

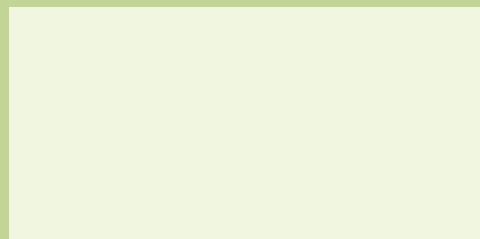
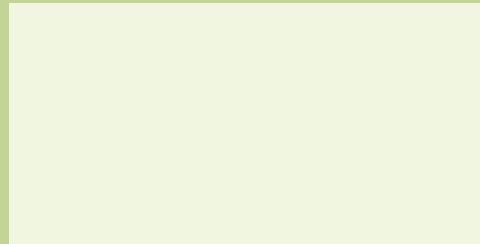
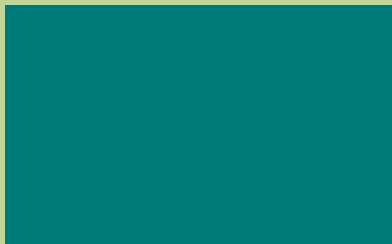
**McGraw Hill**  
**CONSTRUCTION**

# Residential

## Green Building SmartMarket Report

*Design & Construction Intelligence*

2006  
Residential  
Green Building  
Issue



connecting people\_projects\_products

Produced in conjunction  
with the National Association  
of Home Builders



# Introduction

Harvey M. Bernstein, Vice President, Industry Analytics & Alliances  
McGraw-Hill Construction



“...the ‘green homes’ of today will become the standard homes of tomorrow.”

We are excited to bring you the latest issue in our SmartMarket Report series. This issue, a product of recent market research conducted by McGraw-Hill Construction in conjunction with the National Association of Home Builders (NAHB), focuses on the Residential Green Building market.

The results you will find in this report exceeded our expectations of the involvement of home builders in the growing trend of “green” design and construction. On page 9 you will note that we discovered green building will reach its “tipping point” by 2007 using conservative estimates. This is profound. As any industry crosses from being “less involved” to “more involved,” it means the rest of the industry will be forced to follow, and the “green homes” of today will become the standard homes of tomorrow.

This is the second recent study we have conducted on green building. As we shifted our focus from green commercial buildings to residential construction – or to the home building population, we found a great number of differences and some similarities between commercial construction and residential. We have pointed some of those out where applicable. What was most notable was the faster rates home builders are adopting green practices compared to their counterparts in commercial construction. Additionally, the types of green building activities builders are engaged in are more community and politically based than their commercial counterparts, who tend more toward green building professional development and educational activities.

All in all, the results are groundbreaking. They confirm the findings of our previous study that green building is moving mainstream – that it is a growing trend. NAHB, with the release of its *Model Green Home Building Guidelines*, is seeing builders across the country building homes that are more efficient and better performing: homes that protect the well-being of their occupants as well as the environment.

This report takes the reader through today’s residential green building marketplace. We begin by outlining the advantages of green homes, a section we hope will encourage builders to make the case (if they aren’t already) to their customers – homeowners and homebuyers. The next several sections present and analyze data collected through the recent study conducted by McGraw-Hill Construction’s Research and Analytics Group with support from NAHB. The study analyzes a representative sample of the more than 75,000 builders – both small and large – comprising today’s home building firms. In addition, there are other features including an overview of NAHB’s *Model Green Home Building Guidelines* and profiles of a few examples of green homes.

We hope you find the residential green building market opportunities as exciting as we do. As we move forward, McGraw-Hill Construction is committed to continuing its role as the “voice of the industry” and serving as a clearinghouse for green building information, resources, and expertise through our publications, analytics work, and the MHC Network database of construction projects and products. We look forward to helping our partners and the construction industry learn more about the green building marketplace.

For details on the methodology behind the analytic research results, see page 25.

Harvey M. Bernstein has been a leader in the engineering and construction industry for over thirty years. He is a frequent speaker and has written numerous papers covering innovation, energy conservation and sustainability in the built environment. He has co-authored the book *Solving the Innovation Puzzle: Challenges Facing the Design and Construction Industry*.

# Table of Contents

## Introduction

## 4 Market Summary

## 6 Advantages of Green Homes

## 8 Market Demand for Green Building

- a) General Outlook
- b) Market Size
- c) Residential Green Building Activity
- d) Tipping Point and Critical Mass
- e) Motivation for Residential Green Building
- f) Customer Willingness to Pay
- g) Triggers to Increased Residential Green Building
- h) Obstacles to Increased Residential Green Building

## 14 Green Home Building Certification and Voluntary Programs

## 16 Methods and Practices

- a) Residential Green Building Options
- b) Importance of Specific Residential Green Building Options
- c) Use of Specific Residential Green Building Methods and Practices

## 19 Project Profile: Green Building VISION House

## 20 Residential Green Building Products

- a) Product Availability
- b) Concerns about Greenwashing
- c) Market Penetration

## 21 Project Profile: Production Builder - Pardee Homes

## 22 Project Profile: Custom Builder - Don Ferrier

## 24 Viewpoints:

- a) Small Builders
- b) Larger Builders

## 26 Resources

### Photos Courtesy of NAHB reflecting winners of the 2006 National Green Building Awards.

Front Cover (Clockwise from top right): Remodeled Home of the Year – Seville Consulting of Decatur, Georgia; Green Homes Marketing Program of the Year – Lakewood Ranch Communities, LLC of Bradenton, Florida; Custom Home Builder of the Year – SunTerra Homes of Bend, Oregon; Single-Family Concept House – Andersen Sargent Custom Builder, LLC of Waxahachie, Texas (center)

Page 9: Program of the Year – Wisconsin Environmental Initiative and its Green Built Homes Program (Madison Area Community Land Trust)

Page 20: Remodeled Home of the Year (interior) – Seville Consulting of Decatur, Georgia

Page 25: Multifamily Home Design of the Year – Hickok Cole Architects of Washington, DC

The New American Home ([www.buildersshow.com](http://www.buildersshow.com))



Photo: James F. Wilson

# Residential Green Building Market

Results reported in the Residential *Green Building SmartMarket Report* are a combination of McGraw-Hill Construction's proprietary data, analytic expertise, and information gathered by McGraw-Hill Construction Research & Analytics Market Research Group from December 2005 to March 2006. For that research, a representative sample of the entire population of home builders was surveyed regarding its involvement, habits and perceptions about green home building. The profiles presented herein, while excellent examples of green home building, do not comprise the entirety of green homes or the exact methods that must be used to build a green home. Where applicable, results for the commercial sector (found in McGraw-Hill Construction's *Green Building SmartMarket Report 2006*) are used for comparison.

## Overall Market Involvement

Today's home builders are becoming more and more involved in green building.

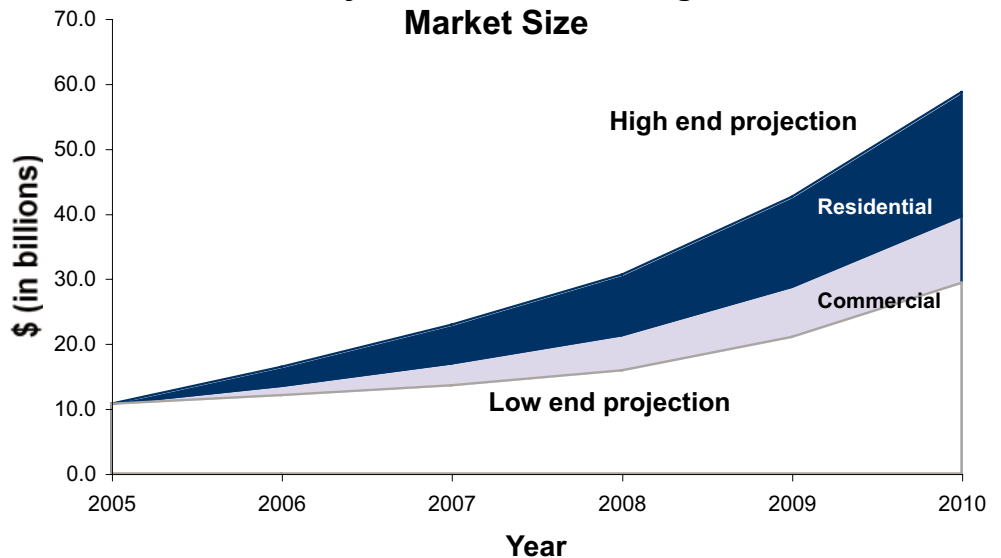
- In 2005, 31% of builders report more than moderate involvement with green building.
- 90% of the home builder community report participation in green building activities.
- The National Association of Home Builders (NAHB), through its *Model Green Home Building Guidelines*, has established an easy guide for builders to use when building a "green" house.
- More builders are becoming involved in voluntary green programs at the local and national levels.

## Market Trends & Outlook

In 2005, green building comprised approximately 2% of the U.S. construction market, including both commercial and residential construction. The residential market size of that 2% translates to approximately a \$7.2 billion market size. Findings from the market research suggest continued growth of the residential green building market as more builders, suppliers and product manufacturers become involved in green building and more homeowners and homebuyers demand green homes.

McGraw-Hill Construction projects that by 2010, between 5% and 10% of new construction starts (both commercial and residential) will be green projects. A projected growth to 5%-10% of the market translates to between \$19 billion and \$38 billion for the residential construction marketplace, not counting residential remodeling. Residential remodeling adds much greater market opportunities for green home builders and product manufacturers.

## Projected Green Building Market Size



Source: McGraw-Hill Construction (MHC), 2006. Market values projected based on MHC construction starts value for 2005 and forecasted starts value through 2010. Figures do not include single-family housing remodeling expenditures.

