

# Making the Green-Building

LEED for Homes is a new, comprehensive national certification program for green, energy-efficient homes. Builders who've tried it like it, but will it change the way houses are built?

BY SEAN GROOM



## Here's how three houses

**I**n a roadside meadow atop a gentle hill in Bainbridge Island, Wash., sits one of architect Russell Hamlet's recent projects. The two-story red house at the north end of the field evokes a traditional farmhouse but has a contemporary flair. For starters, the roof sports photovoltaic panels, and a bank of solar hot-water collectors braces the patio trellis. Between them, the house should be energy neutral.

Materials—from the framing lumber to the paint to the kitchen countertops—were chosen to limit their environmental impact and to eliminate noxious off-gassing in the house. Building green also takes location into account: This house is just a half-mile walk from the village center. A bus stop on the street connects to the ferry, so car keys aren't needed for the commute to Seattle.

If all this sounds great, consider that a plaque by the front door says that the U.S. Green Building Council (USGBC) rates the house as one of the greenest in the Pacific

Northwest. What more could anyone want? Well, if you're the developer of this spec house, a buyer would be nice.

### Is green the new black?

If you look at the home-building market from a green perspective, there are three types of homebuyers: those who are looking specifically for a green, energy-smart house; those with enough green inclinations that environmentally friendly features would sway their decision between two houses; and those who are interested in getting the biggest, most luxurious house, everything else be damned.

Even among buyers inclined toward green construction, the biggest hurdle green builders face is that most homebuyers don't have the knowledge to evaluate competing claims of greenness. And in the building industry, a lot of people are claiming to be green. For the consumer, it can be a real challenge to pick legitimate green prod-

ucts and services from those that have been "greenwashed."

The USGBC believes its LEED for Homes (LEED-H) rating program will hold builders to rigorous green-building standards and provide benchmarks for consumers purchasing or building a home.

LEED's strength is that the rating is done by a third party. All material selections and construction techniques are documented, and energy performance is tested. A homebuyer doesn't have to take the real-estate agent's or the builder's word that certain construction methods were used. Also, a builder who's serious about energy efficiency and green materials can distinguish himself from peers paying lip service to green building.

A look at three different LEED-certified houses helps to explain how the program works. These houses—a platinum-rated house in Freeport, Maine; Hamlet's gold-rated house in Bainbridge Island, Wash.; and a silver-rated house in Boise, Idaho—were

# Dean's List



made the grade.

participants in the 2½-year LEED-H pilot program. Feedback from the architects and roughly 400 builders involved in the pilot played a significant role in crafting the final standards for the nationwide LEED-H program that rolled out in December 2007.

LEED-H has its critics, but devising a system that provides a comprehensive evaluation of the home-building process from design phase through homeowner possession—one that uses a consistent, meaningful grading scale regardless of locale—is an ambitious undertaking.

## Flexibility suits a variety of climates

LEED-H breaks the home-building process into eight components and offers points in each category for adopting specific practices and/or using certain materials (sidebar p. 97). Although there are a few required measures, architects and builders are free to choose how they want to acquire points depending on site, climate, house design, and budget.

The potential hazards presented by an attached garage are one way to see how LEED-H allows different solutions to a problem. When the garage shares a wall or ceiling with the house, carbon monoxide (CO) and other toxins can leak into the house. As basic protection, the USGBC prohibits HVAC ductwork and equipment in a garage. However, LEED-H offers up to three points for taking additional safety measures.

The easiest way to ensure that carbon monoxide from a running car and fumes from gasoline, paint, or other stored materials stay out of the house is to forgo an attached garage. But with Maine's long, snowy winters, an attached garage makes sense, so the platinum-rated house has one. The builders, Wright-Ryan Construction, took extra precautions to protect indoor-air quality. Sealing all penetrations and joist bays in the garage, painting the walls and ceilings, weatherstripping the door to the house, and installing a CO detector in adjacent rooms

## What is LEED?

LEED is a system developed by the U.S. Green Building Council (USGBC) to encourage the construction of energy- and resource-efficient buildings that are healthy to live in. (LEED stands for **Leadership in Energy and Environmental Design**.) In the LEED for Homes (LEED-H) program, participating houses are awarded points based on materials, construction methods, and energy efficiency. The USGBC awards a LEED rating of certified, silver, gold, or platinum based on the number of points a house accumulates in the 136-point system (see p. 97). The point total for each grade listed here is for an average-size house.



