



Leap of Faith

A family embraces the unknown to build a pair of houses for the distant future

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WITH A DIP OF A GLASS into a container of freshly harvested rainwater, Charlie Weiss savors the aftertaste of an unlikely filtration system—the ancient hickory tree towering above his ecohome in Southwest Portland. “It tastes a little like the Celestial Seasonings tea Morning Thunder,” he says, smacking his lips while contemplating the pale bronze color of the water that will eventually stream from every low-flow faucet in the house. “We’re looking into whether a carbon filter will get enough tannin out of the water so that we won’t taste it and it won’t turn all of our white clothes a light shade of brown.”

Weiss and his wife, Katharine Lawrence, are slowly discovering the quirks of their new home—one of the first in Portland to be certified LEED Platinum. They’ve named it “Leapfrog” for its long jump into green design, and they’re anxious to learn how the house’s twin, which they built just 50 feet away, will fare on the real estate market.

They’re betting that Portland will produce another owner as desirous of a home that approaches net-zero electricity consumption—and that was framed with Forest Stewardship Council (FSC)-certified lumber harvested from local forests



FAR LEFT Charlie Weiss and Katharine Lawrence’s green home has an impressive plumbing network (affectionately called “the wall of wonder”) that not only filters rainwater, but also heats it geothermally and distributes it throughout the house.

LEFT Though the two Leapfrog homes are not identical, they share the same forward-thinking design, with roofs designed to collect rainwater and solar power, efficient insulation from foundation to attic, and FSC-certified wood products throughout.



or from trees felled on the couple's large, south-facing lot. "We wanted to demonstrate that it's possible to build a really nice house that has a really small footprint," Weiss says. "We want other people to learn from it and walk away inspired."

Leapfrog's ambitious composition starts with the house's tightly sealed "envelope," where foam insulation blown thick in the extra-wide walls and beneath the long-lasting Galvalume roof (a coated steel that reflects summer sun) works with high-efficiency doors and windows to form a nearly impenetrable weather barrier.

"The house almost heats itself by retaining the warmth of the bodies and appliances inside," says Leapfrog's designer, Kathy Kremer. The envelope's stellar performance led Weiss, a student of environmental architecture, to the realization that he could dramatically downsize the heating system needed for a 2,600-square-foot house (including a 600-square-foot apartment above the garage) by installing an efficient ground-source heat pump to supply the home's radiant flooring and faucets with hot water—the same rainwater that's collected from the roof, stored in underground tanks, and zapped clean by an ultraviolet filter.

Electric appliances populate the laundry room and kitchen (including a whiz-bang electromagnetic induction

cooktop), all powered by roof-mounted solar panels that should generate about 5,000 kilowatt-hours of pollution-free power a year. The couple expects that amount to meet up to three-quarters of their energy needs. "It helps that we're vigilant about turning off lights," says Weiss.

That conservation mind-set is elemental to Leapfrog's success. Take, for example, the fiberglass-enclosed shower in the master bathroom that's built to retain warmth, allowing Weiss and Lawrence to comfortably stop the water flow when soaping up, saving up to 30 gallons of water per shower. Everyone on the property pays attention to such details, including Britta Dedrick, who rents Leapfrog's attached studio apartment.

"Charlie and Katharine have really built the house of the future—the *distant* future," remarks Stephen Aiguier, president and founder of Green Hammer Construction, the firm that did much of the heavy lifting in bringing the house into being. He likens working on the Leapfrog houses to walking into a cloud of unknowns, but with a result so uplifting that Green Hammer itself has changed the way it builds houses—the company now consistently uses advanced framing techniques and has added an in-house sawmill for cutting FSC-certified lumber.

To wrap the home's innovation in an attractive package, Kremer chose to showcase sustainable materials in every room. "Knowing there's a local connection to every post and beam in the house gives the space so much meaning," she says, noting the way the exposed timbers and natural wood colors warm the contemporary lines of the open floor plan. Wood accents abound—knotty slabs of fir cut from a tree on-site make elegant stair treads, local Pacific madrone creates durable kitchen countertops, and more fir reclaimed from discarded high school bleachers is used as trim in every room—its pale color offset by dusky green concrete floors and rich bathroom countertops.

