From a Leaky Old House to a Tight

A young couple retrofits the house next door as an investment in deep energy savings

BY ANDREW WEBSTER

Sara and Gareth Ross had spent a decade on the move. Postgraduate degrees and finance work had propelled them from Boston to New York, Philadelphia, and San Francisco. When it came time to settle down, though, they moved to Amherst, Mass., where Sara had grown up. Amherst is a vibrant college town with rural beauty and Japanese restaurants; for the Rosses, it was the perfect place to slow down, nurture roots, and raise children. The Rosses were not tied either to the idea of a new house or to a remodel. Instead, their vision centered on creating a healthful, durable, and energy-efficient home.

Location was the most important criterion

While they searched for the right plot of land or a perfect rehab opportunity, Sara and Gareth rented a three-bedroom house in town. It was within walking distance of everything: a bakery that saved the *Financial Times* for Gareth every morning, a school with swings for kids, and a string of restaurants, bars, and coffee shops. They fell in love with the neighborhood. When they heard that the house next door was going up for sale, they eagerly made an offer, completed the sale, and became quickly and firmly committed to an extensive renovation project.

Built in the 1880s, the house had suffered years of deferred maintenance: The roof was failing, the chim-

Photo left: courtesy of Coldham & Hartman Architects. Photo right: Ethan Drinker.

Fine Homebuilding 2012 HOUSES AWARD

BEST REMODEL

Our remodel-of-the-year award goes to Andrew Webster for the gut rehab of an 1880s house in Amherst, Mass. The retrofit opens up a choppy floor plan to yield loads of living space with a modern flair. The combined kitchen, dining, and entertaining spaces mean you can cook dinner and keep an eye on the kids. Outside, the house was wrapped with new wood siding but still looks like it fits the neighborhood. Superinsulation and solar panels mean the house uses less energy than it makes—a true sign of 21st-century design excellence.

New Home

Clean lines and power to boot. *Squaring off the front bay and a new facade gave this 19th-century house a more modern look. It also provided an uninterrupted expanse of roof for a 21st-century power plant. The palette of materials established on the exterior continues inside: exposed wood, metal, and minimalist trim details. Photo taken at A on floor plan.*

SPECS

Bedrooms: 4 • **Bathrooms:** 3½ • **Size:** 2200 sq. ft. before; 3270 sq. ft. after • **Remodeling cost:** $192 per sq. ft. • **Completed:** 2011
Location: Amherst, Mass. • **Designer:** Andrew Webster, Coldham & Hartman Architects; www.coldhamandhartman.com
Builder: Holden Builders; www.holden-builders.com • **Energy consultant:** Marc Rosenbaum

ney needed work, most of the exterior was covered in asbestos siding, the walls were barely insulated, and the furnace was 40 years old. In other words, it was the perfect candidate for a deep-energy retrofit.

The interior spaces were not much better. Small rooms on the main floor provided lots of privacy, but these areas were begging for openness. This is a common problem when updating an old house. For example, kitchens used to be tucked away in the back, but now folks use them as a central hub for family time and entertaining.

Form that follows function for a long time

Both trained in finance, Sara and Gareth were interested in energy savings and long-term planning. They hoped this would be the last home that they lived in. They considered this house part of their retirement portfolio, so they had no intention of cutting corners on long-term energy performance to achieve short-term savings.

The Rosses also wanted a comfortable space for a growing family and room for entertaining. Because most of family life would happen downstairs, priority was given to the shared spaces. Aesthetically, they were drawn to symmetry, pale whites, and a modernist style, but they also wanted their home to be approachable, usable, and welcoming.

On the first floor, an open plan links the kitchen, dining area, and living room. The original structure is plain to see, now expressed as deep engineered-lumber beams where load-bearing walls once stood. Sara and Gareth can cook, entertain, listen to music, and keep an eye on the kids playing outside from one central spot. The kitchen connects to the entry hall, a half-bath, the pantry, and the laundry, and it has direct access to the raised patio overlooking the side yard.

Upstairs, we created a parents' suite. This simple suite contains just a quiet bathroom and a small walk-in closet. The bedroom and reading nook are made up of all the leftover spaces. The rest of the second floor is devoted to the kids: two bedrooms with generous light and a playful bathroom designed with bathing children in mind. Under the stairs sit a cat door and a private nook for a cat box. We found space for a home office against a gable end on the third floor where Gareth can squeeze in a few productive hours late at night and early in the morning before heading to the office. Sara, on the other hand, needed a "constellation of shared spaces" to help her manage home and work: a desk in the kitchen, a chair in the bedroom, and a serene room that doubles as guest quarters under the other third-floor gable.