# Summary

## Market Drivers

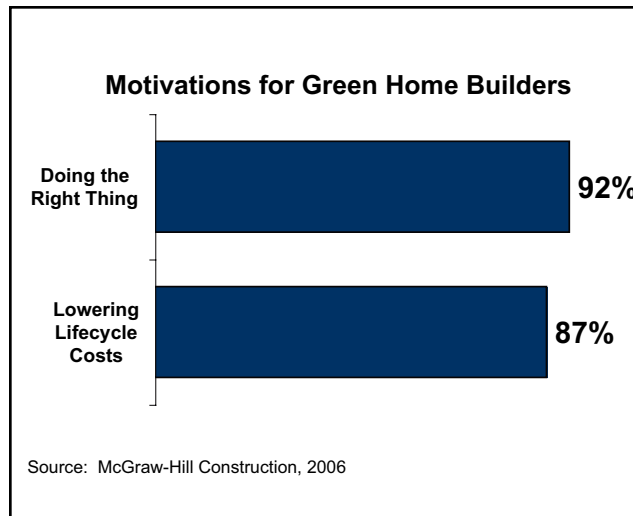
The most important motivators for builders when considering building green homes are “doing the right thing” and “lowering lifecycle costs.”

### Most Cited Triggers to Increased Residential Green Building

- Energy cost increases
- Consumer demand
- Superior performance

### Most Cited Obstacles to Increased Residential Green Building

- Higher perceived first costs
- Consumer willingness to pay
- Lack of consumer education on green building



## Products & Practices

### Top Three Green Building Important Practices

- Energy efficient techniques top the list of important methods to integrate into a new home (82%).
- Indoor air quality is the second most important green building practice at 66%.
- Water conservation ranks third at 66%.

### Most Used Green Building Features

- Nearly all survey respondents are implementing some form of energy efficient technology in their homes, with most using Low-E (emissivity) windows (82%).
- 95% of respondents report use of environmentally-preferable building materials, with the most used feature: OSB (oriented strand board), in lieu of plywood (80%).
- Nearly 90% of respondents are working with open space preservation techniques; minimizing vegetation disruption is the most used method (67%).

### Residential Green Building Products

- In the home building marketplace, unlike commercial construction, product manufacturers have brand recognition for all product types.
- Builders were able to identify a primary green brand at least 70% of the time for the following product categories: house wrap, doors and windows, insulation, and HVAC.
- Builders were able to identify a green product brand at least 25% of the time for all product categories.

## Recommendations

With green building an established, emerging market with rapid growth, the following are a list of recommendations to the industry to be successful in this marketplace:

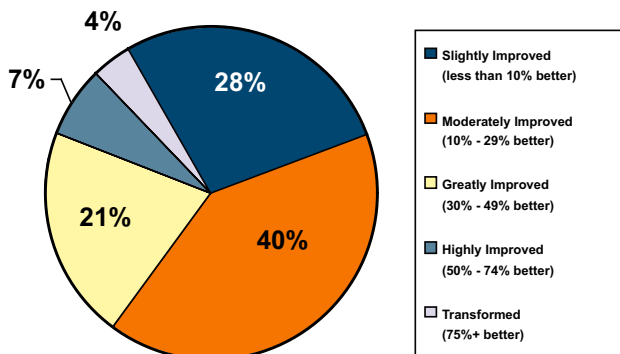
- ✓ For builders to gain competitive advantage, they should become familiar with use of green building practices in the next two years.
- ✓ For manufacturers to compete against established brands, they must establish credibility of products as “green” and market them appropriately.
- ✓ The homebuyer and homeowner will continue to demand more green homes. As a result, builders should be able to speak to homeowners about the advantages of a green home – not merely from a cost basis, but also by highlighting increased performance and health benefits.
- ✓ Emerging voluntary programs, particularly at the local levels will speed up green building adoption, so it is critical that builders participate in the formation of these programs to make them workable and ultimately successful.
- ✓ Builders should work with suppliers and product manufacturers to encourage adoption of new technologies to meet future demand.
- ✓ Green home building supporters should work with realtors, appraisers and other financing institutions to accelerate market penetration of green homes.
- ✓ Builders and policy makers should work together to establish common-sense ways to build sustainable communities.

# Advantages of Green Homes

## Green Homes Today

Not so long ago, green homes were seen as a niche market, with eccentric environmentalists driving production. However, today's green home building market is much more diverse in its participants – from small family-owned custom builders to large production builders to producers of affordable housing. The reality is that today's green homes often look no different from their non-green counterparts.

**Degree to Which Homes are More Environmentally Friendly than Five Years Ago**



Source: McGraw-Hill Construction, 2006

Builders are adopting more and more green principles into their construction of new homes. Nearly a third of surveyed builders (32%) believe today's homes are greater than 30% more environmentally friendly than they were just five years ago.

As this trend continues and green homes become more mainstream, the way we define a green home will also evolve. However, even today, defining what exactly constitutes a green home is a topic of debate. Yet, despite this continuing dialogue within the industry and broader community, the industry has begun to agree that green homes contain a number of common elements, such as

- Energy efficiency
- Indoor air quality
- Water conservation
- Resource efficiency
- Construction process

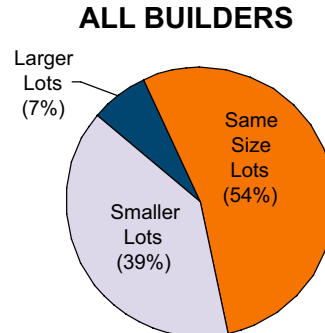
The National Association of Home Builders' Model Green Building Guidelines (outlined on page 15) fleshes out a comprehensive set of guiding principles for the construction of a green home. Because the data in this report is self-reported and gleaned from the NAHB membership, this report uses the term "green" home as one that meets the "bronze" threshold of the guidelines. This level emphasizes energy

efficiency, resource efficiency and indoor environmental quality, but there are also requirements in the other categories. For specific elements included in these green homes, download the guidelines at [www.nahbr.org/greenguidelines/](http://www.nahbr.org/greenguidelines/).

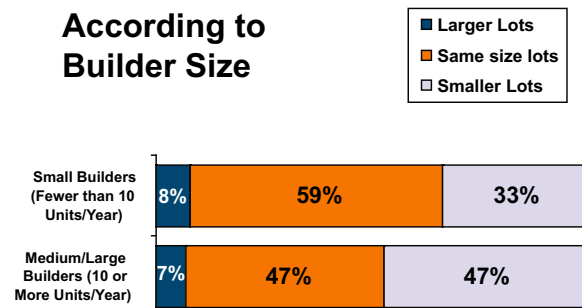
## Beyond the Home

According to builders, lot sizes are not increasing. As a result, people are living closer to their neighbors. As such, some developers are moving beyond building individual green homes to creating green communities where homes within the entire development are dedicated to sustainable design and construction practices.

**Percent of Builders Considering Size of Lots Compared to Five Years Ago**



### According to Builder Size



## Advantages of Green Homes

There are a number of advantages to owning and building a green home, including but not limited to the following:

### Lower Operating Costs

According to the U.S. Department of Energy, the average American family spends \$1,291 on home energy per year (depending on home characteristics, occupant lifestyle, and climate). Green home features can lower energy expenditures by half. With today's rising energy costs, green building features become even more economical.

### Tax Incentives & Rebates

Many electric utilities provide incentives to homeowners who adopt energy efficient appliances, products, and other features into homes.

Examples include Pacific Gas and Electric Company ([www.pge.com/res/rebates/](http://www.pge.com/res/rebates/)) and Southern California Edison ([www.sce.com/RebatesandSavings/Residential/](http://www.sce.com/RebatesandSavings/Residential/))

The Federal Government also provides tax incentives through the Energy Policy Act of 2005 ([www.doe.gov/taxbreaks.htm](http://www.doe.gov/taxbreaks.htm)).

- Tax credit up to \$500 for consumers who purchase and install specific products, such as energy-efficient windows, insulation, doors, roofs, and heating and cooling equipment in the home
- Credits equal to 30% (up to \$2,000) of expense for qualified solar water heating systems
- Tax credits to eligible residential green building contractors for homes meeting ENERGY STAR criteria (see page 8)
- Tax credits for manufacturers of energy-efficient dishwashers, clothes washers, and refrigerators.

### Increased Health & Comfort

Features built into green homes often control humidity, reduce chemical exposure, and have better air exchange and filtration. These elements lead to a healthier indoor environment and more comfortable surroundings.



Photo: James F. Wilson

The New American Home kitchen

## Challenges to Owning a Green Home

Because so many of the advantages of green homes come from the home's mechanical features and appliances, understanding how to maintain the green features is essential.

For example, energy-efficient HVAC systems can save energy and improve air quality, but if the system is not maintained and if filters are not regularly changed, homeowners and occupants will not reap the benefits of the system.

Homeowners, builders, product manufacturers, retailers and others invested in seeing green homes become standard should work together to clearly outline how to maximize the advantages of green homes.

# Market Demand for Residential Green Building

## General Outlook

The general outlook for the residential green building marketplace is positive. **There are several indicators that residential green building will escalate in the next year at a significant rate, making what is considered a green home today the industry standard in the future.**

Over 30% of a representative sample of today's home builders report more than moderate involvement with green building.

## Brief Historical Overview of Green Building Programs

In June of 1996, it was announced that the U.S. Environmental Protection Agency (EPA) and the U.S. Department of Energy would partner on the ENERGY STAR® program. The program officially began in 1995, housed within EPA. Since that time, energy efficient appliances have gained market share, and today it is hard to find home appliances that are not an ENERGY STAR labeled product. By March of 2005, over 350,000 homes in America earned the ENERGY STAR label.

The National Association of Home Builders (NAHB) and its Research Center also began to recognize the emerging segment of home builders engaged in green construction. NAHB's National Green Building Conference debuted in 1998 with approximately 200 attendees. In 2006, that number skyrocketed to nearly 800 attendees. In addition, with the distribution of NAHB's *Model Green Home Building Guidelines*, more and more builders have access to the information necessary to build cost-effective green homes.

## Market Size

In 2005, approximately 2% of homes built in the U.S. were built "green" primarily through energy efficient standards and practices. The value of this marketplace is approximately \$7.4 billion. Given forecasts of the housing market and other trends, McGraw-Hill Construction projects this market size increasing to 5-10% of the residential construction market by 2010. In dollar terms, that translates to a \$19 - \$38 billion market size. If one considers residential remodeling (not captured in these numbers or projections), there is a much greater additional opportunity for green home builders and product manufacturers.

