Built for the Long Haul

This family-friendly house combines recycled materials and energy-conserving strategies that will pay off for centuries

BY JONATHAN ORPIN

Kitchen in the middle. *Enclosed by timber-framing, the Commons includes spaces for living and dining, and a kitchen island deep enough to include a cooktop and a counter for lunch or homework sessions.*

Fine Homebuilding 2011 HOUSES AWARD

Our new-home-of-the-year award goes to Jonathan Orpin and Maxine Bromfield for the house they built for themselves in Portland, Ore. The house expertly balances a contemporary floor plan with traditional detailing rendered in sustainable materials. Its state-of-the-art mechanical systems will substantially lower its demand for energy and water usage for decades.

After 25 years of designing and building energy-efficient homes in upstate New York, my wife and I decided to see what it would be like to live on the other side of the country. So Maxine and I rented an RV and explored the Pacific Northwest, imagining ourselves as residents of each town we passed through. We eventually narrowed it down to Portland, Ore., where we were lucky enough to find a south-facing lot with a sense of privacy.

Maxine and I are no strangers to the world of residential design and construction. We've helped plenty of clients to build their dream homes, but we learned a great deal more than we expected as we met our toughest, most ornery clients yet: ourselves.

Thousands of decisions about floor plans, materials, construction details, finishes, mechanical equipment, and more go into a custom home. Unlike our paying customers, who count on us to filter out the majority of choices,

we had no place to hide. Everything had to be researched, debated, and reviewed.

To shape that debate, we approached the design and construction of our project with the principle that a well-built home stands on four legs. They are:

1. A long-lasting, thermally efficient structure.
2. Advanced and efficient mechanical systems.
3. Sustainable structural and finish materials.
4. A plan tailored to our family's needs and to carefully crafted, coherent detailing.

Guided by these criteria, we set about designing and building the house in which we plan to grow deep roots.

Distinct spaces open to one another

We call our main space the Commons. It occupies the western half of a rectangular timber-frame room (floor plans, facing page) with a 12-ft. ridge and a bank of clerestory windows. The kitchen (photo 1) is dead center in this room, out of the traffic patterns but in the thick of family activity. Most of the windows in the Commons face south, overlooking a forested creek bed.

The entry is just to the east of the kitchen, where the mudroom calls from one side to unload daily baggage (photo 2). Personal cubbies, key hooks, and mail slots reach out to us from the mudroom as we come in the front door. Shoes come off on the tile; hats go in the bin. After a recent tour, a visitor said, "You are the most organized people I know." Actually, we're not really organized, but our home is.

Next up is the pantry, our little corner store with a pass-through to the kitchen (photo 3). Our cleanup sink is nearby (photo 4), overlooking the backyard and just a few feet from our sit-down table for big meals. It's tucked off to one side with banquette seating and a walnut and steel dining table.

The northern half of the house is private space for bedrooms, our family bath, and Maxine's office. Our son, Jake, gets the tower bedroom. The walkout basement is part play space, part guest wing, and home to the mechanical and water systems.

Cutting down on energy bills

One key to building an energy-efficient house is minimizing thermal bridging, which is heat transfer through building components that span from inside to outside. In a typical house, the studs, the rafters, and the foundation are the culprits. We avoided thermal bridging by using structural insulated panels (SIPs; *FHB* #188, pp. 56-61) in the roof, a modified-stud exterior wall, and insulated concrete forms for the foundation and basement walls.

I like SIPs best on the roof, where they can span timber rafters, retard vapor drive, and form overhangs, all in large, typically rectangular shapes. I've installed more than 1 million sq. ft. of SIPs and will do a million more.

KITCHEN AND MUDROOM

Along the sunny south side, overlooking a private little patch of forested creek bed, the kitchen, the Commons, the mudroom, and the pantry occupy a rectangular space under a timber-frame roof.