The interior finishes are not complex. Sara found ash she liked at a local lumberyard, and we used it for floors, stairs, windowsills, and trim. We used slate for countertops in the bathrooms, kitchen, and pantry. We left the engineered beams exposed for their modern look and painted the walls mostly white, with splashes of color.

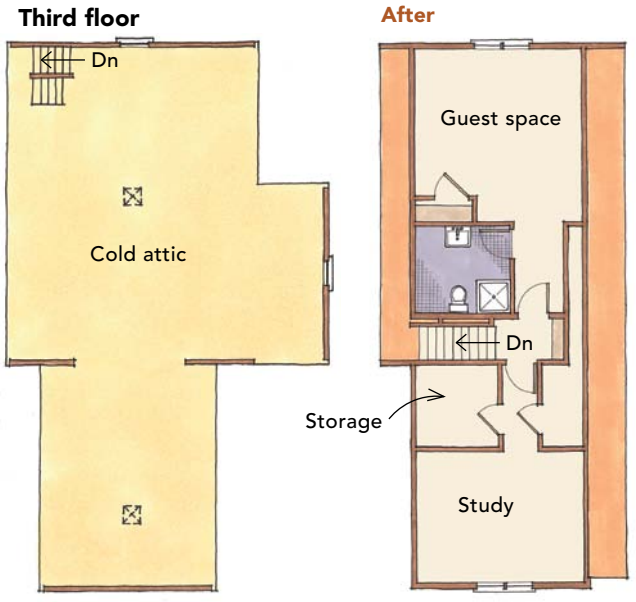
An all-electric house that works without electricity

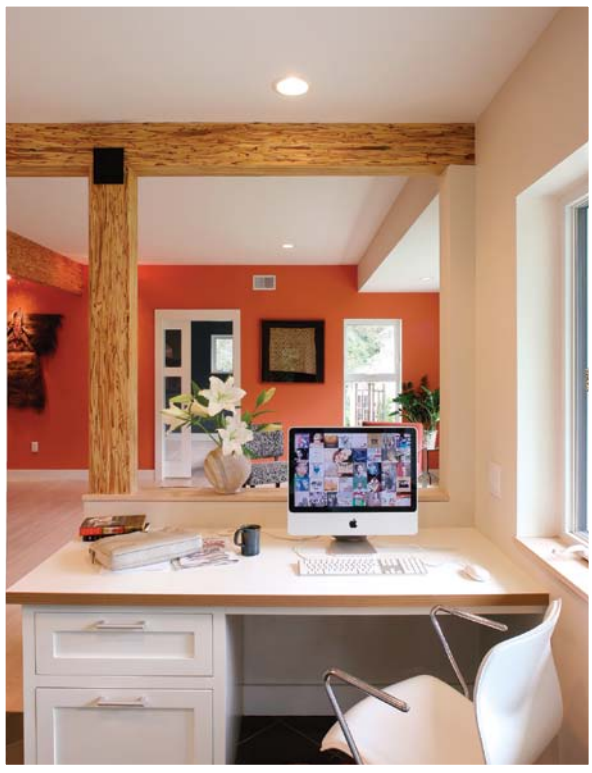
While solar power was on the long-term wish list, Sara and Gareth weren't committed to it in this first round of work because it is so