## Residential Green Building Activity

**Nearly all surveyed home builders report participation in some green building activity.**

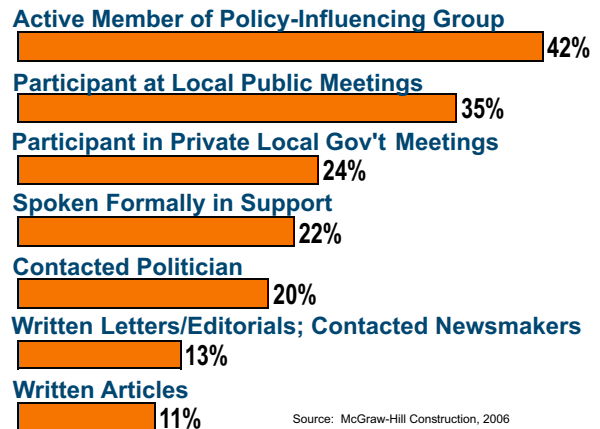
Small builders show the greatest involvement, with 98% reporting participation in a green building activity. For small builders, the top three activities were as follows:

- Member of policy-influencing group
- Participant at local public meetings
- Participant in private local government meetings

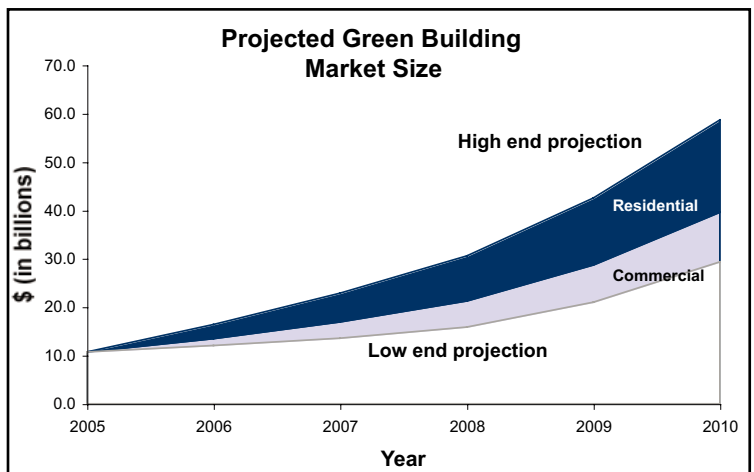
Top three activities for larger builders:

- Member of policy-influencing group
- Participant at local public meetings
- Spoken formally in support

## Percent of All Builders Engaged in the Following Green Home Building Activities



Source: McGraw-Hill Construction, 2006

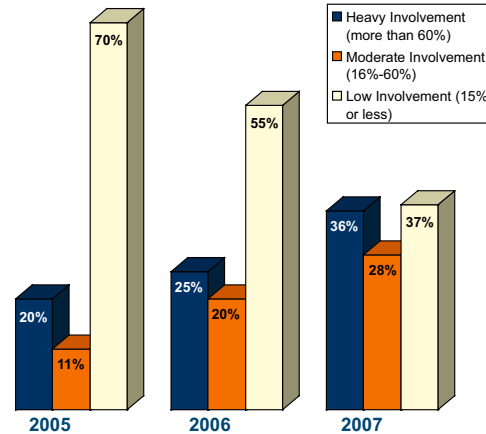


## Tipping Point & Critical Mass

Green home building will reach its “tipping point” in late 2006 / early 2007.

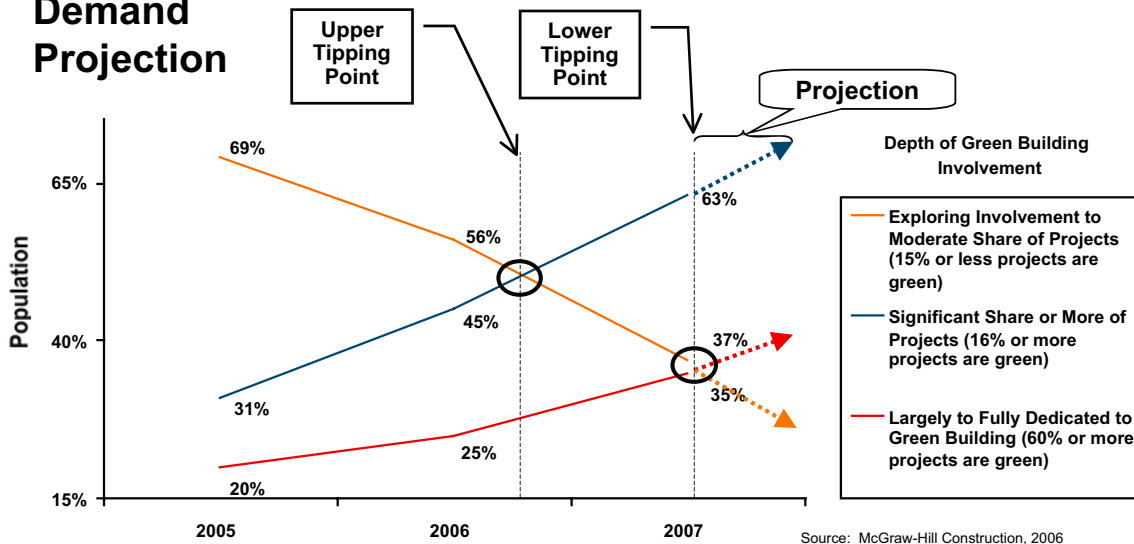
Green home building will reach its tipping point – the point where the builder population turns from “less involved” to “more involved” – in the 2006 to 2007 timeframe, depending on how conservative the estimate. In 2006, the growth in green home building will rise by 20% over 2005, and in 2007, there will be a growth of 30% over 2006 numbers. The result: more than two-thirds of builders will be building green homes (more than 15% of their projects), with only one-third not yet engaged in the marketplace. Looking beyond 2007, the sheer number of participants in the home building market will pull the rest of the market up to their standards in order for them to remain competitive.

### Firms' Involvement in Green Home Building Over Time



Source: McGraw-Hill Construction, 2006

### Demand Projection



Source: McGraw-Hill Construction, 2006



Photo courtesy of NAHB

# Market Demand for Residential Green

## Motivation for Green Home Building

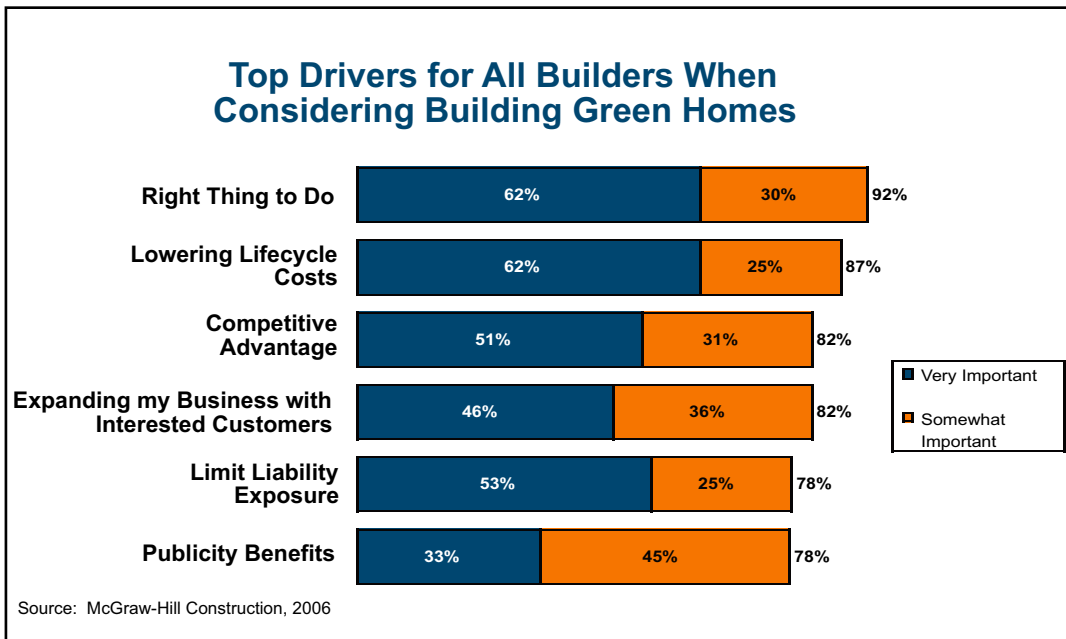
The majority of builders report that the two top factors when deciding to build green are “doing the right thing” and “lowering lifecycle costs” respectively. In fact, these two top motivating factors are practically tied as the “most important” drivers for green building.

The selection of “doing the right thing” as the most important overall motivator may point to the fact that many homebuilders work in the communities in which they live. It is interesting to note, however, that “doing the right thing” also ranked in the top two motivations for the commercial construction industry, suggesting green building in general is still being driven by those most passionate about it.

The business motivations suggest that builders are mindful of the homebuyer and rising energy, healthcare and other costs that can be reduced by green homes.

It is also notable when ranking by “most important” motivator, “limiting liability exposure” rose to the top three, though it ranked fifth in overall motivators. This finding points to the risk-averse nature of the industry.

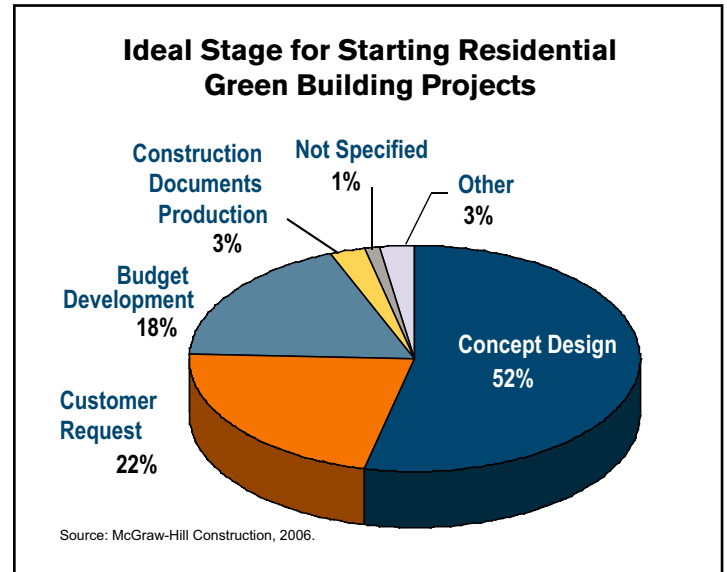
Smaller builders ranked “limiting liability exposure” as more critical than larger builders, whose third most important motivation for green building was “competitive advantage.” In fact, for larger builders, the top three most important motivations (“doing the right thing,” “lowering lifecycle costs” and “competitive advantage”) all tied, with 60% of medium and large builders finding them most important.