- Certified, 45 points
- Silver, 60 points
- Gold, 75 points
- Platinum, 90 points

The size of an average house increases with the number of bedrooms. By LEED-H standards, an average-size house is 900 sq. ft. (1BR); 1400 sq. ft. (2 BR); 1900 sq. ft. (3 BR); 2600 sq. ft. (4 BR); or 2850 sq. ft. (5 BR). The point threshold in each rating category is lowered for smaller-than-average houses and raised for larger-than-average houses.



From a **construction-methods** perspective, there's nothing new in LEED-H. It's all about encouraging best practices because a **well-built** house is an **energy-efficient** and **healthful home**.



**Look! No headers.** Traditional framing (left) uses a lot of unnecessary wood. Optimum-value engineering (OVE; right) relies on careful structural analysis so that studs and headers are used only where they're needed. That means less wood, more insulation, and reduced thermal bridging.

were worth two points. They received an additional point for installing an exhaust fan in the garage, wired to the garage-door opener.

A car doesn't need to be protected from snow or frost in Bainbridge Island, Wash., but a detached garage that forces an unsheltered trip to the house doesn't make sense in this rainy climate. A carport provides shelter without trapping vehicle fumes, and its construction saved significant money compared to a garage (photo facing page). The carport was awarded three points toward the LEED-H gold rating, the same as no garage or a detached garage.

The silver-rated Boise house gained three points for a detached garage. Boise's dry climate means the walk between garage and house isn't a big concern, and with alley access at the rear of the narrow urban lot, a detached garage on the alley makes perfect sense (drawing p. 99). The garage creates a small courtyard behind the house, and the streetscape is improved by the lack of big blank garage doors lining the front elevations of the five-house development.

### Smart building begins with a plan

Geoffrey Hobert has been building custom houses in Kitsap County, Wash., for 20 years. The gold-rated house in Bainbridge Island was his first LEED project, but he found that the building techniques required were pretty much the same as those he has used on other homes. From a construction-methods perspective, there's nothing new in LEED-H.

Reasoning that a well-built house is an energy-efficient and healthful home, LEED is all about encouraging best practices. A builder who has been reading *Fine Homebuilding* or keeping up with the work of building scientists like Joseph Lstiburek and his crew at Building Science Corporation ([www.buildingscience.com](http://www.buildingscience.com)) for the past few years is well versed in the techniques rewarded by LEED.

While LEED-H encourages the use of sustainable, low-impact materials, the system aims squarely at using resources wisely and efficiently. Architect Russell Hamlet appreciates that LEED-H rewards energy efficiency and careful detailing that extends the life of a house. He believes these factors aren't exclusive to green building: "Focusing on durability and energy efficiency is just good building practice."

Hobert agrees, adding, "LEED forces you to be conscious about the way you build." Consider waste disposal: With LEED, you must have a plan for reducing waste and sorting recyclable materials from garbage headed to the landfill. In addition to submitting plans, you have to document that the plan was followed. If you want credits for going beyond the minimum requirements, you have to submit the weight tickets from the landfill.

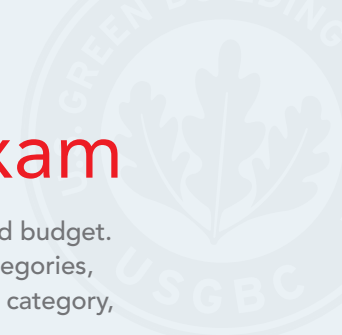
### Navigating the LEED process

Getting a house certified with a LEED rating adds a bunch of paperwork to the building process, and there's a steep learning curve to navigating the point system. Wading through the 114-page packet that explains the eight building categories and the criteria and rationale for each point is a bit daunting, especially because decisions in one category affect choices in other categories. The process also involves working with a LEED-H provider. A provider functions as the local USGBC representative and supplies the third-party rater who verifies materials and procedures and performs energy-efficiency testing. The provider also serves as the architect's or builder's resource to help navigate the LEED system and interpret the criteria for credits.

Providers typically are companies that have been involved in home testing and green-building education, often overseeing Energy Star home ratings and regional green-building programs.