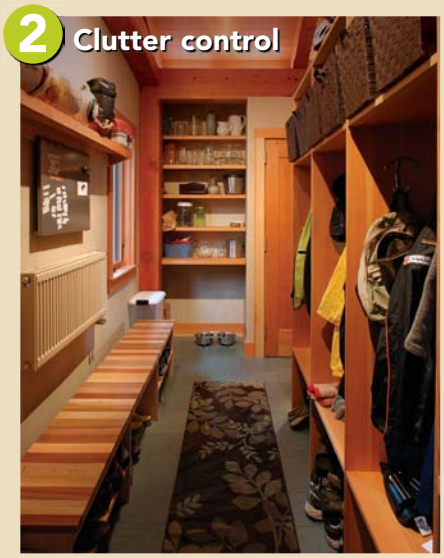
Drawings facing page: Martha Garstang Hill

PINWHEEL AROUND THE PANTRY

1 Partition power

The freestanding partitions that enclose the mudroom and pantry and define the east side of the kitchen stop at 8 ft., allowing the full length of the timber-frame ceiling to be appreciated from the Commons. The pass-through to the pantry is below the microwave.

2 Clutter control

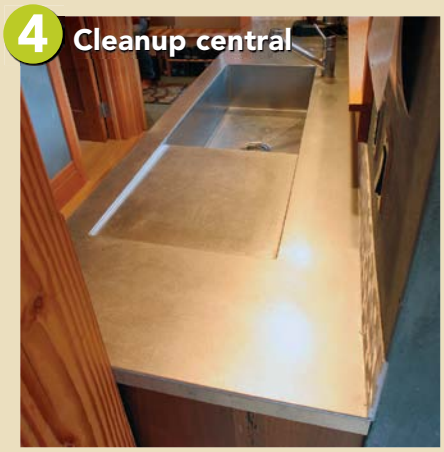


Hooks, shelves, bins, and baskets line the mudroom walls.

3 Minimize upper cabinets

The pantry is like a little grocery store/recycling center just a few feet from the fridge.

4 Cleanup central



A custom stainless-steel counter with integral sink and drainboard top the dedicated dish-cleaning and coffee-making zone.

Upper floor

SPECS

Bedrooms: 3

Bathrooms: 2½

Size: 3000 sq. ft.

Cost: $320 per sq. ft., including partly finished basement

Completed: 2010

Location: Portland, Ore.

Architect: Ty Allen, RA; Maxine Bromfield; and Jonathan Orpin

Builder: New Energy Works

Main floor

Basement level

Limited local utilities We designed our electrical, heating, and water systems to supply most of our needs, striking a balance that uses local utilities only when we have to. Here's how.

Mechanical systems

ELECTRICITY Twenty Sanyo 210w panels (4.2kw total) are supplying 80% of the annual household needs. The initial $32,000 cost for this system was peeled down to about $9000 by federal grants and tax credits.

PRIMARY BOILER The Lochinvar Knight WB5 natural-gas boiler self-modulates from 50,000-Btu output down to 15,000 Btu, which is important in minimizing the short cycling (on/off, on/off, on/off) so common in most modern, well-insulated homes. Between the lower output temperature of 120°F and the demand-driven Grundfos Alpha pump, delivery efficiencies are kept high.

HEATING DISTRIBUTION The main floors use wall-mounted European-style flat-plate radiators imported by Hydronic Alternatives of Springfield, Mass. They are less expensive and more responsive than floor tubing when there is no concrete slab.

WOODSTOVE Our boiler is designed to come on at about 5 in the morning and turn off at 8. Later in the day, as the cooler evening temperatures settle in, we light our Rais woodstove. It quickly heats the Commons. This stove has a closed-combustion firebox that takes outside air, never house air, directly into the stove.

DOMESTIC HOT WATER Two Schüco steam-back solar panels supply an 80-gal. Rheem water tank to preheat our family's hot water. In the summer, the tank is always well above 100°F, and even in our cloudy winter, we typically have temperatures between 60°F and 90°F. This is fed to a 50-gal. Amtrol BoilerMate that has its own heat exchanger and uses the main boiler for heat when the solar tank can't meet the family's needs. Tax incentives and credits from a local organization, Ecotrust, brought the initial price tag of $8100 down to $3800.