## Residential Green Building Decision-Making Process

Home builders overwhelmingly (over 50%) believe the “concept design phase” is the best stage for influencing the initiation of a green building project. “Customer request” is the second most important stage at 22% of survey respondents.

In comparison, the commercial marketplace perceived “customer request” as the best time to influence the start of green building projects. The difference suggests that home builders consider themselves as the primary driver to green building projects, whereas building owners are driving the pace of green construction in the commercial construction sector.

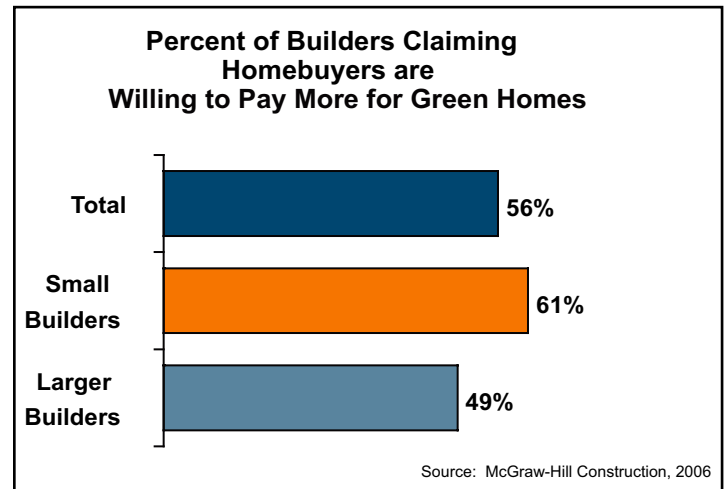


## Customer Willingness To Pay

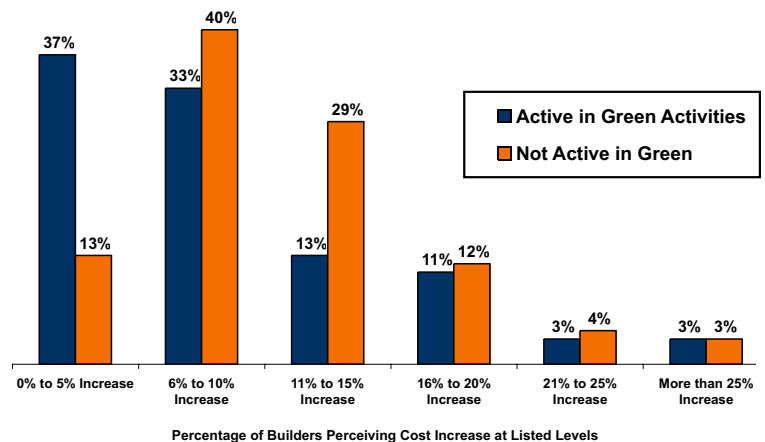
Overall, more than half the surveyed builders claim buyers are willing to pay more for green building elements. This is particularly the case among smaller builders.

Perceptions of increased costs for green building also vary among builders. Those active in green activities perceive average project cost increases of 8.7%, while builders not active in green building perceive additional costs at 11.1%. However, some builders report green homes being built at 2% - 5% more.

These differences may be due to lack of accurate product information, but could also be attributed to different base-lines for homes (i.e., homes are already including energy efficient appliances) or location of builders (i.e., certain building products or construction materials are more easily available in certain regions or areas and therefore cheaper). There remains a need for more research in this area.



## Degree of Cost Increases For Green Homes: Perceptions of Home Builders



# Market Demand for Residential Green Building

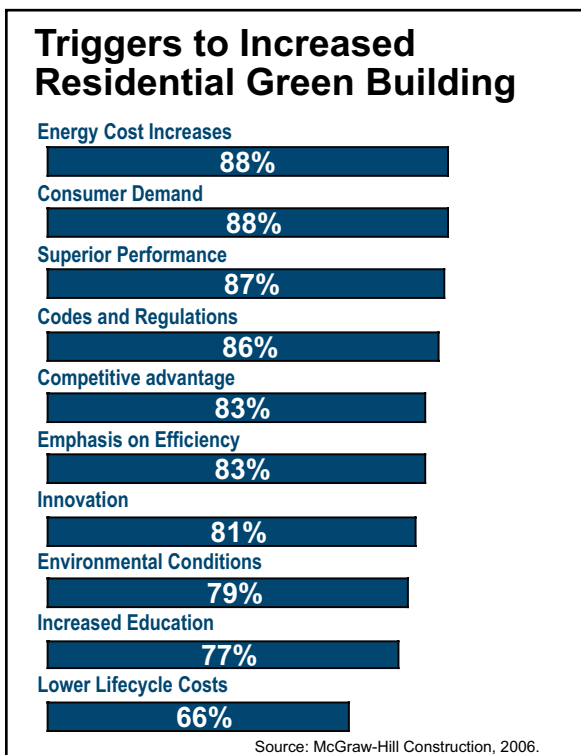
## Triggers to Increased Residential Green Building

The most important trigger to green building is rising energy costs.

Energy costs have been increasing steadily over the past five years, and experts project this increase will continue in the foreseeable future. Therefore, it is not surprising that these costs are the most cited trigger for increased residential green building, which by definition is more energy efficient than standard construction practices.

What is more interesting is that when builders were asked to rank the “most important” triggers, the order of the top five triggers changed with “energy cost increases” ranking third, preceded by “consumer demand” and “codes and regulations.”

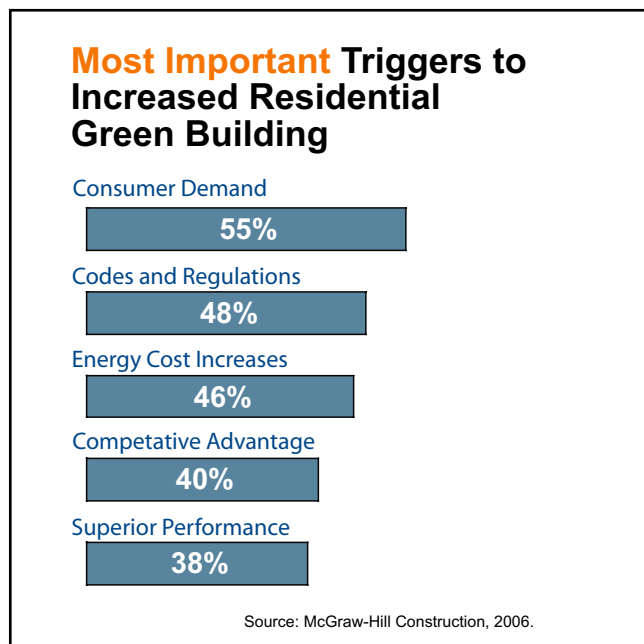
As part of an industry with small profit margins, it is not surprising that builders perceive an increase in consumer demand as a key driver to increased green building. Interestingly, increased education about green building, which is innately tied to increasing consumer demand ranked lower (though still in the top results) with 77% of respondents finding this an important factor to triggering increased performance. “Better performing homes” and “codes and regulations” round out the top triggers.



Some of the difference in the ordering of the top five triggers is likely a result of the different perceptions by smaller builders, who place more overall emphasis on energy costs, compared to larger production builders, who perceive the market being driven more by “codes and regulations” and “increased consumer demand.”

Interestingly, “codes and regulations” are seen as both a trigger and an obstacle to green building.

Codes can encourage green building by mandating that a certain level of performance be adopted, but regulations can also impede innovation and make building green more expensive and difficult to implement. Therefore, it is important that builders and governments, particularly at local levels, work jointly to determine the best mechanisms for the long-term future of green home building.



Small Builders (less than 10 homes/year)	Larger Builders (more than 10 homes/year)
1) Energy Cost Increases	1) Codes and Regulations
2) Superior Performance	2) Consumer Demand
3) Consumer Demand	3) Energy Cost Increases

## Obstacles to Increased Residential Green Building

Builders perceive the most critical obstacles to increased rates of residential green building to be “consumer willingness to pay” and “higher first costs.”

Again, when looking at overall obstacles, builders place production (or first) costs at the top of their lists. However, when delving into those obstacles considered most critical, builders view reluctance on the part of consumers to pay more as the most critical barrier to increased green building.

### Top Five Overall Obstacles

1. Higher First Costs (82%)
2. Consumer Reluctance to Pay (79%)
3. Lack of Education about Concept (72%)
4. Codes and Regulations (72%)
5. Lack of Awareness about Products (70%)

Source: McGraw-Hill Construction, 2006

Interestingly, other results from the study found that nearly half the representative sample of builders (and 60% of the small builder participants) feel that consumers would pay more for green building. Therefore, the next logical step is to understand how much more consumers truly are willing to pay for green homes versus builders' perception of the market.

Though the top obstacles remain the same, differences do emerge in comparisons between small and large builders. The top five are rounded out by different priorities for small builders versus their larger counterparts. Specifically, smaller builders are more concerned about education and products – likely due to lack of the same type of resources to find these products and get them at affordable rates. Larger builders, however, are more concerned with institutional challenges such as codes and regulations, approval times, and costs.

## Most Important Obstacles to Increased Residential Green Building

Consumer Reluctance to Pay More

44%

Higher First Costs

36%

Codes and Regulations

35%

Lack of Education about Concept

28%

Lack of Awareness about Products

28%

Cost and Approval Time

28%

Consumers Do Not Care

27%

Politics

26%

Liability

23%

Not Enough Information

21%

Lack of Products

20%

McGraw-Hill Construction, 2006.