The first step to achieving a LEED-H rating is to meet with the provider and get a preliminary LEED score based on the plans. This forces the designer to map out the path he or she is going to take through the eight building categories before construction begins. Involving the project team in this process earns extra LEED points. The USGBC believes that by involving professionals with design, mechanical-engineering, building-science, and landscape-design skills, it's easier to have an integrated design and building process.

# Take the building exam



**LEED-H grades on a 136-point scale.** Points are offered in eight categories for adopting specific building practices and for using certain materials or products. All homes in the program must adopt 18 mandatory measures. In addition, 16 points must be achieved to meet minimum requirements in four of the categories. Architects or builders are free to choose how they want to acquire additional points depending on variables

such as site, climate, house design, and budget. Below is a breakdown of the LEED categories, the number of points available in each category, and the goals of each category.



## Indoor-air quality starts outdoors.

Unlike a garage, a carport doesn't trap car exhaust where it can work its way into the house. The carport also serves as the gold-rated house's main entrance, keeping elements off the doorway and sheltering a bench for removing and storing shoes before going inside. This feature was worth one point in the indoor-environmental-quality category; shoes can track heavy metals into a house.

**No burn piles here.** The gold-rated house also earned four points for waste management: two for using advanced framing techniques and a detailed cutlist to reduce waste; and two for recycling all wood scraps. The photo shows all the framing cutoffs as they are trucked away for recycling.



- 11 POINTS**  
**INNOVATION AND DESIGN**  
Integrate knowledge of all the trades in the design process, plan to make the most durable house possible, and orient the house for solar design.
- 10 POINTS**  
**LOCATION AND LINKAGES**  
Choose a socially and environmentally responsible site.
- 22 POINTS**  
**SUSTAINABLE SITES**  
Minimize the impact of construction and the house on the site.
- 15 POINTS**  
**WATER EFFICIENCY**  
Conserve water indoors and outdoors.
- 38 POINTS**  
**ENERGY AND ATMOSPHERE**  
Build a well-insulated and tight building envelope with efficient heating and cooling systems.
- 16 POINTS**  
**MATERIALS AND RESOURCES**  
Reduce material waste during construction, and use green products.
- 21 POINTS**  
**INDOOR ENVIRONMENTAL QUALITY**  
Use appliances, installation methods, and ventilation measures to improve indoor-air quality.
- 3 POINTS**  
**AWARENESS AND EDUCATION**  
Compile a homeowner's manual covering the operation and maintenance of the house.



# Green report card



**SIZE:** 1566 SQ. FT. • **Cost:** \$120 per sq. ft. • **Completed:** 2007 • **Bedrooms:** 3 • **Bathrooms:** 2½ • **Location:** Boise, Idaho • **Architect:** Roxana Vargas Greenan • **Builder:** Jay Story • **Insulation:** Walls, R-21 cellulose with spray foam on kneewalls; ceilings, R-38 cellulose • **Heating system:** Forced air with 92%-efficient gas furnace • **Cooling system:** 14 SEER central air conditioner • **Windows:** Milgard double-glazed; U-factor 0.3 • **Green splurge:** Heat-recovery ventilator and Kliptech counters

GREEN RATING	POINTS EARNED/AVAILABLE	
Innovation and design	0/4	Energy and atmosphere 8/29
Location and linkages	9/10	Materials and resources 15.5/24
Sustainable sites	14/14	Indoor environmental quality 6/14
Water efficiency	7/12	Awareness and education 1/1

**Total score**  
**60.5/108**



**SIZE:** 1886 SQ. FT. • **Cost:** \$280 per sq. ft. • **Completed:** 2007 • **Bedrooms:** 3 • **Bathrooms:** 2½ • **Location:** Bainbridge Island, Wash. • **Architect:** Russell Hamlet • **Builder:** Geoffrey Hobert • **Insulation:** Soy-based spray foam; R-22 walls, R-42 ceilings • **Heating system:** Radiant floor and woodstove on first floor; auxiliary electric heat on second floor • **Cooling system:** None • **Windows:** Pella double-glazed; U-factor 0.34 • **Green splurge:** 8kw PV solar panels (\$41,000) and solar hot water (\$9000)