Packing this much design and new technology under one roof certainly comes at a cost—not just the second Leapfrog house's list price of \$749,000, but also the time spent learning how to maximize the homes' potential while resolving their idiosyncrasies, like tap water that tastes a little too much like tea. "It's completely natural, but totally ridiculous, to just expect all of these systems to work perfectly," Weiss says. "But our feeling is that this way of building houses is going to become *the* way of building houses. For that, I'm willing to tolerate a little ambiguity." ■



FAR LEFT Britta Dedrick loves the abundant natural light, leafy views, and cork floors in her studio apartment above Leapfrog's garage.



LEFT Leapfrog's interiors showcase sustainably harvested and reclaimed wood products, including trim milled from old high school bleachers (above) and elegant stairs cut from a fir tree felled on site (below).

Take the Leap

Here's a snapshot of the costs and benefits specific to the Leapfrog's systems and suggestions for adapting them to your own home.

SPACE AND HOT WATER HEATING

● *What Leapfrog Does*

An efficient ground-source heat pump captures the warmth of the earth to heat a single 100-gallon tank of water to between 112 and 120 degrees, for use in radiant-heat floors and the home's hot water. Total cost: \$18,000

● *What You Can Do*

A ground-source heat pump and radiant floor heating are retrofits worth exploring, but they are often more cost-effective in new construction. Imagine Energy, a consultant on the Leapfrog houses, recommends considering an air-source heat pump instead, which runs about \$7,000 to \$9,000 and is two to three times more efficient than a gas furnace.

TIGHTENING THE ENVELOPE

● *What Leapfrog Does*

Special framing techniques create a large wall cavity for more insulation, helping add up to 50 percent more weatherproofing than building codes require. Perlite underneath the concrete floor prevents downward heat loss, and there's additional spray-foam insulation in the exterior walls and beneath the roof. The Pella fiberglass windows are more durable than wood, metal, or vinyl and are less likely to expand, contract, and wear out. Panasonic WhisperGreen fans help circulate air and draw out moisture that could lead to mold. Total cost: About 30 to 50 percent more than traditional construction

● *What You Can Do*

Hire a professional energy auditor to conduct a blower door test to find your home's biggest drafts—air leaks often can be remedied for just a few hundred dollars. You can also tighten your envelope by using high-efficiency foam insulation in your old home's walls and attic space (\$3–\$5 per square foot) and resealing old windows. (Find a list of contractors on the Energy Trust of Oregon's database at energytrust.org.)

WATER CONSERVATION

● *What Leapfrog Does*

The Galvalume roof directs water into two 3,000-gallon concrete cisterns. A five-micron particulate filter and a UV sterilizing system gives that water the purity of a fresh mountain spring. Low-flow plumbing fixtures and appliances, plus quick showers, result in the household using about 50 gallons of water a day—compared to the typical Portland household's 158 gallons a day. Total cost: \$10,000

● *What You Can Do*

Retrofitting an existing house for rainwater filtration is possible, but smaller and cheaper systems also can be installed to capture and use rainwater for nonpotable uses. Or take incremental steps: replace old toilets with dual-flush models, switch showerheads and faucets to low-flow models, and use a front-loading washing machine; install a Galvalume roof that doesn't leach petroleum and that keeps rainwater runoff clean; and collect rainwater for garden uses in rain barrels.

POWER CONSERVATION

● *What Leapfrog Does*

An array of 30 photovoltaic (PV) solar panels mounted on the roof should generate up to three-quarters of the home's electricity supply for the entire year. Those panels, plus Energy Star electric appliances, eliminate the need for natural-gas service, and contribute to an estimated 10-year total energy savings of \$37,000. Total cost: \$30,000, after rebates and tax credits

● *What You Can Do*

Smaller solar PV systems start at around \$10,000, after tax credits and rebates. Solar hot-water systems start at about \$4,500. The simplest step: buy a \$30 monitoring device called a Kill A Watt to find and isolate household gadgets that use power even when turned off.