



Super Models

Modular homes, which have been around for a few hundred years, are adopting an ultra-green identity. They aren't your grandfather's factory-built homes. *By Cheryl Weber*

Four Boxes and a Roof The net-zero Great Diamond features double 2x4 stud walls, creating ample insulation space and a thermal break.

Screen Shot The Great Diamond's airy screened porch, breezeway, and garage are prefab add-ons.





Low-Carbon Copy

Originally stick-built for real clients, this modular home merges middle-class affordability with net-zero status.

Net zero-energy custom homes are common enough, but rarer is the architect-designed building that achieves net zero for \$139 per square foot, including a 6-kW photovoltaic (PV) system and basic site and foundation work. Kaplan Thompson Architects, partnering with Keiser Homes, makes affordability its mission. Case in point: the Great Diamond, occupying the neglected middle ground between custom homes and basic modular products.

“Custom homes typically start at \$200 per square foot in our area,” explains Phil Kaplan, principal of Kaplan Thompson. “Keiser’s manufactured homes for the affordable market are about \$90 per square foot. So we’re able to quote \$139 per square foot to clients without causing sticker shock.” The key to hitting that price point, he says, is using energy modeling to find the equilibrium between mechanical, insulation, and PV performance. That precision has a second pay-off: When potential buyers question the negative numbers, out come the spreadsheets.

Part of the Modular Zero Collection, the 1,680-square-foot Great Diamond began life as a conventionally built home for carbon-conscious clients. The team value-engineered a concise box with double-stud framing and dense-pack cellulose insulation, resulting in R-40 walls and an R-60 roof. Not only is the near-perfect square efficient to build and insulate, its traditional New England form is a cinch to customize.

“When we decided to create the collection with Keiser, the house became a prime candidate” for net-zero modular conversion, Kaplan says. “When people want something

a little different, we can change some of the details to make it more contemporary or traditional.”

While mirroring the original, the road-ready version is made of four 14-foot-by-30-foot modules—two on each floor—and a panelized third story with dormers, which can be ordered prefinished for a combined 2,200 square feet of living space. With a pitched metal roof atop classic old-fashioned proportions, its appearance belies how seriously it takes today’s environmental mandate. The house is clad in durable fiber-cement siding—4x10 sheets with battens on the lower part, horizontal boards above. Triple-glazed windows double up on envelope efficiencies, and sun-protecting overhangs wrap the south and west corners. Add-ons include a screened porch, garage, and breezeway.

Can a prefab business model honor individuality? In this case, yes. The firm will modify floor plans, within reason. “Everyone is asking us to tweak it a bit, that’s the irony of this,” Kaplan says. “Everyone who wants something at this level wants to make their mark.”

Project Great Diamond
Modular Zero Home,
Falmouth, Maine

Architect Kaplan Thompson
Architects, Portland, Maine

Builder Keiser Homes,
Oxford, Maine

Trent Bell



3-D Vision Origin is built to LEED-Silver standards. State-of-the-art “configurator” software lets buyers fully visualize their choices before plans are downloaded to the factory.

SUM OF ITS PARTS

When mix-and-match modules can serve as additions, backyard studios, or a whole-house compound, the possibilities are limitless.

Blu Homes co-founder Maura McCarthy likens its modular homes to a luxury European car—an apt image given their transportability. A house is fully assembled in the factory in four to eight weeks, then partially broken down and folded in half for delivery. The floor literally hinges up against the fixed “wet” parts—kitchens, baths—and the walls swing in.

It’s an engineering feat, to be sure, but you don’t have to be obsessed with prefab to appreciate 10-foot ceilings, glass walls, radiant floor heat, and heavy-gauge tubular steel and I-beam framing designed for high seismic, wind, and snow loads. Or operating costs that are typically half that of comparable homes.

Like its six other models, Blu Homes’ Origin is built to LEED standards. With three interchangeable modules (18 feet wide and 24 feet, 36 feet, and 48 feet long) and multiple ways to configure the orientation, floor plan, and windows, “you can create a compound instead of one huge house,” McCarthy says, “or use them as granny flats and artist studios.” With aging in place on the rise, each plan offers full accessibility options.

But its latest genre-busting innovation is the “configurator,” an online visualization tool that lets buyers walk through the house at different eye levels and swap specs, zoom-

Project Origin, Wayland, Mass.

Architect/Builder Blu Homes, Waltham, Mass.

ing in to inspect the recycled-glass countertops they’ve just picked out. This isn’t just any design program. Each component is 3-D modeled, and the sophisticated engineering software shows every bolt and screw. “It really helps our sales team and is literally the same file that gets downloaded to the factory,” McCarthy says. “That integration is a critical business model for us.”

It’s also the M.O. of a company whose stated goal is to “use advanced technology to improve the health, economics, design experience, and environmental effect of housing for American families, and to do it in a fun and collaborative way.”

Collaboration with local contractors is the key to Blu Homes’ future expansion, McCarthy says. Although it doesn’t build foundations, decks, or garages, it will design them. “We’ll fly builders to the factory to show them how to build a typical foundation or soffit and fascia detail,” she says. “We’re trying to invest in builders so they can make money off these projects.”

OUTSIDE THE BOX

A prototype Seattle home offers an unusual gift: graywater recycling.

Greenfab's premier prefab house took three-and-a-half months to build: 14 days in the factory, one day to install, and three months to finish. But the business model was years in the making. The goal: to create a house that is healthier, stronger, and more energy efficient than its stick-built counterparts. "Ours may have a similar sales price to other new homes on the block, but it offers more value in energy efficiencies and innovation," says Greenfab founder Johnny Hartsfield.

One of two models the company sells, this one is owned by Robert Humble, principal of the Seattle firm HyBrid Architecture, who developed the designs and studied their adaptability to different sites. "It was a good opportunity to get Greenfab's business off the ground," Humble says.

And to influence the state's residential building code. The pilot graywater loop Humble and Hartsfield developed is the first of its kind for a Seattle home. A 1,400-gallon cistern captures rainwater from the roof for landscape irrigation, toilet flushing, and laundry. The used water from bathroom sinks, laundry, and showers passes through a filter and into three 300-gallon bio-treatment basins in the backyard. Any overflow gushes into a rain garden and percolates back into the ground. "It passed inspection, and we'll finish it once the new code is adopted," Humble says.

The 1,790-square-foot, three-bedroom house is also extremely efficient. Exterior walls (R-26) are covered in rigid insulation and spray foam. A hybrid water heater supplies hot water, and a mini-split heat pump takes care of heating and cooling. There is also pre-wiring for a 2.4-kW PV system—enough to offset a quarter of the energy use.



Green and Gray Greenfab reuses rain water and treats graywater. The system includes a rain garden and three bioretention basins.

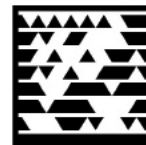
If modular construction is all about control, so are snazzy details such as the TED 5000 energy monitor. "You can access it on an iPad or phone and adjust your usage if you want to hit targets," Hartsfield says. "It's easy to monitor on the go."

Now developing partnerships with factories and builders across the U.S., Hartsfield believes prefab is a good delivery model for today's carbon-neutral goals. Humble thinks so too. "Houses are becoming more sophisticated from an energy and mechanical perspective, and harder to build," he says. "A factory can easily accommodate those requirements." **B**

Project Greenfab, Seattle

Architect/On-site general contractor HyBrid Architecture, Seattle

Developer Greenfab, Seattle



See a video of the modular home factory process on your smartphone. Instructions on page 4.