 percent on energy.

“Still, we’re gonna do it.”

## WALL ASSEMBLY: SHIFT HOUSE VS. STANDARD NEW CONSTRUCTION



To become certified as a Passivhaus, Root's Shift House will have to pass three tests. It must use almost no heating and cooling energy (less than 15 kilowatt-hours per square meter per year), it must use very little other energy (less than 120 kilowatt-hours per square meter per year), and it must be airtight.

To achieve those goals, Root has designed an elegant two-wall home, through which structural and insulating functions are divided between an inner and an outer envelope, respectively. Shift House's inner envelope is a traditional wood stud frame that bears the weight of the second story and the roof, as well as housing the electrical and plumbing systems. But the outer envelope is what's truly impressive: a seamless casing of 8-inch-thick structural insulated panels, or SIP, penetrated only by windows and doors, which extends even under the concrete slab.

"The really unique thing about this project," says University of Oregon architecture professor G.Z. Brown, "is the use of a double envelope in which SIP panels form the airtight outer layer. No one's ever done that before."

Shift House will also have passive solar heating along its south-facing wall, thermal masses (warm in winter, cool in summer) in the form of concrete floors on the first story, and a state-of-the-art heat exchanger that transfers heat from outgoing old air to incoming fresh air. For some, the word "airtight"—a key term in Passivhaus—may imply a damp, stale interior, but the heat exchanger that will be used in Shift House provides a level of air exchange far superior to that of most traditional homes.

Don't confuse Passivhaus with passive solar. Passive solar heating is the conversion of sunlight into usable heat without the use of mechanical systems. Although many Passivhaus-certified buildings employ passive solar as a way to maintain a pleasant interior temperature, Passivhaus is a much more comprehensive term that refers to overall standards of energy and heat efficiency.

The Passivhaus movement began in 1990 in Darmstadt, Germany, but the technology has been slow to catch on in the States. Passive House Institute U.S. co-founder Mike Kernagis says that's due in part to a history of cheap oil.

"Low energy prices from the 1980s forward basically allowed us to hit the snooze button on energy efficiency," says Kernagis. "But now, concerns about the climate and independence from volatile energy costs are immediate, and people are more interested in sensible solutions like passive house."

Speaking with Jovanovic, who's got a flair for self-promotion, you'd never guess there was another Passivhaus-certified architect in the United States, let alone Oregon. In fact, Passive House Institute U.S. will hold training programs in six cities this year—New York, Chicago, Boston, San Francisco, Seattle and Portland—and by the end of 2009 it expects to have certified over 150 architects. In Oregon alone, there are 10 Passive House projects under way, of which Shift House is just the first.

"There's a sense among people associated with the movement that we need radical change," says Tad Everhart, Passive House consultant and informal regional coordinator. "That includes addressing climate change and re-employing a devastated construction industry. But that also means collaboration, not competition. We've got a lot to learn, and not much time to learn it."

American passive houses are in Illinois, Minnesota and Massachusetts. But Shift House stands out from these other buildings for two reasons. First, the comparatively mild weather in Hood River is much more conducive to Passivhaus design principles than that in colder climes. (To insulate effectively in Bemidji, Minn., requires 22-inch-thick walls, whereas Shift House's walls come in at a svelte 14 inches.)

The second advantage is aesthetic. Existing American passive structures have achieved superior levels of energy efficiency at the expense of design; generally speaking, they look like big bland boxes with weird windows. By contrast, the exterior styling of Shift House is approachable, employing a traditional overall form, a pitched roof and vernacular materials like wood, stucco and glass. With characteristic brio, Jovanovic likens the design to that of Spanish architect Antoni Gaudí.

"Gaudí merged the vernacular materials of Catalonia with the ethos of art nouveau," he says. "We're doing the same thing. It's a simple shed roof reinvented as a sustainable 21st-century home."

But for PSU architecture professor Jeff Schnabel, it's the accessibility that counts.

"One of the most important things about this project," says Schnabel, "is the way it employs sustainable strategies in a conventional-looking house. It doesn't look funny or odd. It looks like a desirable home."

The current industry standard for sustainable design is the Leadership in Energy and Environmental Design, or LEED, a rating system devised in 1998 by the U.S. Green Building Council. Jovanovic is no stranger to LEED; he expects Shift House to receive a gold rating without even really trying. But he thinks he—and we—can do better.

"Naturally, LEED is a step in the right direction," says Jovanovic. "But in terms of real sustainability, there is no comparison. Passivhaus blows LEED right out of the water."

