



Green:



# A FACTORY-BUILDING PERSPECTIVE



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*Manufactured Housing Research Alliance*

Hardly a day goes by without the public press (and increasingly the construction press) covering the growing enthusiasm for a “greener” lifestyle. In combining the personal (desire for a healthy living environment) with the altruistic (taking action to slow global climate change and conserve vanishing resources), being green is doubly virtuous. For a fast-growing cross-section of Americans, buying a hybrid car or a green home taps into the desire to make a very visible and personal statement about protecting the environment.

**W**hile it may feel as if green entered the public consciousness only in the past few years, the focus on total resource conservation took root well over a decade ago. At that time, energy dominated the discussion of resource conservation. As a result, energy performance is deeply ingrained in today’s home design and buying process. Most Americans recognize, for example, that Energy Star is the mark of superior energy performance and most manufactured home builders have qualified their plants to build Energy Star homes.

At the same time, energy practices and standards are strengthened on an almost annual basis in the inexorable march toward “net” zero-energy use when new homes will generate as much energy as they consume. While commercially viable, zero-energy homes may be a decade away, working prototypes are already in operation.

The new push for “green” extends this idea of measuring and methodically reducing the use of all resources used in the construction and operation of a home, not just energy. As was the case with energy, benchmarks are emerging that establish best practices in and practical limits on the use of all types of building-related resources.

So what does all this mean for the factory-building industry? Will manufactured and modular homes be recognized and

accepted as green homes? Are there ways that manufactured and modular home builders can accelerate the adoption of green building practices into the factory-building process in order to build green homes that can reach new markets?

#### **What is Meant by Green?**

A green home uses less energy, water, and natural resources; creates less waste; and is healthier for the people living inside. Seems simple enough, but there is much debate about how much less of each and against what benchmarks the savings are measured. Despite the fact that programs encouraging green construction have been around for over a decade, there is little consensus as to the features that characterize a green home, often with good reason. For example, in areas where the availability of water is a critical planning issue, there is likely to be more emphasis on water conservation strategies.

#### **Where From Here?**

What continues to propel energy efficiency forward is a mix of three factors: experimenting with and perfecting new technologies by “cutting edge” practitioners that push the limits on what is technically feasible (such as zero-energy homes); voluntary incentive programs that typically underwrite part of the cost of exemplary efficiency practices stimulating the market (think

Energy Star tax credits): and ever-tightening regulations that continue to move up the baseline for energy performance.

With energy efficiency, fragmented efforts by pioneers came first. These evolved, were rationalized and became the foundation for regional and national energy standards, codes and best practices. The evolution of energy efficiency from an afterthought to a central theme in home design was in fact a dynamic process. Along the way there was (and continues to be) a good deal of technical debate and consensus-building that eventually lead to widely accepted benchmarks, like the International Residential Code and the HUD-Code standards. Widely accepted benchmarks are particularly important to companies that build in one location but distribute their products to many sometimes far-flung market areas.

Green will probably follow the same trajectory as energy efficiency and be

driven by a similar combination of forces. Missing from the mix at the moment, except in a few communities, are mandatory green provisions. But with pent-up consumer demand, voluntary green programs have begun to proliferate and the market has been quick to respond. An NAHB survey of local home building associations found that more than 97,000 homes have been built and certified by voluntary, builder-supported green building programs around the country since the mid-1990s (with a 50 percent increase since 2004) and project that by the end of this year one-half of all companies engaged in home construction will describe themselves as a "green" builder.

The patchwork of community and state-based green programs—often with location-specific technical requirements and occasionally offering financial assistance (such as tax breaks)—mainly appeals to small builders who can readily

customize designs to meet local market demands. Larger companies hoping to tap into the growing demand for green homes across markets need to stay abreast of and weigh in on developments at the national level, particularly model guidelines or standards. The Manufactured Housing Institute and the National Modular Housing Council are actively engaged in these national efforts. As with the IRC, these models serve as a template for any local, state and federal government agency looking to promote or set standards for green construction.