### Small Builders

#### Top Five Obstacles

1. Higher First Costs (81%)
2. Consumer Willingness to Pay (78%)
3. Lack of Education about Concept (74%)
4. Lack of Awareness about Products (71%)
5. Not Enough Product Information (70%)

Source: McGraw-Hill Construction, 2006

### Large Builders

#### Top Five Obstacles

1. Higher First Costs (84%)
2. Consumer Willingness to Pay (79%)
3. Codes and Regulations (76%)
4. Costs & Approval Time (72%)
5. Consumers Do Not Care (70%)

## Commercial Construction Comparisons

Commercial construction had the same top trigger and obstacle to green building. However, there were some differences, as listed here.

COMMERCIAL	RESIDENTIAL
<ul style="list-style-type: none"> <li>• Certification programs seen as second largest trigger to green building.</li> <li>• Education and awareness on green building concepts second largest barrier.</li> <li>• Contractors less likely to consider higher costs an obstacle.</li> </ul>	<ul style="list-style-type: none"> <li>• Certification programs ranked low as a perceived driver.</li> <li>• Lack of education not perceived as an important barrier to large builders.</li> <li>• All builders - large and small consider costs most important obstacle.</li> </ul>

Source: McGraw-Hill Construction, Green Building SmartMarket Report, 2005, www.greenSmartMarket.com

# Green Home Building Certification

## Green Home Building Certification

**Very few homes in the U.S. are currently reported as “certified!”**

Though only a small number of homes are reported as being certified “green,” there seems to be high interest in voluntary green building certification programs (see below, right).

Small builders have the most interest at 80%. This result is not surprising since small builders are often in closer contact with their homebuyers or the communities in which they are building.

The results suggest there will be increased adoption of these types of programs, but it remains to be seen how this interest translates to the marketplace.

## Green Home Voluntary Program Information

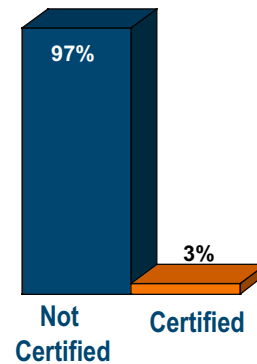
**There certainly has been an increased number of certification programs, particularly at the local level, in recent years.** The emergence of local programs likely will lead to faster adoption rates because of the professional connections and tie-ins to the local community.

However, green or sustainable home certification is not new. The federal government, for example, established the ENERGY STAR Qualified New Homes program (see page 8). This program began in 1995 for homes that were 30 percent more efficient than the model energy code. By March 2005, over 350,000 new homes in the U.S. had earned the ENERGY STAR; nearly 1 in 10 new homes built in 2004 qualified as ENERGY STAR homes.

Other programs are both established and emerging at the local levels. Examples include the following:

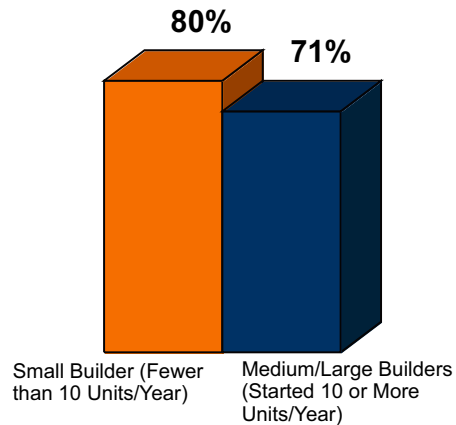
- Wisconsin’s GreenBuilt Home, implemented in partnership with the Madison Area Builders Association in cooperation with other builders’ associations ([www.greenbulthome.org](http://www.greenbulthome.org))
- Colorado’s Built Green, established in 1995 through joint efforts of the Home Builders Association of Metro Denver, the Governor’s Office of Energy Management and Conservation, Xcel Energy, and E-Star Colorado. ([www.builtgreen.org](http://www.builtgreen.org))

### Homes Reported to Be Certified Green



Source: McGraw-Hill Construction, 2006

### Builder Interest in Green Building Certification Programs



Source: McGraw-Hill Construction, 2006

- Green Building Initiative (GBI) programs, established in conjunction with local home builder associations on the principles of the NAHB’s *Model Green Home Building Guidelines*

As more players become involved in the creation and promotion of new green home building programs, it will be interesting to see how they affect the increase in green home production in coming years.

# The NAHB Model Green Home Building Guidelines

The National Association of Home Builders (NAHB) represents more than 225,000 residential construction industry members, including nearly 75,000 home builders. Therefore, the organization has the potential to influence the adoption of increased green building elements and production of green homes.

In 2005, NAHB published and issued a set of Model Green Home Building Guidelines. Below is a snapshot of those guidelines.

## Guiding Principles

The guidelines are arranged according to a set of core principles.

### *Lot Design, Preparation, and Development*

The guidelines offer suggestions on how resource-efficient site design and development practices can reduce housing impacts on the environment and on energy usage. One example would be orienting a home for passive solar heating and cooling.

### *Resource Efficiency*

This section reviews how resource-efficient practices can be integrated into the design process to use these materials while still creating a home with excellent building performance. An example of resource efficiency would be the use of engineered wood versus traditional dimensional lumber.

### *Energy Efficiency*

With the tremendous impact of energy use – from increasing costs to impacts from mining for fuel sources and burning non-renewable energy sources – reducing energy use is weighted heavily in the guidelines. Energy consumption occurs both in the operation of a home (for example, through HVAC systems and appliance usage), but also through the construction process and the materials going into the home.

### *Water Efficiency*

According to NAHB's guidelines, indoor daily use of water in today's homes is approximately 64 gallons, but water conservation practices can reduce usage by nearly 20 gallons. These features are particularly important in regions of the U.S. with water shortages. Examples include the installation of on-demand water heaters or water-efficient dishwashers.

### *Indoor Air Quality*

After energy efficiency, homebuyers are most concerned with the quality of the air in their homes, particularly in areas where allergens and pollen levels are high. As more information emerges, this area is likely to be one of the more critical in contributing to increased consumer demand for green homes.

### *Operation, Maintenance, and Homeowner Education*

Poor maintenance can often minimize the advantages of the green features built into homes. Therefore, builders have a tremendous opportunity to educate their homeowners not only to make their customers happier, but also to build a reputation and help increase the demand for green homes.

### *Global Impact*

Some issues can have effects that go beyond the home itself. An example in the guidelines is the use of paints that contain volatile organic compounds (VOCs). Aside from the VOCs released into the home, they can also form ground-level ozone pollution.

### *Site Planning and Land Development*

Appropriate site planning and land development will improve communities and may contribute to increased economic development in these areas. An example would be avoiding building in an environmentally "sensitive" area.

## Guideline Development Process

NAHB created its Guidelines through an open consensus process. Each principle area was examined through a set of lenses and weighting was determined. The primary goals were, in order of importance, reducing environmental impacts, defining a set of "best practices" around green building, and determining ease of implementation for new practices. As an example, energy efficiency ranks high.

The guidelines also address the various needs of homeowners and builders in different regions across the U.S. As such, the guidelines include climate specific information.

*Author Note: The above is taken mostly from the NAHB Model Green Home Building Guidelines, 2004, used with permission from NAHB. Other than some assessment statements matching content throughout the report, the facts and examples in this section are not products of McGraw-Hill Construction. The guidelines can be downloaded at [www.nahbrc.org/greenguidelines](http://www.nahbrc.org/greenguidelines).*

# Residential Green Building Method

## Residential Green Building Options

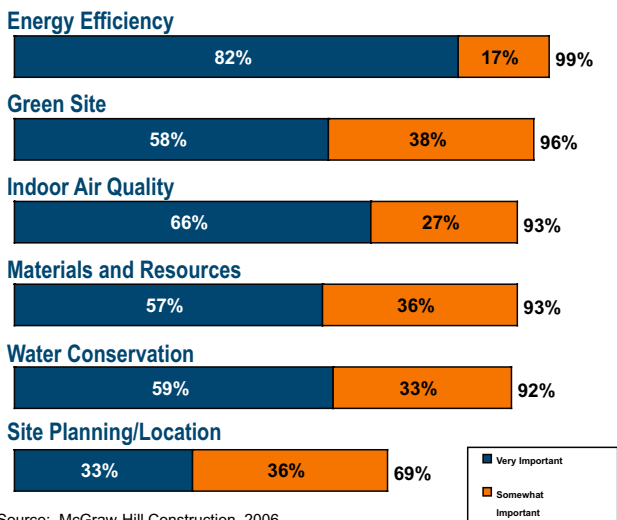
Energy efficiency options far outpace other green building areas as the most critical category for green building options.

As is evident below, nearly all survey respondents consider energy efficiency a critical component in green buildings, with 82% considering it the most critical.

Though “green site” – or the option area that includes the use of practices to minimize site disruption and preserve open spaces – ranks second overall, it is fourth in level of importance. In contrast, builders saw “indoor air quality” as the second most critical green building area. These results are not surprising; the homebuyer or consumer is more directly affected by air quality and sensitive to it given rising awareness of allergens and the potentially negative health effects of the built environment.

Because these results are national in scale, it is likely that water conservation options would be an area of much more importance in regions where water is scarce.

