

Reassembly Required



BY SOPHIE PIESSE

A gut remodel puts a 1915 kit house on the LEED scale while restoring its Arts and Crafts charm

The Bahansen-Herzenberg house was one of several kit homes built in 1915 as part of the first subdivision in Chapel Hill, N.C. Built on what was then a rural street, it's now walking distance from a bustling downtown and the University of North Carolina.

Its owner, Melissa McCullough, had been looking for a fixer-upper to make into a green home when she found this house, which had been abandoned during a renovation. Because it was already gutted down

to the studs and all the mechanical systems were accessible for inspection and testing, we decided to take the home to LEED status.

The house might as well have been condemned. It was partially boarded up and had missing windows and a crumbling chimney. Despite the deserted building supplies and the bathtub on the front porch, however, the bones of a beautiful Arts and Crafts home were apparent.

Melissa and I had worked together before. In designing her previous home, we incor-

porated passive and active solar, Agri-Panel construction, superinsulation, and radiant floors. Here, options were more limited. We had no control over the home's orientation and little influence on the square footage or the wall and roof structures.

We did, however, have a great site that was close to transportation, shopping, and existing infrastructure. We had control over finishes, material use, water conservation, and indoor-air quality. We also had a unique opportunity to see how far that we could take the existing envelope.

With the help of Trip Renn and his crew at Actual Size Builders, we brought this leaky-as-a-sieve home up to a HERS (home-energy rating system) rating of 61 (39% more efficient than code), a LEED-silver certification, and a new life for the next 100 years.

Historic and energy goals align

The first hurdle was getting through the Chapel Hill Historic District Commission, whose approval is needed for any exterior improvements on structures within the district. With the architecture of surrounding homes to draw on and a vintage Aladdin kit-home catalog in our hands, we had the details we needed.

Because Melissa planned to keep within the existing envelope and to restore the exterior as close to the original as possible, the commission welcomed our design. Members were also open to our desire for energy efficiency and the use of modern construction techniques. Details such as energy-efficient casement windows that look like double-hungs and superinsulated walls that look like the original clapboards were welcomed as solutions that met both sides' needs. Minor modifications, such as replicating the original front-porch details on a new back porch and replacing existing rails with nearly identical ones to meet code, demonstrated that it's possible to meet modern requirements and still respect the past.

A tighter, better-insulated envelope

Compared to today's standards, the existing framing on this kit house was pretty minimal. Not wanting to demolish more than necessary, we worked with what we had: 2x4 walls and 2x6 rafters. The siding was in disrepair and covered with lead paint, so it was a simple decision to remove it. We filled the walls with open-cell spray-foam and wrapped the original sheathing with 1-in.

UPDATE AND INSULATE

The 1915 floor plan, shown with dotted lines in the drawings below, had already been altered. The latest remodel added a new bathroom and extended the staircase on the first floor. On the second, a sleeping porch was enclosed and incorporated into the master bedroom, and a second bath was added. The home's double-hung windows were swapped for energy-efficient casements (Jeld-Wen Siteline EX Wood series, photo left) designed to mimic the originals.



Dow Styrofoam to reduce thermal bridging and achieve an R-value of 19. We then added furring strips over the foam to create an air-space over which we mounted new Nichiha cementboard siding. We ended up with a much-better-functioning envelope consistent with the look of the original house.

The original windows had been removed, and most had been left inside. They were covered in lead paint and had single-pane glass, and few had their original frames. New windows were a simple choice. We chose casement windows over double-hungs not only for their tighter seal, but because they could catch more of the breeze for cross ventilation. The aluminum-clad units will not rot or need paint, and their double-pane, low-e insulated glass provides maximum R-value and solar control. While not identical to the original 1915 windows, the new units fit the Arts and Crafts style in appearance, yet meet the energy demands of today.

Built with 2x6s, the roof framing needed extra support as well as insulation. By air-sealing with open-cell foam up to and over the rafters, we gained an R-value of more than 20. The original asphalt shingles were replaced with a 5V metal roof with a baked-on coating. The light stone color is Energy Star rated and reflects 51% of the sun's heat, reducing the heat load on the house.

Chimney condition forces a choice

Melissa wanted a heat-generating fireplace in the living room, but the existing chimney and fireplace presented a host of challenges. In addition to being covered with lead paint, the chimney was too short and too crumbly to function safely. Given its condition, retrofitting it would have been expensive. We solved the problem by swapping the living- and dining-room spaces, keeping the original fireplace in the dining room and building a new, efficient fireplace directly opposite it in the living room.

Having these two visually identical yet functionally different fireplaces enabled us to improve traffic flow, take advantage of the latest technologies, boost energy efficiency, ameliorate the effects of a humid climate, and still adhere to Arts and Crafts styling and details without breaking the budget.