Although several organizations have attempted to garner support for their approach to setting the rules for green construction, the efforts of two organizations, the U.S. Green Building Council (USGBC) and the National Association of Home Builders (NAHB), appear to be gaining the most traction. In February 2007, USGBC updated its residential



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green guidelines referred to as LEED-H (LEED for homes) and early in 2008 the National Green Building Standard (NGBS) is scheduled to be released, developed under the ANSI rules with NAHB serving as the secretariat.

### Common Themes, Common Drawbacks

LEED-H and NGBS offer concrete guidance on ways to conserve resources in home construction. These documents have analyzed the entire building process and created a flexible formula for building homes that are by any measure exemplary in their use efficient use of resources. And, while there are substantial differences between two systems in how they weigh the value of alternative green practices, they also share, in their current form, some traits that may limit their value or provide stumbling blocks, particularly for factory builders. These include the following:

- **Points-based compliance.** Both systems are based on accumulating points. The actual assignment of points to resource efficiency measures is based to a great degree on consensus judgments. In awarding points for various practices, the authors of both systems do not appear to have fully recognized the inherent resource efficiencies associated with factory construction, such as efficient use of materials and labor, the savings in energy used in the building process, and the minimization of waste generated by the building process.

- **Complex process.** Both LEED and NGBS, in their desire to be thorough and balanced, engender a rather cumbersome and potentially costly compliance process, although the NGBS is far less so than LEED. Hopefully, experience will yield best practice prescriptive options containing the most effective and least costly combination of measures needed to build green.

- **Multiple levels of compliance.** Both systems provide for multiple levels of

green. The NGBS offers three levels: bronze, silver and gold. LEED adds a fourth tier, platinum. Will homebuyers really notice? Multiple levels are problematic for marketing programs aimed at customers bombarded by marketing messages. EPA got it right with Energy Star: need a clear definition of whether or not a home is energy efficient—look for the Energy Star label. In time, green

will simplify too when building science share the podium with marketing reality. In the meantime, adjust your thinking to multiple levels of goodness.

- **Site requirements.** Both programs contain requirements relative to the site; although with the LEED-H green conforming site provisions carry more relative weight. However, coordination with

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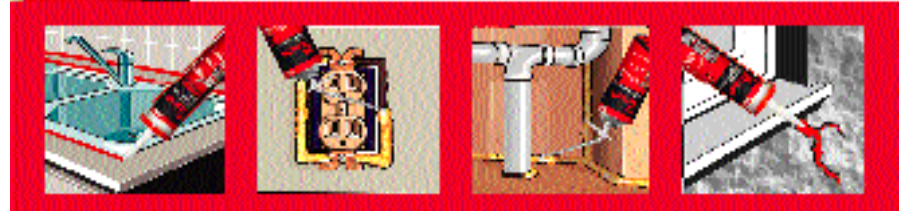
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the local builder or retailer will be required with the NGBS, too. Furthermore, manufacturers confined to selecting measures they control at the plant may miss opportunities to earn lower-cost points for measures done in the field, putting plants at a disadvantage compared to site builders.

- **Energy Star.** LEED-H requires the home carry an Energy Star label. NGBS offers points for Energy Star, but does not require it.
- **Indoor air quality (IAQ).** IAQ is a major portion of both programs. HVAC and materials (such as materials with low volatile organic compounds—VOCs) requirements may add significantly to the cost and/or limit material choices.
- **Administrative costs.** Verification costs can be high for LEED-H and it is too early to predict the costs of complying with the NGBS.
- **Mandatory requirements.** LEED-H contains numerous mandatory requirements that are outside of the plant's control such as no invasive plants used in landscaping, erosion control provisions made during construction and providing homeowner training in the operation of the home's systems.

### CASE STUDIES:

#### Innova Homes, LLC Asheville, NC

##### Principal: David Bennert

David Bennert, a modular builder based in Asheville, N.C., first got involved with green building largely due to the efforts of several organizations, including the Western North Carolina Green Building Council, the North Carolina Solar Center, Western North Carolina Green Building Council and North Carolina HealthyBuilt Homes program, to encourage local builders to consider green, what he jokingly calls “peer pressure.”