The criticism that many, including Jovanovic, have leveled at LEED is that it's like a credit-rating score—less a true evaluation of financial worthiness (or, in this case, sustainable design), more a racket for expensive goods and services. Getting a project certified by LEED is a months-long process that involves ticking off a 100-item checklist—including flashy but arguably superficial elements like bamboo floors, special paints and low-energy light bulbs. Conspicuously absent from the list are stringent—or even mildly exacting—guidelines on overall size or energy consumption.

Eden Bruckman, research director at the Cascadia Region Green Building Council, has been working with LEED since its inception. She concedes that the lack of a per-square-foot energy cap is a problem, but she says LEED was never intended to be the end-all in green design. She maintains that LEED and Passivhaus are not mutually exclusive.

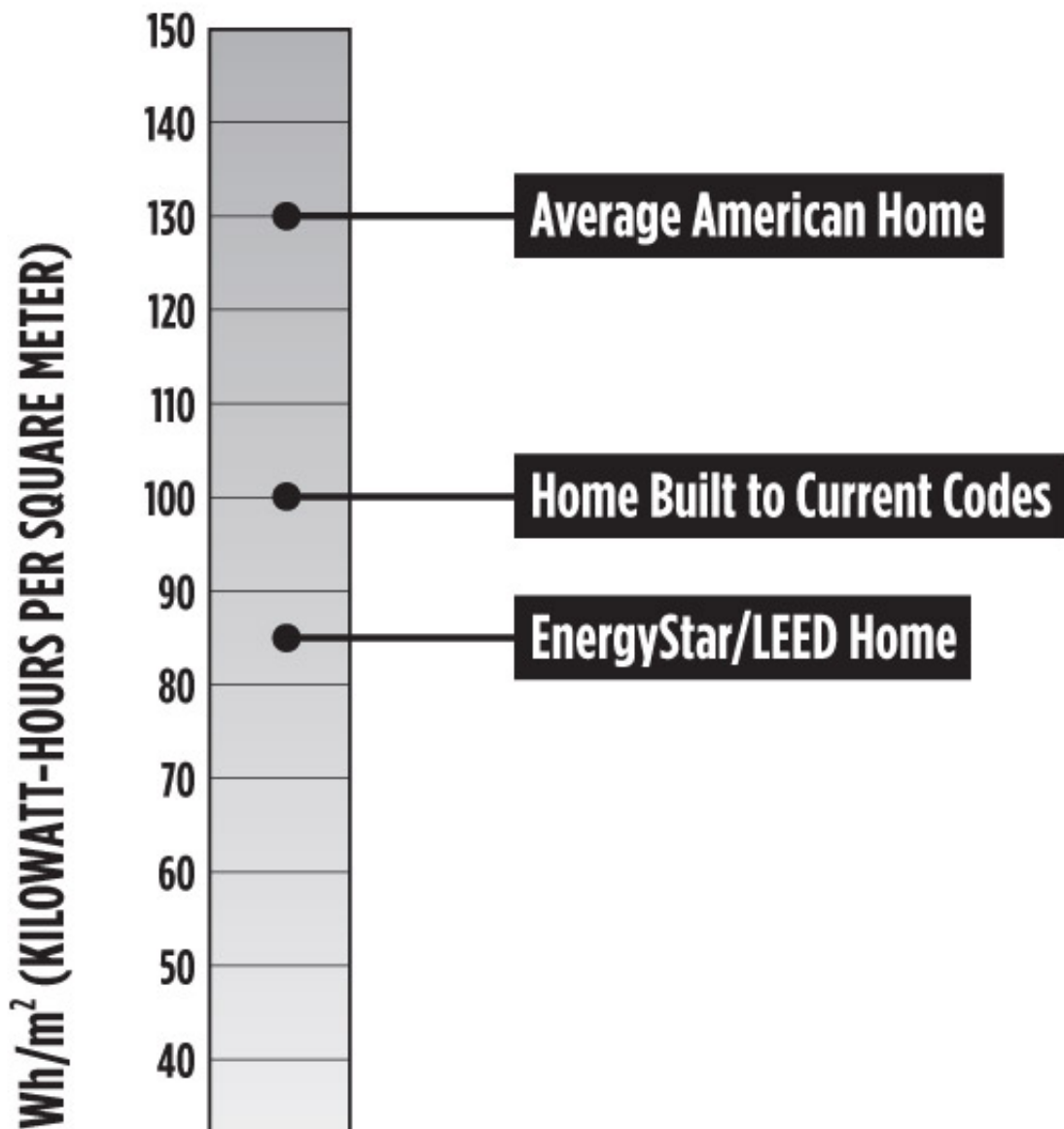
"The goal of the program has always been market transformation, and in that respect LEED is a huge success," Bruckman says. "Ten years ago, most people were not talking about sustainable design. Now, buildings that otherwise may not have considered implementing significant energy efficiency measures are trying to achieve a 50 percent reduction."