RAINWATER-COLLECTION SYSTEM We chose to place

11 ways to avoid air-conditioning

1. Our silver-gray enamel-coated metal roof reflects back about 50% of the solar radiation that hits it.

2. Overhangs shade southern windows from direct sun.

3. The insulation we love so much in the winter is doing the same thing, in reverse, by keeping the heat out in the summer.

4. For our south and west-facing windows, we specified glazing with a low solar-heat-gain coefficient to cut down on afternoon heat gain. For our east- and north-facing walls, we chose high-gain windows.

5. We placed windows for cross ventilation. For example, the low windows in the Commons coupled with operable clerestory windows exhaust the warm air.

6. Overhead fans help to keep that air moving.

7. Our yard has light-colored surfaces, shade trees, and gardens that mitigate heat.

8. We chose efficient appliances that don't have to run all the time, including an induction cooktop that doesn't use electric-resistance heating or an open flame.

9. We use a combination of LED and compact fluorescent lighting in the house. Both kick out significantly less heat than more traditional incandescents and halogens.

10. We open windows at night

Drawing facing page: John Hartman. Inset photo, facing page: Dan Thornton.

our storage tanks inside the basement rather than bury them in the yard. This allowed us to install four 1000-gal. reasonably cheap food-grade tanks. Before water enters the tanks, it goes through four filtration steps. In rainy months, we take in between 2000 gal. and 6000 gal. If we run low in the summer, we switch to city water. The overall price tag of about $6000 offsets some pricey water and sewage charges, but even so, we predict no better than a 15-year break-even on this one.

and close them before the day heats up. The lights need to be turned off, and shades drawn.

11. We designated a refuge for when the rest of the house gets unbearable. In our case, it's a finished basement that is our last resort. Lacking that, we would have mechanically cooled one room, not the whole house.

Our exterior walls are a sandwich of 2x4s filled with cellulose, ½-in. OSB sheathing for shear resistance, 1½ in. of polyisocyanurate foam insulation, housewrap, 1x2 strapping, and siding (drawing below). The cellulose, with borates as a fire and vermin retardant, breathes well and is made from recycled newspaper. Coupled with the foam insulation on the outside, the total R-value of the wall is about R-24, with no thermal bridging or air infiltration.

Faswall block

Call me old-fashioned, but I like the idea of wood siding drying from both sides. So I nail the siding to the 1x2 strapping, creating a real drainage plane behind the siding.

I don't like the vast majority of the insulated concrete forms (ICFs) available, which are made of expanded polystyrene (EPS) filled with concrete. While I admit they make a warm basement, I think they've got drawbacks. EPS blocks are vulnerable to ant infestations, and they require some fussy work to protect them from weather on the outside and general living conditions on the inside.

I used Faswall instead. It's a post-World War II European invention now being produced in the tiny town of Philomath, Ore. Faswall form blocks are made from 85% recycled wood-pallet stock that has been crushed, rolled in portland cement, and molded into stackable form blocks. Plaster or stucco finishes stick tenaciously to the textured blocks.

Sustainable finishes, inside and out

All the interior nonwood surfaces are of American Clay's earthen plaster products, including a recently introduced sprayed-on first coat called Enjarre. The second coat is applied by hand trowel, giving the wall the "smooth imperfect" look of the craftsman's hand. The plaster lets the walls breathe, and we'll never have to paint them.

The woodwork all came either from reclaimed sources or from FSC-certified forests. We used gray elm for the floors, walnut for the cabinetry and much of the furniture, oak for counters, and of course, salvaged Douglas-fir for our timber-framing. The wood all had been repurposed from agricultural sources by Pioneer Millworks, our recycled-wood company. The exterior siding is either redwood from salvaged wine tanks or recovered barn siding, which, as I like to say, comes finished with a coat of ultraviolet degradation.

We like these telltale signs. The bolt holes, dings, and rusty nail patches in the recycled timbers, flooring, and cabinets bear witness to the past life of those materials, and their enduring usefulness. □

Jonathan Orpin and Maxine Bromfield operate New Energy Works, a design-build company, and Pioneer Millworks, dealing in reclaimed and sustainable flooring. Photos by Charles Miller, except where noted.

A WALL THAT STOPS THERMAL BRIDGING