

Sustainable Building at Habitat for Humanity of the Chesapeake

S. Thiel Butner

Overview

In the words of Habitat for Humanity International,

“The terms sustainable building and green building are used somewhat interchangeably within the building industry and describe a type of construction which focuses on the following three interrelated goals: maximizing energy efficiency, maximizing indoor air quality and conserving natural resources. In the Habitat for Humanity context, the following three statements form the cornerstone of an organizational focus on sustainable building practices:

- Habitat houses should be energy-efficient;
- Habitat houses should be healthy places for our partner families to live;
- Habitat should incorporate building practices and materials that have a positive impact on our natural resources and the environment.”

- *Construction Affiliate Operating Manual (AOM)*

All three of these goals relate directly to our homeowners, our communities, our environment, and our world. Increased global awareness about each of these ideals has influenced HFHI to encourage local affiliates to be world leaders in building affordable, healthy, and resource-efficient housing.

Affordable

Heating and cooling are the biggest burdens on a typical homeowner's utility bills, and petroleum prices will continue to rise. Long-term affordability is important for homeowners with long-term mortgages:

“Habitat for Humanity's mandate is to build simple, decent and affordable houses for our partner families. Traditionally, the word affordable has been principally associated with the cost to construct and maintain a home, rather than the ongoing cost to live in and operate a home. As energy costs continue to rise, however, it has become apparent that the concept of affordability must include all costs associated with homeownership – including energy costs. By expanding our focus from only initial affordability to long-term, all-inclusive house affordability, building a sustainable house can also result in the creation of sustainability for a family.”

- *HFHI Construction AOM*

Affordability is factored into efficiency of appliances and the HVAC system as well as the durability of chosen materials.

Decent

Low income families are the least able to pay for healthcare, and “unhealthy housing” can cause chronic problems:

“Poor building practices and inferior house systems can result in a number of air quality issues, the most common of which are mold and allergens. In addition, off gassing of chemicals (the releasing of vapors) found in certain building materials can contribute to indoor air quality issues. Although these types of invisible issues are certainly not unique to Habitat houses, our partner families deserve the benefit of building practices and materials which will maximize the air quality within their homes.”

- *HFHI Construction AOM*

Non-toxic materials, adequate ventilation, proper drainage, and pest control are all important components of healthy housing. Systems-thinking is important, too: improperly designed wall systems can lead to mold and mildew and improperly sized HVAC systems can adversely affect pressurization and energy bills.

Simple

HFHI outlines eight basic design criteria that set a national standard to ensure housing that it is “safe, healthy, durable and energy efficient.” Simple is not synonymous with budget design and construction, but rather means that houses must be simple to build and simple to maintain. Perhaps “simple” could also mean using resources that tread lightly on the earth:

“The residential building industry has a tremendous impact on energy usage in the United States. According to the Department of Energy, in 2005, the construction and operation of residential properties accounted for 21 percent of our nation’s energy consumption, just behind transportation, at 27 percent. In addition, the construction and maintenance of commercial and residential buildings account for 30 percent of wood and raw materials used in the United States. The effects of residential construction on our environment go far beyond excessive consumption of energy and materials. As one of many examples, sediments from unchecked construction site run-off can result in severe damage to fish and wildlife habitat in streams and lakes. The incorporation of simple practices designed to enhance energy efficiency, limit building material waste and eliminate environmental contamination can fundamentally change the negative effects that residential construction can have on the environment. Habitat for Humanity should be a leader – both nationally and locally – in these efforts.”

- HFHI Construction AOM

Resource consumption can be confronted by improving construction practices. For example, Advanced Framing techniques require less lumber and, therefore, fewer pieces to assemble than conventional framing, while allowing more space for insulation. Choice of products and installation techniques affect a house’s durability as well as its effects on the environment.

“Our first design criterion is the incorporation of affordable solutions for families who can least afford the cost of sophisticated technology, escalating energy costs and environmental conditions that compromise the health of their children.” (HFHI Construction AOM) It has become imperative that HFHC commit to a comprehensive plan for improving its quality of housing.

The Greening History of HFHC

HFHC’s past has been dotted by attempts at moving toward more sustainable building practices, but none of its case studies became standard practice until recently.