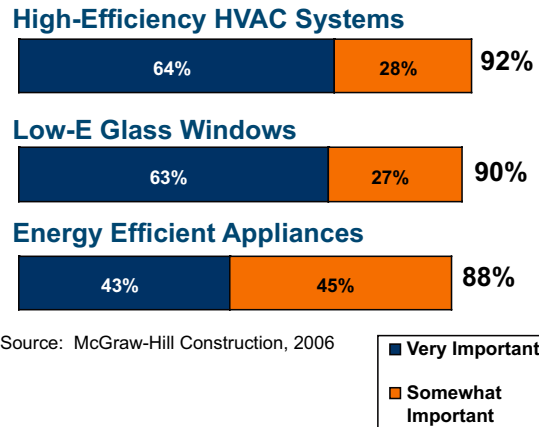
### Top Ten Important Green Home Building Options



Source: McGraw-Hill Construction, 2006

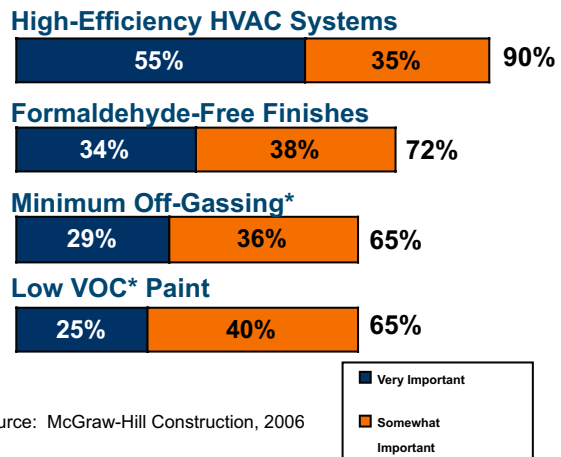
## Importance of Specific Residential Green Building Options

### Energy Efficiency



Source: McGraw-Hill Construction, 2006

### Indoor Air Quality\*



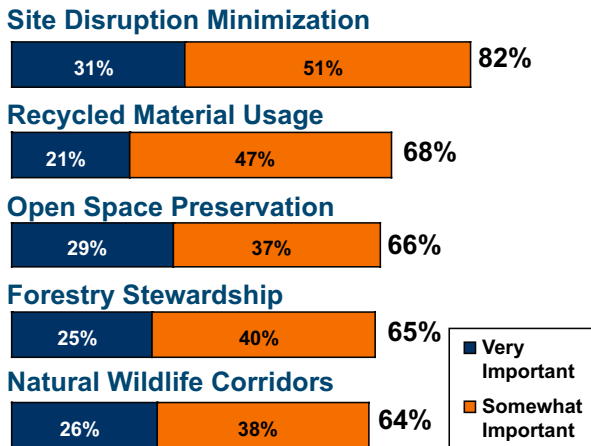
Source: McGraw-Hill Construction, 2006

\*Off-gassing refers to the chemical gases that some materials may release into the air. Heat and light can increase rate of off-gassing.

\*VOC stands for Volatile Organic Compounds. VOCs are released as gases (see off-gassing above) from certain products and occur at higher levels indoors. VOCs include a variety of chemicals, some of which may have short and long-term adverse health effects.

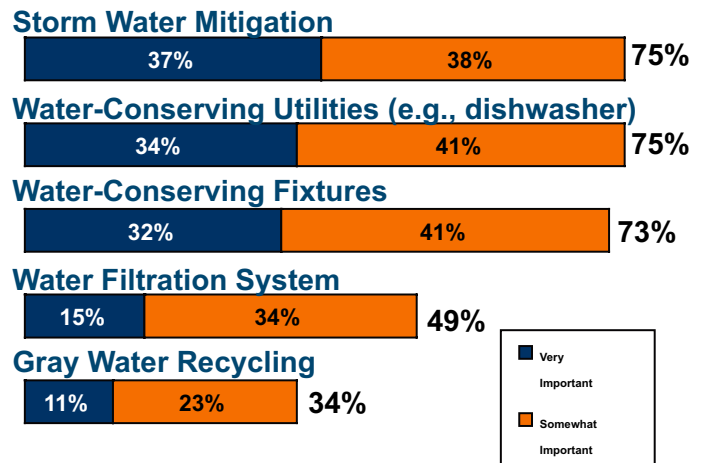
For more information, go to [www.epa.gov](http://www.epa.gov).

## Green Site



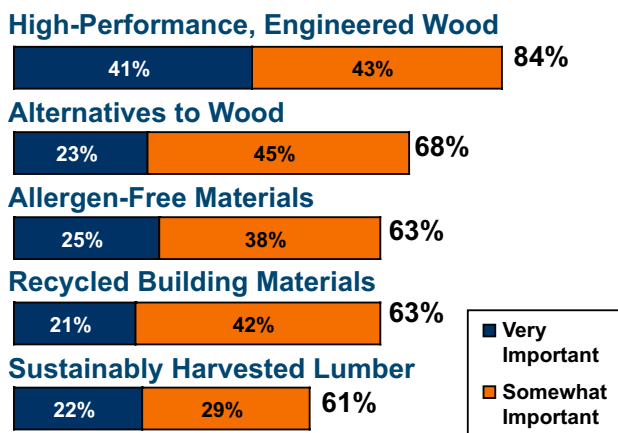
Source: McGraw-Hill Construction, 2006

## Water Conservation



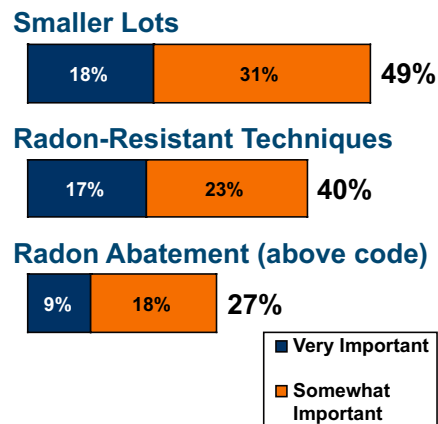
Source: McGraw-Hill Construction, 2006

## Materials and Resources



Source: McGraw-Hill Construction, 2006

## Site Planning/Location



Source: McGraw-Hill Construction, 2006

# Residential Green Building Methods

## Use of Specific Residential Green Building Methods and Practices

Residential products and methods are included in more and more homes. However, in many circumstances, the activities occurring most frequently do not always match up with what builders indicate as most important. This finding suggests that as builders increase involvement in green building, newer techniques will be used more frequently.

### Energy Efficiency

**80% of builders identify “Low-E” (emissivity) windows as their most used energy-efficient practice.**

Low-E windows have the advantage of reflecting heat back to its source using a thin coating on or in the glass. Among other things, Low-E glass allows through visible light while blocking and reflecting certain amount of UV (ultraviolet) and IR (infrared) light. Ultimately, it leads to more efficient cooling and heating. Innovation is increasing in this area, likely due to the technology’s increased adoption rate.

Builders also cite using the following energy-efficient practices (rates of use in parentheses):

- Sealing joints (79%)
- Energy-efficient appliances (76%)
- Ceiling fans (74%)

Energy-efficient methods, though, vary by region, as seen below.

### Building Materials

**80% of builders identify “use of OSB (oriented strand board) versus plywood” as their most used green building materials practice.**

OSB, one type of engineered wood, is preferable to plywood because it can use up to 50% more of the log versus conventional lumber. Its advantage over plywood is that it can use trees that otherwise would not be able to be used for construction, such as smaller trees or scraps.

Builders also cite using the following material reduction strategies (rates of use in parentheses):

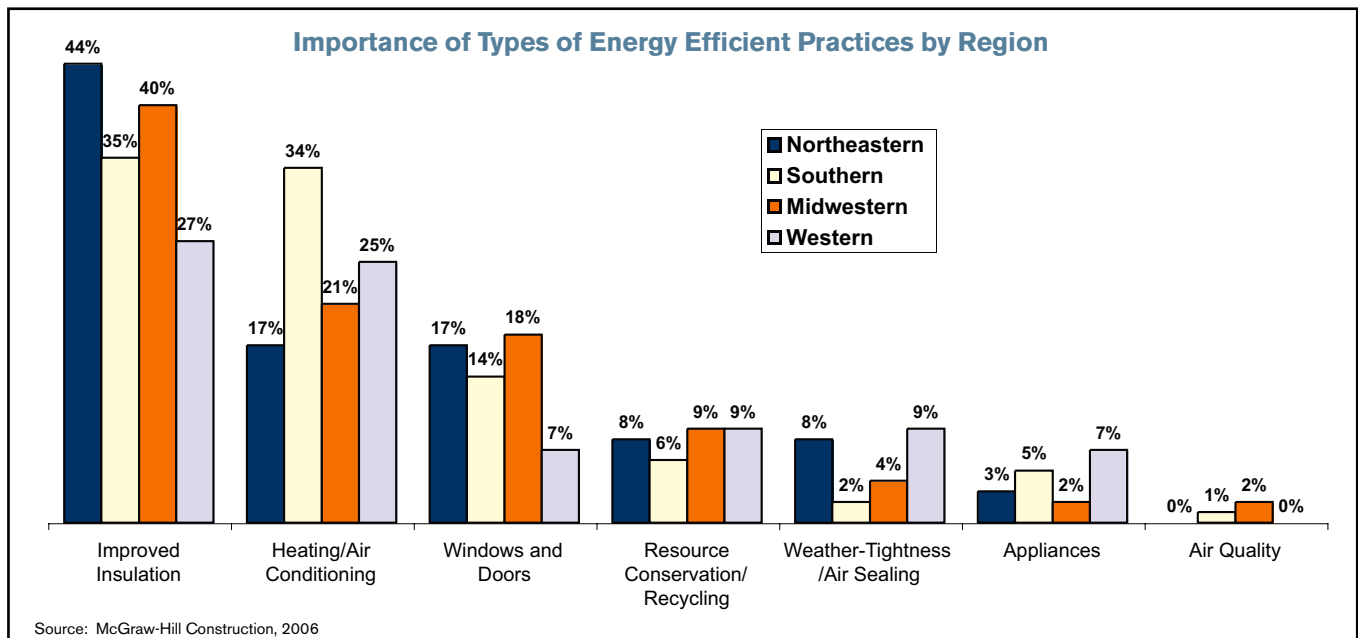
- Alternatives to dimensional lumber (79%)
- Construction waste reduction techniques (54%)
- Recycled and recyclable products (51%)
- Durable materials (46%)

### Open Space Preservation

**67% of builders identify “vegetation disruption minimization” as their most used open space preservation action.**

Builders also cite using the following open space preservation strategies (rates of use in parentheses):

- Preserving natural water drainage (64%)
- Preserving wildlife habitat (51%)
- Encouraging pedestrian-friendly communities (47%)



## Green Builder VISION House 2006

Sun Mountain Construction, Corrales, NM

*Green Builder Magazine* teamed up with award-winning builder Norm Schreifels to design and build a home that met or exceeded the specifications of the NAHB's *Model Green Home Building Guidelines*. Aside from an aim to take away much of the home's energy load away from oil or gas, the partners also sought out manufacturers who offer exemplary green building products to incorporate into the home.