OPENING A CLOSED-IN KITCHEN

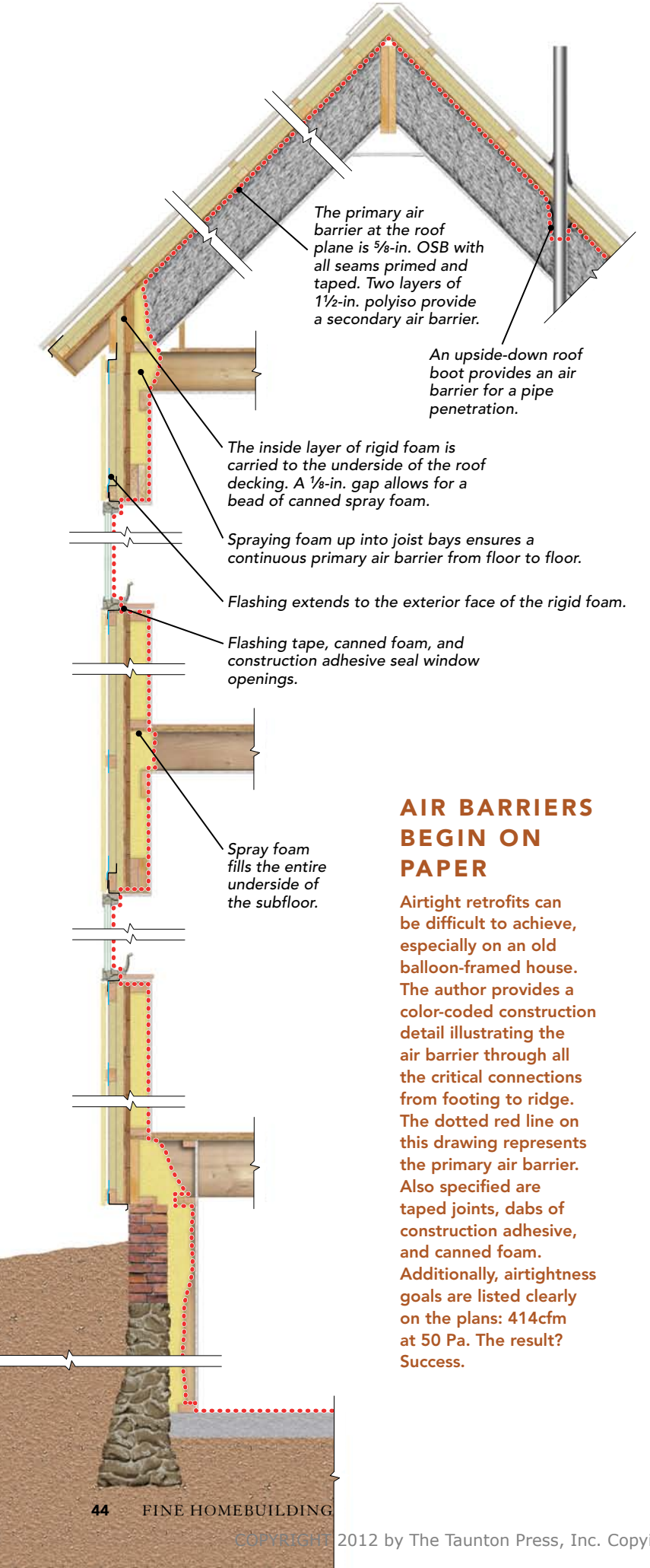
The blue wall had to go—partly because it was blue, and partly because it was a wall. Opening this main floor plan meant that parents could cook, keep an eye on kids, and entertain guests comfortably—sometimes simultaneously. Upstairs, 1000 sq. ft. was harvested from the attic and by reconfiguring existing stairways.

Floor-plan drawings: Martha Garstang Hill.
Photo left: courtesy of Sara Ross.





An open plan with privacy built in. *The kitchen connects the dining and living rooms to flanking spaces, such as the front foyer, the mudroom, and the pantry. A private away room is accessible through a door off the living room. While not totally private, a kitchen-desk area provides a nook of solitude. Photo above taken at B on floor plan; photo left taken at C.*



AIR BARRIERS BEGIN ON PAPER

Airtight retrofits can be difficult to achieve, especially on an old balloon-framed house. The author provides a color-coded construction detail illustrating the air barrier through all the critical connections from footing to ridge. The dotted red line on this drawing represents the primary air barrier. Also specified are taped joints, dabs of construction adhesive, and canned foam. Additionally, airtightness goals are listed clearly on the plans: 414cfm at 50 Pa. The result? Success.

expensive. The building's perfect orientation for solar power, however, prompted us to consider an all-electric solution for the house. This would make it easy to add photovoltaic panels later. The options for electric-based heating systems are few: electric strip heaters or heat pumps. While the heat pumps of the 1980s had given this technology a bad rap, cold-climate air-source heat pumps are promising. After making inroads into the United States after being perfected in Europe and Japan, these units provide heating and cooling in one efficient little package. We decided on a multiport unit by Mitsubishi with five zones. It would maintain operation to –15°F and perform with a coefficient of performance (COP) of 3 or better. That means that for each kilowatt hour of electricity we put into it, the heat pump would deliver 3kwh of heat to the house.

Perhaps the more difficult decision was in the kitchen, where all-electric meant induction cooking. Giving up gas cooking was a tough sell for these two cooks, but they were surprised by how much they loved the induction cooktop. For the kitchen floor and also for the parents' bath, we chose tile warmers for a quick pickup to warm a cool house after a weekend away, or to ensure warmth should the heat pump go down during an extended cold snap.