In 2003, the Arundel affiliate partnered with the National Association of Home Builders’ (NAHB) Research Center and the Partnership for Advanced Technology in Housing (PATH) of the U.S. Department of Housing and Urban Development (HUD) to build a duplex unit that was built with Energy Star standards in mind. The non-standard materials included ICFs (insulated concrete forms) for basement walls, engineered wood, pre-painted fiber-cement siding, and R-13 wall insulation. Designers located the ductwork in conditioned space and included ventilation for indoor air quality. Builders used some Advanced Framing/ Optimum Value Engineering (OVE) techniques and worked on air sealing the building envelope. Envelope air-tightness was benchmarked with a Blower Door test. The process of this build is summarized in “Final Report for Field Evaluation of Resource and Energy Efficient Construction: Arundel Habitat for Humanity, Annapolis, MD.”

From the beginning, the Chesapeake affiliate has focused on resource-efficient housing: reclaimed and renovated row houses. CHFH reuses as much material as possible and its urban sites give homeowners easy access to amenities like grocery stores and public transit. But houses that were not built with Energy Star standards in mind struggled to meet energy code requirements.

In 2006, Chesapeake partnered with Building America of the U.S. Department of Energy (DOE) and one of its design teams, the Consortium for Advanced Residential Buildings (CARB), led by Steven Winter Associates, to renovate four row houses using Building America's best practices for achieving increased energy efficiency. Green features included half-inch extruded polystyrene (XPS/ blueboard) between existing brick walls and new framing; insulation to Energy Star standards; low-e, double pane, vinyl frame windows; mechanical ventilation; Energy Star appliances; and low-flow fixtures. With careful planning and management, these houses stayed within the budget of a typical rehab. They also surpassed Energy Star standards by 17% and were 32% more energy efficient than new houses built to code. The green features of this build are described in "Efficient Solutions for Existing Homes: Comprehensive Energy Retrofit – Case Study: Chesapeake Habitat for Humanity, Baltimore, MD."

Energy Star houses are built to be at least 15% more energy efficient than the current energy code requires. Energy Star features include: tight construction and ducts, effective insulation systems, efficient heating and cooling equipment, high performance windows, efficient products, and independent testing, as outlined by the Environmental Protection Agency.

Houses built in partnership with Building America use 40 – 100% less energy than average houses, using cost-effective solutions. The ultimate goal of Building America is to provide resources that will lead to cost-effective net zero energy homes, which produce as much energy as they use.

In 2009, the merged affiliate built nine new, modular row house units, with guidance from CARB and Steven Winter Associates. Upgraded HFHC specifications included an unfinished basement with R-10 insulation on the interior, half-inch XPS on exterior walls, more ceiling insulation and a cool roof, more stringent window standards, better air sealing, 13.5 SEER central air conditioner, tight ducts (3% leakage), exhaust-only ventilation, 0.92 EF electric water heater, and compact fluorescent lighting. All aspects of the build, from its modular construction to homeowner habits, were reviewed by CARB in a cost-benefit analysis, though HFHC sometimes chose less-efficient equipment because of the price differences and the affiliate's financing structure. Each unit achieved Energy Star, rating between 63 and 67 on the HERS Index (between 33 and 37% more energy efficient than new houses built to code). They were also built according to the National Center for Healthy Housing's EcoHealth guidelines.

HFHC is currently working to build or renovate all of its houses to Energy Star standards and more than 20 units have received the Energy Star designation. HFHC has struggled with keeping track of which components go into each house (what the efficiency rating of a gift-in-kind HVAC system is and whether appliances are Energy Star qualified, for example), which is important for Energy Star computer modeling. A new design continuum draws from HFHI and Energy Star requirements to outline standards for house layout. A new building specs document keeps track of housing components so that the house will meet Energy Star requirements. HFHC has also had difficulty with standardizing construction practices between sites and across different types of housing. Construction staff is learning about steps and techniques for achieving Energy Star through office trainings and site visits. Cross-communication between sites is also improving. Many green building guidelines are written for new construction; HFHC has confronted many obstacles in renovating gut rehabs to Energy Star standards.