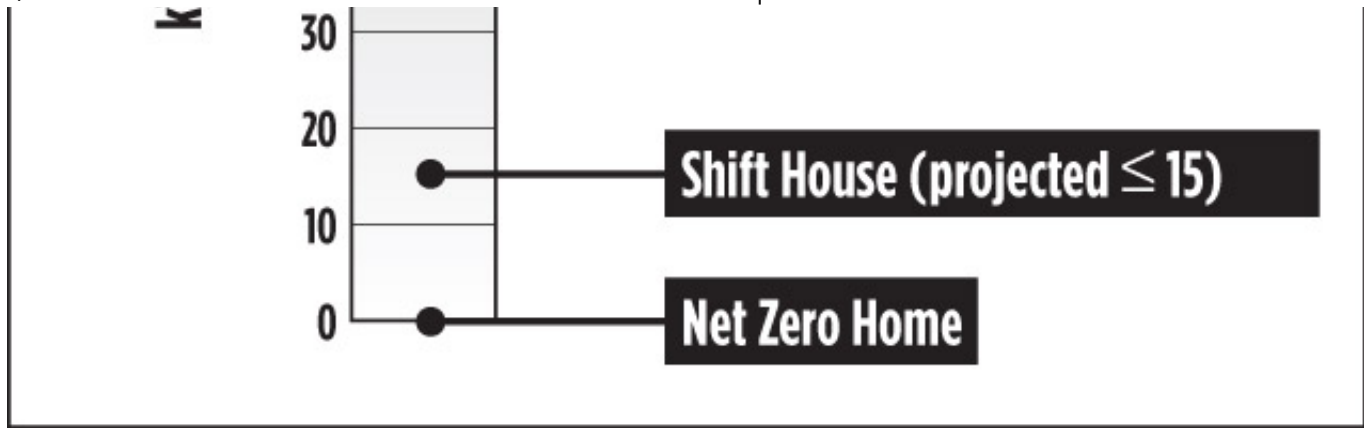
One thing is clear: Americans have to change the way they build. According to a 2005 report by the U.S. Energy Information Administration, buildings consume 48 percent of the energy—and over 70 percent of the electricity—used in this country every year. But is Passivhaus really the way forward? Or is it just a flying car?

Tough to say. For example, Portland Water Bureau investigated building a model passive house on a lot it owns in the Glendoveer neighborhood, but it has provisionally suspended the project. According to Portland's Bureau of Development Services, the building will still adhere to rigorous green construction standards, but Passivhaus certification exceeds its budget.

"Passivhaus is definitely the way forward," says Alisa Kane, Portland Bureau of Planning and Sustainability green building coordinator. "I mean, it's just difficult to argue with an \$8 heating bill. But at this point, not everyone is financially or conceptually able."

## ANNUAL ENERGY CONSUMPTION OF A SINGLE FAMILY RESIDENCE





## IS THE PRICE RIGHT?

Is Shift House expensive? That depends on your point of view. Root Design Build has budgeted \$300,000 for construction, and under normal circumstances would charge 10 percent of that amount (\$30,000) as a design fee. (Shift House, however, will serve as the primary residence of Milos' father, Root co-founder V.J. Jovanovic, so in this case, the design is gratis.)

For a brand-new house, \$330K is not horrible. Then again, the floor area of Shift House is only 1,741 square feet, compared with a national average (for new homes) of 2,349 square feet. That leaves V.J. Jovanovic with a cost of about \$190 per square foot, compared to \$85 to \$120 for most houses.

So is the price of a truly green home prohibitive for most Oregon families?

According to PSU architecture professor Jeff Schnabel, not really.

"The payback period on the technologies employed in Shift House is short," says Schnabel, who reviewed a proposal for the project. "There might be an extra investment up front, but families would get that money back very quickly over the life of the house, in the form of heating and energy savings."

Root designer Will Allured enthusiastically agrees: "By spending 10 percent more during construction, we can eliminate the need for 90 percent of the heating energy, indefinitely."

The target for Shift House's annual heating bill, Allured says, (not counting the energy gain from proposed photovoltaic panels) is \$194.

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