Improving mechanical efficiency

When it comes to LEED, tightening up the building envelope goes hand-in-hand with choosing the right mechanical equipment. In

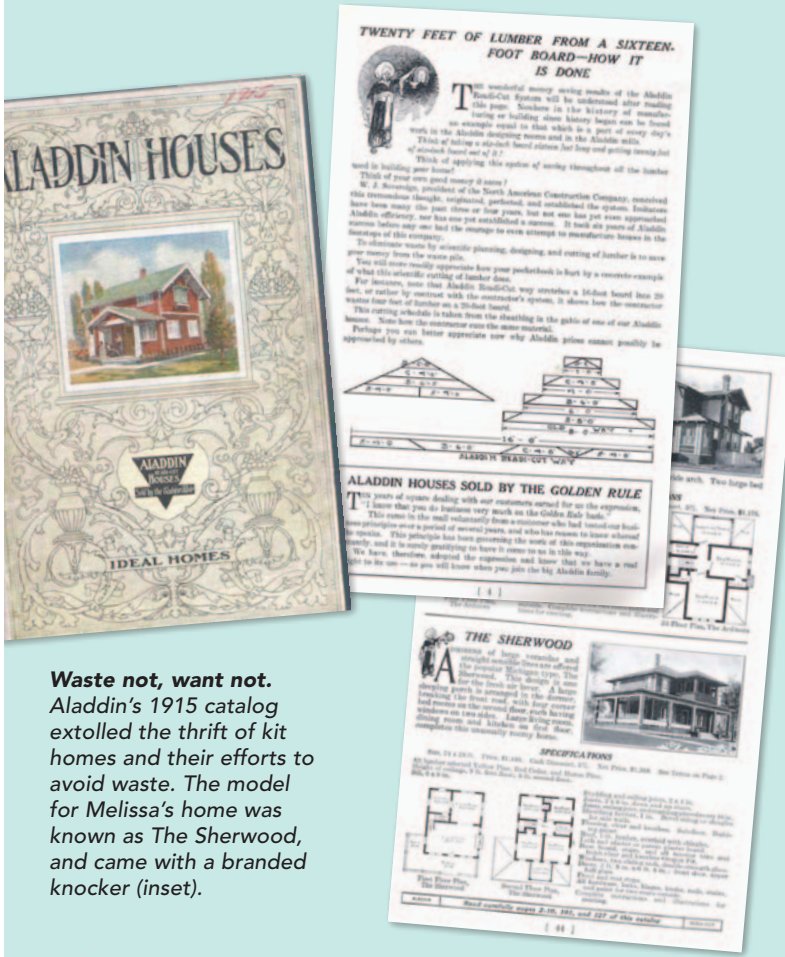


EFFICIENCY VS. AUTHENTICITY

Unable to restore the original living-room fireplace to working condition, the author installed a new, efficient direct-vent gas fireplace directly opposite, then sealed the old fireplace and gave it a door to match the one on the new gas version. Although the look of the original exposed-brick chimney was sacrificed by encasing it in drywall to provide a thermal break and improve insulation, some charm was regained by building a false chimney structure on the opposite wall to match the old. Matching mantels made from the builder's stockpile of red oak were designed to integrate with surrounding built-ins and, in the case of the new fireplace, a remodeled staircase. The transformation was completed by matching the new hearth to the existing brick hearth and surrounding both fireboxes with recycled-content tile.



Smarter stairs open up the space. Extending the staircase to the far wall (photo above) introduced light into the stairwell and created space for a personal art gallery. Moving the landing to the end of the living space also improved traffic flow.



Waste not, want not. Aladdin's 1915 catalog extolled the thrift of kit homes and their efforts to avoid waste. The model for Melissa's home was known as *The Sherwood*, and came with a branded knocker (inset).



Green before their time

It was a delightful experience to give this simple Aladdin kit home a new life. In planning the renovation, we talked about energy and water efficiency, superinsulation, natural ventilation, and the ways we could make this 100-year-old structure green.

When we looked through the original kit-home information, we realized that these were the original green homes. Although Aladdin and other kit makers marketed their homes as being of low cost and high quality, their documentation's emphasis on reducing waste and saving energy means that they were selling green. They minimized waste by thoughtful cutting of trees into the most efficient selections of board feet, and of the board feet into framing members. The wood was cut in the factory, minimizing job-site waste. The climate-controlled environment of the factory yielded dry, stable lumber that was bundled up and sent directly to job sites for fast construction.

These houses were mass-produced, so the kit makers could specify exact quantities of paint, plaster, nails, hardware, and trim. The kit makers may not have considered insulation, but they discussed the use of quality plasterboard on the inside and the sealing of all joints to make their houses tight. We may think that green building is new, but back in the 1910s, low energy costs, minimal waste, and quality construction were sold as common sense.