The first modular home certified by the N.C. HealthyBuilt Homes program. Photo: Marmol Radziner Prefab.

Bennert's company, Innova Homes, LLC, specializes in in-fill development in Asheville and works with customers and modular manufacturers to design and build custom modular homes within a 60 mile radius. The company builds about seven homes a year at a cost of around \$100,000 to \$250,000 (without land and profit). All Innova homes are Energy Star-qualified and constructed to meet the N.C. HealthyBuilt Homes program requirements.

The North Carolina HealthyBuilt Homes Program provides a third-party certification certificate for homes meeting “green home guidelines” built by residential builders who practice sustainable, high-performance building strategies that make the home a comfortable, healthy and affordable place that reduces energy and water usage, promotes renewable energy use and helps protect the land where the home is built.

According to Bennert, the first home they built to achieve green certification was an experiment and a learning process. He estimates that the additional cost (above Energy Star) to build that first home was around \$10,000, including time spent on research, documenta-

tion and certification. Now that they have gone through the process several times, understand and keep records of all the required documentation on products and materials, their additional costs have come down to between \$2,000 and \$3,000 per home for the basic certification.

The four to five modular companies Innova works with offer features, such as low-e windows, Energy Star-compliant construction options and keeping documentation on construction materials, which help the final home achieve points towards green certification. But to meet local green standards, Bennert must specify and field-install some products normally provided by the plant, such as formaldehyde-free oriented strand board, low VOC paints, cement-board siding, sustainable flooring materials, and recycled-content materials.

To avoid doing in the field what could be accomplished more cost effectively in the plant, Bennert encourages modular manufacturers to consider supplying more of the specialty green finishes and to use engineered lumber, finger-jointed studs and recycled-content insulation, drywall and roofing materials.

**Marmol Radziner Prefab**  
**Los Angeles, CA**  
**Principals: Leo Marmol and**  
**Ron Radziner**

Marmol Radziner Prefab is a small-volume modular home producer based in Los Angeles, Calif. that specializes in high-end, contemporary designs. Being green was a core corporate goal from the onset and shaped decisions about every aspect of its home designs. The basic structural system consists of recycled steel framing infilled with structural insulated panels. The company builds all of its homes to meet LEED guidelines.

Although the company started with site building, it gravitated to factory construction because of the plant's inherent advantages for using resources efficiently, including minimizing waste due to precise cutting and the ability to easily recycle excess materials; reducing noise, dust and damage to existing site landscape and neighborhoods; and for centralizing trades, reducing vehicular emissions from travel to construction sites. In fact, Marmol Radziner has evolved a more extensive definition of green that goes well beyond the measures included in the LEED program, such as educating clients and striving to strike a balance with environmental responsibility, affordability and aesthetics in all its projects. The company either uses in-house staff or local contractors to finish the homes, but in either case, it has hands-on quality control over the finished product.

Marmol recognizes that the market for green is growing quickly and buyers are willing to pay a premium to live in a green home. Their average home cost for a basic green home is \$250/sf for interior modules and \$130/sf for deck modules. Standard features include items such as tankless water heaters, Energy Star-rated appliances, open floor plans to take advantage of natural cross ventilation and high efficiency windows. Big ticket upgrades, such as solar panels and geot-



hermal heating systems, also are available.

As these two case studies suggest, a few companies are beginning to look to factory-built homes as a source of green homes, driven, in part, by the realization that building in a factory is inherently a resource efficient and, therefore, green approach to home construction. These efforts are at the periphery of mainstream factory-building in terms of price, style and method of home assembly. However, they suggest some of the challenges that factory builders will face as they convert their homes and building practices to green, particularly in the selection of materials, control over the land development and completion of the

home on the building site.

The "green" train has left the station and the serious debate within the building community is not whether, but rather when and how to jump aboard. The smart money is on fully engaging this opportunity early on and for the industry to proactively promote and build green homes; steps that will help future buyers recognize the intrinsic resource efficiencies of building homes in factories. ■

*For updates on developments with green building, visit the Manufactured Housing Research Alliance Web site at [www.mhrahome.org](http://www.mhrahome.org).*