The Vision House offers a "living lab" for a green home and creates unique educational opportunity in demonstrating various types of residential green building products and practices.

"When selecting the products for this home, we looked for building components that not only had high scores for green performance – like operational efficiency and indoor air quality – but also that had low-impact/no-impact manufacturing processes and recycleability at the end of the product life cycle," said John D. Wagner, editor in chief of *Green Builder Magazine*.

The Vision House has 4,000-square-feet of conditioned space and 1,500-square-feet of covered space, including a central courtyard. Below are specific green features of the House.

The home used many recycled or sustainably harvested products. Examples include the following:

- The spruce used for the ceiling and beams was wood recovered from a forest fire area.
- Kitchen countertops were made from 100% recycled glass and concrete.

All the perimeter landscape walls and outer walls of the Vision House are made of concrete, a material long known for its design flexibility, resistance to mold, and structural reliability.

The house is heated with a simple groundsource geothermal system whose water-to-water geothermal exchanger supplies heat through multi-zoned, in-slab radiant tubes.

Super-high-efficiency, roof-mounted air conditioning is distributed through a carefully engineered and well-insulated room-to-room duct system.

High-efficiency products were included throughout the house, such as the following:

- Energy-efficient windows
- Water-conserving fixtures, including the faucets, tubs, sinks and toilets

The exterior stucco is a unique facade insulation system that provides a heat-delivery infrastructure.

The following features contribute toward exemplary air quality and create a nearly toxin-free built environment:

- Wool woven fabrics
- Non-toxic alternative to traditional plaster
- Low and zero-VOC paints
- Formaldehyde-free doors glued together with ultra-low-VOC, water-based adhesives
- Central vacuum system that helps to greatly reduce dust and mold spores

*This profile is taken from excerpts of the April and May 2006 issues of **Green Builder Magazine**. For more information, go to [www.greenbuildervisionhouse.com](http://www.greenbuildervisionhouse.com).*



Artist rendering of the *Green Builder Vision House 2006* in New Mexico.

# Residential Green Building Products

## Residential Green Building Product Availability

Like all new technology and innovations in home building, alternative materials and products necessary to meet many requirements of green building are slow in coming to market.

In fact, builders, particularly small ones, believe there is a lack of awareness and information on products. Therefore, due to this need, builders and suppliers must overcome challenges in order to supply credible residential green building product information. With this increasing demand it is expected that, at least in the area of energy efficiency, new technologies will emerge in tandem with new, nonbiased, mechanisms for finding product information.

## Concerns About Greenwashing

With increasing size of the green building market, more and more product manufacturers are seeking ways to capture their share. With that comes the challenge for builders, architects and consumers to find products that are “green” in production and function. Typically, the construction industry is cautious to accept claims directly from manufacturers, and third-party information is lacking in regards to green building products. This presents a tremendous opportunity area for industry information brokers and academia.

## Market Penetration of Residential Green Building Products

Unlike the commercial construction market, product manufacturers in the residential construction market enjoy brand recognition and market penetration. Brand recognition indicates commercialization of residential green building.

In the study, McGraw-Hill asked builders for top-of-mind recall of “green” product brands in a number of different product category areas. In the results, no building product category had less than 25% identification of a green product brand.

At least 70% of surveyed builders identified a green building brand in the following building product categories:

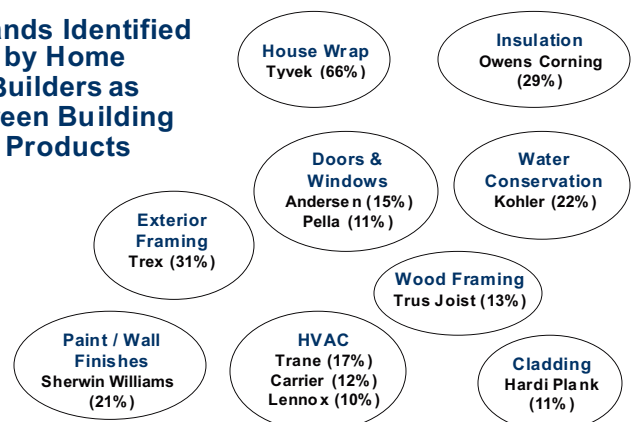
- House Wrap
- Doors & Windows
- Insulation
- HVAC

The picture below shows the rates at which home builders recollect specific “green building product” brands within various building product categories.



Photo courtesy of NAHB

## Brands Identified by Home Builders as Green Building Products



## Production Builder Project Profile

### Pardee Homes

Pardee Homes was named the 2006 Production Builder of the Year at NAHB's National Green Building Conference in Albuquerque, New Mexico. The company is one of a growing number of large-volume homebuilders that have seen the competitive value of building green.

The company's green building program is comprehensive – from its 100 percent compliance with federal ENERGY STAR requirements all the way down to its growing fleet of hybrid company cars. "Pardee Homes couples all green initiatives with an inclusive approach to outreach programs, thus strengthening awareness of green building principals and ways to integrate them into new home planning and development," according to its award application.

The company also makes sure that it publicizes its green programs in its new home advertising and through additional marketing efforts, such as completing an energy-efficient seven-bedroom home for ABC's Extreme Home Makeover program.

Among the components of Pardee's green building program:

- ✓ "Living Smart." Depending on the community, Pardee homebuyers can choose from a number of environmentally sensitive and energy conscious programs.
  - "Energy Smart" homes feature low-E glass on windows and doors, a sealed duct system that helps eliminate airleaks in non-conditioned spaces, photovoltaic cells for solar power, fluorescent lighting, ENERGY STAR appliances and third-party inspections that ensure the house exceeds code requirements.



Photo courtesy of Pardee Homes



Photo courtesy of Pardee Homes

- "Earth Smart" homes use engineered and certified wood, come with a tankless water heater, sprayed-on attic insulation made from recycled newspapers and flooring made from recycled or sustainable materials, such as soda bottles.
  - "Health Smart" homes include a central vacuum system, a reverse osmosis water treatment system and walls finished with low-VOC paints.
  - "Water Smart" homes can include water-saving faucets, drought-tolerant landscaping or zeri-escaping, programmable sprinklers and ENERGY STAR washers and dishwashers.
- ✓ Habitat restoration. In Pardee's Pacific Highlands Ranch development in San Diego, the company is restoring 150 acres and dedicating an additional 860 acres to open space for wildlife conservation. Other subdivisions include programs that preserve riparian wetlands, heritage trees and a frontier graveyard – all in excess of local jurisdictional requirements.
  - ✓ Hybrid cars. Starting with the leasing of 10 Ford Escape hybrid vehicles for company couriers and customer service vehicles, Pardee plans to continue to replace its conventional fleet where possible when additional leases come up for renewal. ■

by Calli Barker Schmidt, NAHB

For more information on the NAHB Green Building Awards, go to [www.nahb.org/news\\_details.aspx?newsID=2221](http://www.nahb.org/news_details.aspx?newsID=2221).

# Project Profile

## Custom Home Project Profile

Don Ferrier Custom Homes, Fort Worth, Texas

by Calli Barker Schmidt,  
NAHB

For Ferrier, potential customers with green building inquiries are coming in at ten times the rate they did just three years ago.

When it comes to consumer interest in green building, Fort Worth builder Don Ferrier of Ferrier Custom Homes says that a “paradigm shift” is already under way.

Ferrier attributes the new attitudes to the 800-pound gorillas of home building trends: the Baby Boomers. With retirement looming, this generation has already influenced the design and construction of vacation homes and “active-adult” communities. According to Ferrier, they are now turning to green building.

“These customers are saying, ‘this will be the last house we ever expect to build. Building it to a high performance level is the best investment we can make for our future,’” Ferrier said. And they are unafraid to pay a premium for green, because, according to Ferrier, “They know it is worth it.”

However, green building is also beginning to appeal to buyers that don’t have Boomer budgets. Ferrier was putting finishing touches this spring on “Heather’s Home,” built to be an affordable, near-zero energy-using 2,000-square-foot home. It will land within the top 1 percent

in efficiency of Energy Star-rated homes with an estimated monthly heating and cooling bill of \$20 – \$30.

With its quirky glass-block design and contemporary styling, Heather’s Home might not fit into most traditional neighborhoods. However, with a construction cost per square foot of about \$117, the home is considerably less expensive than the average custom home, long the provenance of most green construction.

In addition to its fresh design, three green features stand out in Heather’s Home, Ferrier said.

First, orientation and shading, an important energy conservation effort that often goes missing in traditional, or even some green, building. “The number one thing is that it’s properly oriented, with the majority of glass on the south side, and that it’s also properly shaded. You need to be able to control the sun in this climate,” Ferrier said.

Second, the house is built using structural insulated panels (SIPs), substituting traditional wood framing techniques for rigid foam insulation sandwiched between two structural skins of oriented strand board, or OSB. “I don’t know of a way to get as much energy-efficient bang for the buck as you can with the SIPs. They have an extremely tight structure and a higher efficiency,” and eliminate the thermal loss of conventional wood studs. According to Ferrier, it is also more resource-efficient, using 30 percent less wood than a conventional house.

Third, the house uses a Japanese-made air-conditioning system that allows the compressor to run up to five separate and independent blowers, making it considerably more energy-efficient. The system uses the latest technology with a Daikin inverter “variable speed” compressor allowing very high SEER\* levels (over 20 in



Photo: Don Ferrier

some configurations). Although it costs about 25 percent more, Ferrier expects to see 40 percent more efficiency than he would at 16 SEER (the new Energy Star threshold is 13 SEER\*). It is more efficient than any other kind of system with the exception of geothermal.

With its emphasis on affordability and efficiency, old-fashioned passive solar combined with cutting-edge technology, Heather's Home straddles the narrowing gap between green and traditional building.