GREEN RATING	POINTS EARNED/AVAILABLE	
Innovation and design	0/9	Energy and atmosphere 35/38
Location and linkages	4/10	Materials and resources 10/14
Sustainable sites	16/21	Indoor environmental quality 10/20
Water efficiency	8/15	Awareness and education 2/3

**Total score**  
**85/130**



**SIZE:** 3200 SQ. FT. • **Cost:** \$230 per sq. ft. • **Completed:** 2006 • **Bedrooms:** 4, plus office • **Bathrooms:** 2½ • **Location:** Freeport, Maine • **Architect:** Richard Renner • **Builder:** Wright-Ryan Construction • **Insulation:** Walls, R-21 dense-pack cellulose; ceiling, R-49 loose-fill cellulose • **Heating system:** Radiant floor and woodstove • **Cooling system:** None • **Windows:** Thermotech triple-glazed; U-factor 0.15 • **Green splurge:** 2kw PV and solar hot water (\$30,000)

GREEN RATING	POINTS EARNED/AVAILABLE	
Innovation and design	9/9	Energy and atmosphere 27/38
Location and linkages	3/10	Materials and resources 14/14
Sustainable sites	15/21	Indoor environmental quality 15/20
Water efficiency	10/15	Awareness and education 2/3

**Total score**  
**95/130**

[FineHomebuilding.com](http://FineHomebuilding.com)

Visit the Magazine Extras section of our home page to see the entire LEED-H scorecard for each house.

Architect Russell Hamlet and builder Jay Story say it's worth doing this to ensure the project runs smoothly. Team members can weigh in on how the choice of systems or techniques will affect their area of expertise. They also say it's critical that the builder and subcontractors are included from the beginning to ensure that each trade uses appropriate materials and installation methods, that waste is disposed of properly, and that everything is documented. For instance, Story, who built the silver-rated house in Boise, had to find a new painting contractor; his regular guy wouldn't use the new low/no-VOC paint.

Because of the documentation required with all purchased and discarded materials, everybody working on the house must be aware of their responsibilities and that their follow-through is needed to get LEED points. This includes things as simple as the plumber not parking his truck on areas of the site designated "undisturbed," and as mundane as the drywall crew documenting that the gypsum board has recycled content and that they separated their waste cutoffs and their Coke cans for recycling.

## Choosing a site

LEED-H attempts to reward thoughtful land development by considering the social and environmental impact on the neighbor-

hood. The Boise house embodies much of what the point system rewards: It's on an infill lot within a quarter-mile of community resources like grocery stores, banks, gyms, and post offices; it's a high-density development; and it's within a half-mile of public green space and public transportation. It also received all 14 of the available points for a sustainable site. The bulk of them (8 points) came from limiting turf on the lot and from minimizing the use of irrigation.

Wright-Ryan Construction faced a much different scenario with its 2.6-acre rural Maine lot. The site wasn't eligible for many of the credits available for lot location, but the team did pick up a few points for not disturbing wetlands or building in a floodplain or on agricultural land.

To mitigate the effects of development, the property has a permeable gravel driveway that absorbs water runoff. Even with a septic system installed, more than 40% of the site was left undisturbed. Excavated and trafficked portions were replanted with a mixture of native wildflowers and drought-resistant fescue grass. In his market area, Tom Wright says, the landscaping often gets a double take from people looking at the house: "A large, green lawn is taken for granted around here." However, he believes the landscaping is a strong selling point among potential buyers looking at the house specifically because of its green qualities.

**Building smaller** minimizes resource consumption. LEED-H takes it a step farther by encouraging **high-density development, such as infill building,** that takes the social and environmental impact of the building into account.

But it's among this very group of most-likely purchasers that the house's size might be something of a hang-up.

### Bigger houses require more points

Feedback from prospective buyers walking through the platinum-rated house in Maine suggests that those interested in a green home are put off by the 3200-sq.-ft. size. They want a smaller house that uses fewer resources. The irony, of course, is that Wright and architect Richard Renner were planning a smaller home until consultations with several real-estate agents convinced them that a larger house would sell more quickly.

Building larger made it more difficult to get a platinum rating. The threshold for each rating (certified, silver, gold, platinum) varies depending on the size of the house. The USGBC theorizes that as a home's size doubles, energy consumption increases by one-third and material consumption increases by one-half. Waving its mathematical wand over the LEED-H point system, the USGBC decided that the point adjustment for each doubling in house size equals one-third of the combined points available in the energy-and-atmosphere (38 points) and materials-and-resources (16 points) categories. What did this mean for our case-study houses? The gold-rated Bainbridge Island house (3 bedrooms, 1886 sq. ft.) fell in the neutral size category that LEED-H established for an average-size house (sidebar p. 95).