RECYCLED AND REUSED

Melissa's kitchen is a model of reuse and local sourcing. Wall and base cabinets were recycled from other projects; the island was built using scrap lumber stockpiled by the builder. The storage wall (photo right) is a mélange of salvaged windows, recycled cabinets, and inserts devised by the builder. The vintage cast-iron sink (below) was purchased at a local salvage yard. Richlite, a composite material that contains recycled paper, was used on the kitchen countertops.



Melissa's house, we installed a Lennox XP17 (17 SEER) air-source heat pump, with a separate heat pump for the basement area, which we separated from the main floor by insulating with EnGuard, a product made from recycled soda bottles. Surrounded by masonry walls and two-thirds below grade, the basement acts very differently from the main and upper floors.

Because LEED also rewards water efficiency, all plumbing fixtures are low flow or WaterSense rated, which means they're third-party certified to meet EPA specifications for efficiency. A Rinnai on-demand water heater saves energy by heating water only when needed rather than keeping a whole tank of water hot all the time.

Restored through reuse

LEED also encourages using reused and recycled materials as well as local sources (within 500 miles). Materials original to the house include the five-panel doors (stripped of lead paint), the porch columns, and the claw-foot tub, which was sitting on the front porch when Melissa bought the house. The builder, Melissa, and I pooled our resources to see what we could bring to the renovation. Tile, bamboo flooring, and kitchen cabinets were salvaged from other projects. Locally found old heart-pine flooring was worked seamlessly into the existing floors where needed. When reuse was not an option, new products were selected for their recycled content, such as the fireclay tiles on the fireplace and the Richlite countertops in the kitchen.

We used no-VOC Mythic paints throughout the house. The floor finish was Loba Hybrid, a rich oil finish that brings out the color in heart-pine floors better than water-based polyurethane and has no chemical emissions. We introduced this product to the floor finisher, who now uses it regularly.

LEED also encourages the use of lumber that is certified by the Forest Stewardship Council (FSC). Because it's not readily available here in the small quantities we needed, we decided to go a different route: We found local yellow pine farmed and milled within 100 miles. We could buy in small quantities and get just what we needed. It was not FSC-certified, but we gained LEED credit for supporting a local business. □

Sophie Piesse is an architect in Carrboro, N.C. Photos by Debra Judge Silber, except where noted.

Antique silver: Taking a remodel to LEED

We chose to pursue LEED certification because it is a nationally recognized, all-encompassing program that addresses not only energy efficiency but also site selection, water efficiency, and indoor-air quality, and it encourages the use of locally sourced, reused, and recycled materials. Going through the process has given me a better understanding of what we should do in all our projects, whether we are aiming for LEED or not. It also affirmed a lot of what we already do.

Attaining LEED for a single-family residence that was also a renovation wasn't easy. For starters, LEED requires a large amount of documentation, which is disproportionate to a project of this size.

We also found that the theories behind LEED did not always meet with reality. One example is the required calculation-of-waste factor. A strong component of LEED is minimizing material waste.

To demonstrate that you are minimizing waste, LEED requires that you show how closely the amount of wood estimated for your project compares to the actual amount used. In a renovation like ours, in which the envelope was almost intact and we tried to reuse what we took out, it was near impossible to make this comparison. Because it's a LEED prerequisite, though, we had to figure it out. With a renovation, that meant comparing the amount of lumber required to build the house new with the amount we used to renovate it. The local lumber store estimated that the framing package to build new would cost \$36,000. Our renovation cost \$9000. We far exceeded the requirement, but it took a lot of time to make what seemed like an unhelpful comparison.

LEED also has an adjustment for home size to encourage smaller homes. We had no control over the size of this home, but were penalized because it was more than LEED required per bedroom, even though we used the existing space wisely.

On the plus side, starting with an existing structure did gain us some LEED points by reducing site disturbance—our site work consisted of digging one footing—and, therefore, storm-water problems. The property also had mature vegetation that kept erosion and water runoff to a minimum and eliminated any heat-island effect.

LEED scorecard

LEED-H SILVER points required: 62
Size: 2794 sq. ft. (including finished basement)
Cost: \$187 per sq. ft.
Completed: 2011 • **Location:** Chapel Hill, N.C.
Bedrooms: 4 • **Bathrooms:** 3
Architect: Sophie Piesse
Builder: Actual Size Builders
Insulation: Spray foam and rigid foam (walls, R-19); spray foam (roof, R-20)
Heating/cooling system: Lennox XP17 (17 SEER) heat pump
Windows: Jeld-Wen Sitrine EX Wood series casements
Estimated annual energy costs: heating, \$359; cooling, \$85; hot water, \$222; lights and appliances, \$644; service charges, \$214 (total: \$1524)

CATEGORY	POINTS EARNED/AVAILABLE
Innovation and design	4.5/11
Location and linkages	10/10
Sustainable sites	10/22
Water efficiency	3/15
Energy and atmosphere	20/38
Materials and resources	9.5/16
Indoor environmental quality	14/21
Awareness and education	1/3
Total score	72/136