In fall 2011, the house had a real test of its energy-saving powers: A Halloween storm dropped more than a foot of snow on the area, and the power was out for two and a half days. When electricity was finally restored, the temperature inside the house, which had been without any heat for the duration, had dropped from 70°F to 67°F—not bad for three wintry days with no heat and a lot of foot traffic.

Solar panels make an electric house self-sufficient

The solar panels themselves were nearly the last thing decided. Knowing that solar was possible in the future, we'd cleared the south-facing roof plane of all penetrations. The roofing material was standing-seam metal, with easy attachment for solar clips. Framing was under way, the roof was being rebuilt, and the plan was proceeding without solar power. Gareth had been thinking through the finances of photovoltaics (PV) and had discovered what we already knew: In Massachusetts, the incentives were good. Given the state grants, tax

Big beams open the floor plan. *To open the first floor, a couple of major bearing walls had to be removed. Rather than wrap them with wood, the owners chose to leave the parallel-strand-lumber beams exposed to give a modernist flair to a traditional detail. Photo taken at D on floor plan.*

Drawing left: Toby Welles, WowHouse. Photo right: Ethan Drinker. Top photo, facing page: Rob Yagid. Bottom photo facing page: courtesy of Coldham & Hartman Architects.

incentives, and Solar Renewable Energy Certificates (SERCs) now on offer, Gareth could see his way to an attractive financial return. Rather than being a drain on their finances or a luxury item for the bottom of their wish list, the Rosses realized that an investment in solar made strong financial sense—especially given the lack of other investment opportunities in a rocky economic climate.

"I've been driving back and forth to work for the last month, trying to find the flaw in my own thinking," Gareth said. "But I can't. I think we should put as much solar up on the roof as we can fit." Within three months, the system was installed using the densest residential solar module on the market, for a total of 12.4kw of clean-power generation. It covers the entire southern roof plane.

To install the PV system, the Rosses had to write a painfully large check. In fact, it was larger than the check they wrote to buy the house itself. For most homeowners, this upfront cost is an insurmountable hurdle to solar ownership. A desire to solve this problem for other homeowners led them to start a business, Sungage (www.sungagellc.com), which determines the feasibility of solar power for a home, provides the loan, and smooths the installation process.

The house that was remodeled to save energy now actually produces it. While earning a great return on the money the Rosses invested in it, the PV system makes all the energy the house requires—with some to share. In 2011, the house overproduced by more than 1000kwh. Through careful planning of static and dynamic elements, a supportive climate for PV, and some clever financial thinking, we'd converted a home in need of attention into a renewable-energy powerhouse with a modern skin. □

Andrew Webster is a designer and project manager for Coldham & Hartman Architects in Amherst, Mass. Photos by Charles Miller, except where noted.

Design video: Scan here or visit FineHomebuilding.com for an inside look at this home and those behind its design.

A hint of the modern new plan. *The new foyer provides a clear view through the main-floor living space. Cable rail, ash, and slate build on the exterior palette and set the tone for what's to come: stainless-steel appliances, slate countertops, and pickled-ash flooring. Photo taken at E on floor plan.*

Lessons learned: Project management on the job

All remodels are different because all houses are different. To keep things moving at a predictable (and profitable) pace, it is important to standardize things where possible. Part of that means taking a look at what worked, what didn't, and why. There were at least three take-away items from this project.

1. WATCH CONTINUALLY FOR NO-COST CHANCES TO UPGRADE

When we made the switch to an all-plywood skin, we had the opportunity to change the air-barrier scheme. Primed, taped, and sealed plywood makes an excellent air barrier.

2. THE DEVIL IS IN THE DETAILS

Taping the seams of the sheathing was instrumental in our exterior air-barrier design. All tapes are not the same, however. Some tapes require a primer, and others do not. We couldn't find a local source for the primer, so based on a local lumberyard's recommendation, we went ahead without the primer. Sure enough, the next rainstorm caused our air barrier to fail, which meant that we had to add a thin layer of spray foam inside the rafter cavities to seal the air leaks. Instead of using inexpensive dense-pack cellulose, we had to add an expensive flash coat of spray foam. A little bit of bad advice cost us a lot of money, time, and anguish.

3. BE DILIGENT

The first blower-door test was a shock to us because it came in at 2500cfm at 50 Pa—more than five times higher than we had targeted. With the carpenters, we prepped a checklist of likely problem areas. Together we found nearly 2000cfm of leakage. The final result was 625cfm at 50 Pa.