The reward for building a smaller-than-average house is a credit that reduces the number of points needed for each rating. Under the LEED-H pilot program, the three-bedroom, 1566-sq.-ft. silver-rated house in Boise received a four-point credit. (Today, it would receive a five-point credit.) Conversely, to overcome the impact of its larger size, each rating threshold for the platinum-rated house in Maine was raised four points. (In the current system, the house would be penalized only three points.)

### Tight envelopes save energy

If you want a house to be an energy miser, you have to create a tight, well-insulated building envelope and pay attention to how the HVAC system is installed. LEED puts a lot of emphasis on these details, and that's reflected in the points that can be earned in the energy-and-atmosphere category. All houses must meet Energy Star-qualified home standards, and points are awarded for additional improvements. The teams behind the Maine and Washington houses went after the lion's share of points available for energy efficiency, while the Idaho house's team was more selective (and cost conscious)



### Revitalizing neighborhoods.

Jay Story built five small LEED-H silver-rated houses on an infill lot in an emerging neighborhood in Boise, Idaho. At 1566 sq. ft., each three-bedroom house didn't use a lot of building materials and doesn't require much energy to heat and cool. The efficiencies don't end there: Infill building limits sprawl, uses existing infrastructure, and lets people live closer to work. Plus, the houses inject new life into the neighborhood.

about the investments that it made.

Each LEED house is evaluated with a blower-door test to assess the building envelope, a duct-blast test to evaluate the duct-sealing, and additional testing and modeling to generate a Home Energy Rating Standards (HERS) Index score. Using the 2006 International Energy Conservation Code as a baseline of 100, the HERS Index is a scoring system where each point below the baseline represents a 1% improvement in efficiency over the code's requirements. For example, a house with a HERS Index of 65 is 35% more efficient than the code.

The Maine house has a HERS Index of 42. This rating was reached by filling the walls and ceilings with dense-pack cellulose insulation to create a highly insulated shell with very little air leakage through the walls (drawing p. 100). When houses are this tight, ventilation is important to maintain healthful indoor air. All three houses have dedicated ventilation systems with a heat-recovery ventilator and filtration.

It's not just large, expensive feel-good items like photovoltaic panels and solar hot water that reduce the Maine house's energy costs. The most-efficient windows possible, in this case triple-glazed fiberglass windows ([www.thermotechwindows.com](http://www.thermotechwindows.com)) with the proper solar-gain coefficient for their location, don't add much to the cost of the house but help it to be an energy miser.

While the gold- and platinum-rated houses target the upper end of the market with asking prices in the \$800,000 to \$900,000 range, the



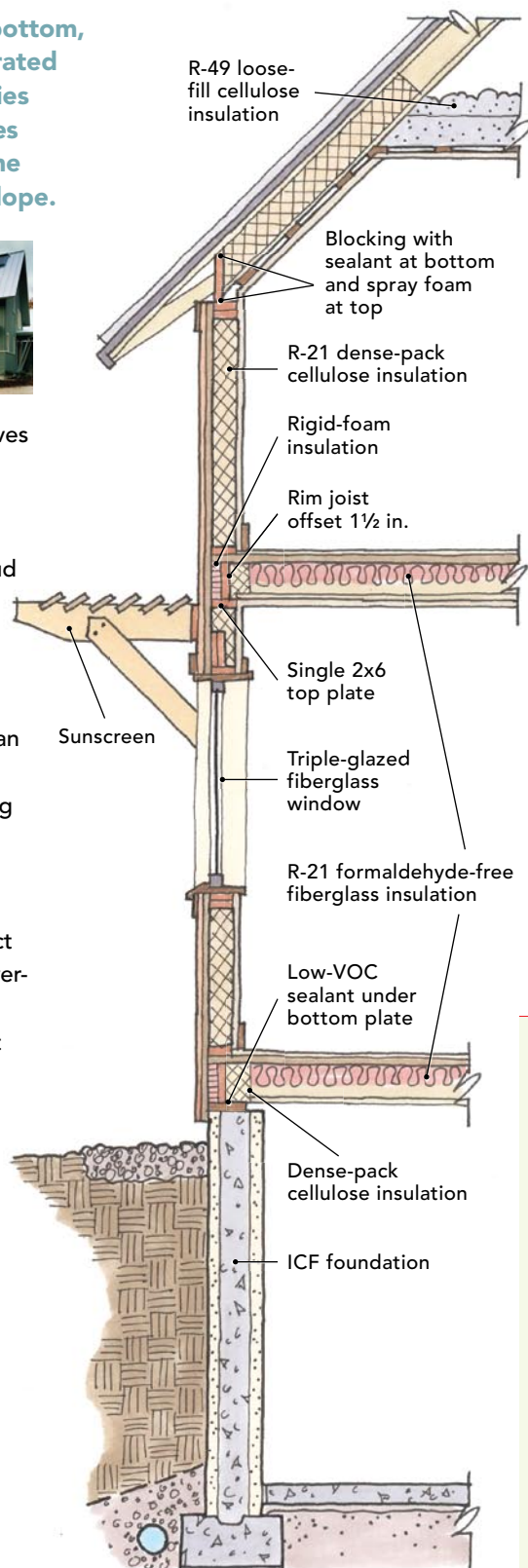
## LEED houses are required to meet Energy Star standards.

Extra points are available for exceeding the guidelines with an improved building envelope, advanced framing techniques, and better insulation.

From top to bottom, the platinum-rated house embodies a best-practices approach to the building envelope.



The framing leaves more room for insulation with 24-in. on-center spacing, two-stud corners, and offset rim joists. Damp-spray, dense-pack insulation does an excellent job of filling and sealing wall cavities. To make sure they didn't miss anything, the project team did a blower-door test before the drywall went up so that any leaks could be filled.



silver-rated house in Boise was built to be affordable with a listing price of about \$250,000. It doesn't have expensive solar panels, but it meets the standards for an Energy Star home, and its design and construction team sought out cost-effective areas to exceed the standards. The careful installation of a combination of dense-pack cellulose and spray-foam insulation exceeded the required HERS standard, and the windows and the HVAC system are both at least 10% more efficient than the Energy Star standard.

### Green materials aren't one size fits all

When it comes to material choices, LEED-H encourages the use of green materials by awarding points for those that are durable, sustainable, recyclable, healthful, and locally sourced. A construction component is also hidden in here. Using materials responsibly means using only as much of a product as necessary. Framing systems that use less material, such as optimum-value engineering (OVE) or structural insulated panels (SIPs), are favored in the LEED-H ratings. If a house is stick-built, comprehensive framing drawings and a detailed cutlist and lumber order are worth additional points. Houses framed off-site, either as modular homes or as panelized packages, are also deemed more efficient than those built with traditional framing methods.

All three of the profiled houses benefited from advanced framing techniques with 24-in. stud spacing, minimal headers, and two-stud corners. Architect Russell Hamlet is proud of the fact that the entire gold-rated house has only two headers. Not only do these framing strategies reduce the amount of wood used, but they also improve the building's energy performance by reducing thermal bridging and creating space for more insulation.

Critics of LEED-H are quick to point to its list of green materials when they complain about the program. They'll ask, for example,



## How much does

The USGBC's target cost for a LEED rating is under \$1000. But we're not there yet.

The fees for the houses in this article ranged from \$2088 for the Boise, Idaho, house to \$3500 for the house in Bainbridge Island, Wash.

When the USGBC first started to develop a residential LEED program, the organizers envisioned that the majority of participants in the program

would be production builders. There are economies of scale when you design a model and build variations of it. Plus, approved builders in a production setting can test a sampling of houses to verify the performance.

"What's really surprised us," says LEED-H acting director Jay Hall, "is the number of custom builders who are building LEED homes." When each

how bamboo flooring, which is shipped halfway around the world, can be a preferred material. Jay Hall, acting director of LEED-H, responds that the LEED program is an evolutionary standard and that as his group figures out ways to quantify components like embodied energy, ratings of materials will evolve.

Currently, LEED's environmentally preferred products are chosen for three qualities: sustainability or recycled content, low volatile-organic-compound (VOC) emissions, and local production. As a consequence, concrete, which is energy intensive to produce, can earn a half-point if it contains at least 30% fly ash or slag and another half-point if it's produced within 500 miles of the job site.

It's important to remember that LEED-H should not be a design-by-numbers approach to building. Neither concrete nor bamboo is required. There are many other material choices that can earn points, and the LEED checklist is not an excuse for an architect or builder to turn off his or her brain and stop thinking critically about what products work best and are greenest in a particular project. For a material like concrete, which is used in almost every new house, an incentive to use fly ash in the mix is not a bad thing.

### Will buyers demand LEED?

The question on the minds of both homebuyers and builders is, how much does building green cost? The answer: It depends.

Jay Story's modest infill houses in Boise are similar in size and finishes to other infill houses he has built without trying to build green. He figures the cost premium to build the LEED-H silver-rated houses was about 20%. That's right in the ballpark of figures that people throw around when talking about the added cost of building green. The problem is that although these are the numbers everybody focuses on, they don't tell the whole story.

Rather than asking what the house costs, people should ask about the cost of ownership. LEED-H is designed to build a healthful house with stingy energy consumption. It's hard to put a price on improved indoor-air quality as a result of formaldehyde-free cabinets, paint that doesn't off-gas VOCs, and no carpets to trap pollen and support dust mites, but if you have a child who is sensitive to these irritants, a 20% premium seems modest.

Energy costs, however, are quantifiable. Not only is the platinum and house likely to be 60% more efficient than its neighbors, but the Washington house is expected to be energy neutral. Think of that: no utility bills. (Yes, the owner will have to pay for some electricity during overcast winter months, but during the summer, the electric meter should run backward and the two should balance out.) Shouldn't you expect to pay more for a house that can save that much energy? If you consider the slightly higher price of the house as payment for energy consumption over the next 20 or more years, and if you factor in that this payment is tax deductible (unlike a typical energy bill) because it's part of your mortgage, it looks like a bargain.

Each of the three houses profiled in this article was built as a spec house. And although each generated a lot of interest at open houses, as of March 2008, no one had signed a contract yet. These days, it's tough to pinpoint exactly why a house lingers on the market. Is it the house, the price, or market uncertainty?

With rising energy costs and the growing interest in green products, it would seem that LEED for Homes is a program whose time has come. But the fact that these three houses in three different markets and two very different price ranges didn't sell right away might indicate that in a cautious real-estate market, prospective homebuyers are falling back on traditional metrics like dividing the asking price by the square footage. Or it might be that people don't know what a LEED rating means. Production builders putting up developments of LEED houses are more likely to advertise the homes as Energy Star-qualified than LEED-certified.

If LEED is going to become the nation's leading green-building program, it has to expand its brand recognition. It seems as if LEED could benefit from some early adopters who are willing to put their money where their social consciousness is so that their friends and neighbors can learn what makes a LEED house green and what the benefits are of living in a green house. If early adopters are the answer, then the unexpected prevalence of custom-home builders vying for LEED-H certification might be the program's saving grace. □

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## it cost?

home is a one-off, expenses are higher.

A LEED rating requires \$600 in registration and certification fees paid to the USGBC. The rest of the fees are for testing and verification by a third-party rater. The USGBC doesn't set these prices; they are dictated by the market. As the number of LEED providers and raters increases, the costs might drop somewhat.

Testing fees, however, can add up. The Bainbridge Island house required enough expensive testing and modeling to show how its solar system offset the all-electric heating that the costs might have had an impact on its final LEED rating.

Even though the house had enough potential points in the "maybe" column to rate a platinum score, the developer decided that a gold rating was good enough and opted not to pay for the testing needed to get the additional five points.

The expense of testing doesn't take into account the amount of time required for research and documentation by the architect and/or builder. The added paperwork includes requesting and filing documentation from suppliers and from waste and recycling haulers as well as locating materials and contractors that meet LEED requirements.

Architect Russell Hamlet says the learning curve can be pretty steep. According to Hamlet, his first LEED project

probably required an additional \$8000 to \$10,000 worth of his time. A second LEED house would not take as much time, and "doing multiple houses based on the same model would make the LEED documentation a minor commitment," he says.

Builder Jay Story's experience bears this out. By the time he got to the last three houses in his five-house project in Boise, he had the LEED-H paperwork down to about eight hours of solid effort.