It is not a moment too soon, Ferrier said, pointing to the 'paradigm shift' within the general public. **For Ferrier, potential customers with green building inquiries are coming in at ten times the rate they did just three years ago.**

"I don't think there's anything more satisfying than helping people achieve their dreams of building a home and to do it so it's green, efficient, healthy and durable. It's a great investment," he said. ■



*\*SEER stands for "seasonal energy efficiency ratio." Every air conditioning unit is assigned a SEER efficiency rating. The SEER is defined as the total cooling output provided by the unit during its normal annual usage period divided by its total energy input during the same period. A SEER rating of 13 represents a 30% increase in minimum energy efficiency requirements for air conditioners.*

Photos Above: Don Ferrier

# Viewpoints: Small Builder versus

## Small Builders

Below are the perceptions and viewpoints of a representative sample of small builders (under ten units per year):

### Involvement in Green Building

- 2005 Involvement: 35% of builders are building at least 15% of their projects green
- 2006: Increases with 50% of builders expected to build at least 15% of their projects green
- 2007: Continued growth with 66% of builders expected to build at least 15% of their projects green

### Green Building Activities

The top residential green building activities:

- Member of policy-influencing group (42%)
- Participant at local public meetings (39%)
- Participant of private local government meetings (23%)

### Motivations to Green Building

Small builders view the following as the most important motivation behind their involvement with green building:

- "It is the right thing to do"
- "Lower lifecycle costs"
- "Limit liability exposure"

### Triggers & Obstacles

- **Triggers:**
  - Energy cost increases
  - Superior performance
  - Consumer demand
- **Obstacles:**
  - Higher first costs
  - Consumer willingness to pay
  - Lack of education

### Residential Green Home Certification/ Voluntary Programs

80% of small builders have interest in these programs, exceeding their larger counterparts by over 10%.

### Methods & Practices

Small builders report the following most important residential green building options:

- Low-E windows (66% rank it most important)
- High Efficiency HVAC (58% rank it most important)

Small builders are most heavily using the following residential green building methods and materials:

- Low-E Windows (91% using)
- Alternatives to Dimensional Lumber (86% using)
- Sealing Joints (85% using)

## Larger Builders

Below are the perceptions and viewpoints of a representative sample of larger builders (at least ten units per year):

### Involvement in Green Building

- 2005 Involvement: 27% of builders are building at least 15% of their projects green
- 2006: Increases with 39% of builders expected to build at least 15% of their projects green
- 2007: Continued growth with 59% of builders expected to build at least 15% of their projects green

### Green Building Activities

Top residential green building activities:

- Member of policy-influencing group (43%)
- Participant at local public meetings (32%)
- Spoken formally in support (25%)

### Motivations to Green Building

Large builders view the following as the most important motivation behind their involvement with green building:

- "It is the right thing to do"
- "Lower lifecycle costs"
- "Competitive advantage"

### Triggers & Obstacles

- **Triggers:**
  - Codes and regulations
  - Consumer demand
  - Energy cost increases
- **Obstacles:**
  - Higher first costs
  - Consumer willingness to pay
  - Codes and regulations

### Residential Green Home Certification/ Voluntary Programs

71% of large builders have interest in these programs.

### Methods & Practices

Larger builders report the following most important residential green building options:

- Low-E windows (59% rank it most important)
- High Efficiency HVAC (53% rank it most important)

Larger builders are most heavily using the following residential green building methods and materials:

- OSB instead of Plywood (78% using)
- Low-E Windows (73% using)
- Sealing Joints (73% using)

# Large Builder



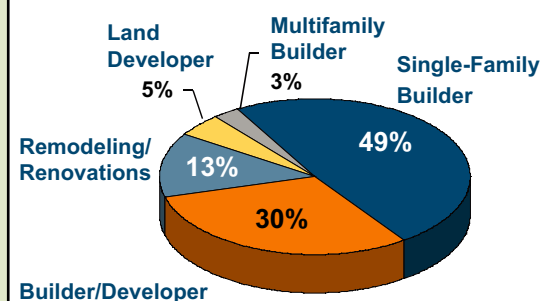
Photo courtesy of NAHB

## Methodology

The research in this report was conducted through an analytic survey of the U.S. homebuilder community, drawing a representative sample of 353 builders from the National Association of Home Builders (NAHB) membership files. This database captures the demographic and firmographic information on over 220,000 builders in the U.S. All builders had annual billings of at least \$500,000.

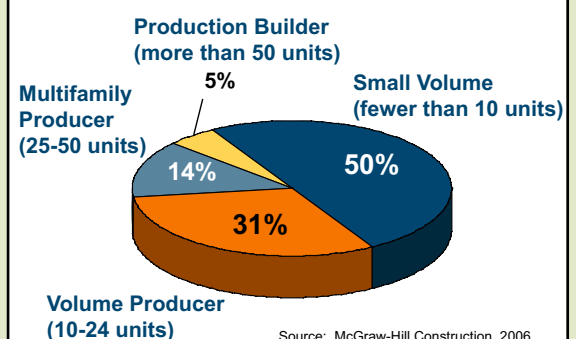
The use of a sample to represent the true population is based on the firm foundation of statistics. While many variables are factors in creating sample size, a key determinant is the ratio of sample to total population. The 353 respondents used in this research amount to 2/10 of a percent of the total population of residential building professionals. In contrast, both the popular AC Nielsen, which produces the Nielsen Television Ratings, and the Gallup Election polls each uses less than 1/100th of a percent to represent their national populations. McGraw-Hill Construction used online-based interviewing services to conduct the data collection and executed the data tabulations between December 2005 and March 2006. The total sample size benchmarks at a high degree of accuracy: 95% Confidence Interval with a Margin of Error of +/- 6%.

### Business Types of Market Research Survey Subjects



Source: McGraw-Hill Construction, 2006

### Size of Market Research Survey Subjects



Source: McGraw-Hill Construction, 2006

# Resources

Organizations, websites, and publications that can help you get smarter about residential green buildings

## National Association of Home Builders

- Main Website: [www.nahb.org](http://www.nahb.org)
- NAHB Model Green Home Building Guidelines: [www.nahbrc.org/greenguidelines](http://www.nahbrc.org/greenguidelines)
- NAHB Research Center: [www.nahbrc.org](http://www.nahbrc.org)

## McGraw-Hill Companies:

### McGraw-Hill Construction

- Main Website: [www.construction.com](http://www.construction.com)
- Research & Analytics: [www.analytics.construction.com](http://www.analytics.construction.com)
- *Architectural Record*: [www.archrecord.construction.com](http://www.archrecord.construction.com)
- *Engineering News-Record*: [www.enr.com](http://www.enr.com)

## McGraw-Hill Construction Green Resources

- *GreenSource* magazine, news and information: [www.greensource.construction.com](http://www.greensource.construction.com)
- Network for Products Green Community: [www.products.construction.com](http://www.products.construction.com)
- *GreenBuilding SmartMarket Report* (commercial): [www.greenSmartMarket.construction.com](http://www.greenSmartMarket.construction.com)

## JD Power and Associates

[www.jdpower.com](http://www.jdpower.com)

## Platts

[www.platts.com](http://www.platts.com)

---

## Other Resources (listed alphabetically)

### American Institute of Architects (AIA)

- Main website: [www.aia.org](http://www.aia.org)
- Committee on the Environment (COTE): [www.aia.org/cote](http://www.aia.org/cote)

### Associated General Contractors of America (AGC)

Green Construction Resources:  
[www.agc.org/page.wv?section=Green+Construction&name=About+Green+Construction](http://www.agc.org/page.wv?section=Green+Construction&name=About+Green+Construction)

### Building Green

[www.buildinggreen.com](http://www.buildinggreen.com)

### Green Builder Magazine

[www.greenbuildermag.com](http://www.greenbuildermag.com)

### Green Building Initiative (GBI)

[www.thegbi.org](http://www.thegbi.org)

### Green Building Pages

[www.greenbuildingpages.com](http://www.greenbuildingpages.com)

### Greener Buildings

[www.greenerbuildings.com](http://www.greenerbuildings.com)

### Sustainable Buildings Industry Council (SBIC)

[www.sbicouncil.org](http://www.sbicouncil.org)

### U.S. Department of Energy

- Main Website: [www.doe.gov](http://www.doe.gov)
- Office of Energy Efficiency and Renewable Energy: [www.eere.doe.gov](http://www.eere.doe.gov)
- Building America Program: [www.buildingamerica.gov](http://www.buildingamerica.gov)
- National Renewable Energy Lab: [www.nrel.gov](http://www.nrel.gov)

### U.S. Department of Housing and Urban Development

- Main Website: [www.hud.gov](http://www.hud.gov)
- Partnership for Advancing Technology in Housing (PATH): [www.pathnet.org](http://www.pathnet.org)

### U.S. Environmental Protection Agency

- Main website: [www.epa.gov](http://www.epa.gov)
- Energy Star Program: [www.energystar.gov](http://www.energystar.gov)

### U.S. Green Building Council (USGBC)

[www.usgbc.org](http://www.usgbc.org)

### Whole Building Design Guide (WBDG)

[www.wbdg.org](http://www.wbdg.org)

# SmartMarket Report

*Design & Construction Intelligence*



## McGraw-Hill Construction Industry Analytics & Alliances

**Vice President of Industry Analytics & Alliances:** Harvey M. Bernstein, FASCE

**Residential Green Building SmartMarket Editor-in-Chief:** Michele A. Russo, LEED AP

**Director, Industry Alliances:** John E. Gudgel

**Director, Market Research & Principal Researcher:** John DiStefano

## McGraw-Hill Construction

**President:** Norbert W. Young, Jr., FAIA

The data contained in this report is proprietary. The user of this material may not commingle any portion of this material with any other information and shall not edit, modify, or alter any portion. Reproduction or dissemination of any information contained herein is granted only by contract or prior written permission from McGraw-Hill Construction.

For further information on this SmartMarket Report or for any in the series, please contact McGraw-Hill Construction Research & Analytics.

1-800-591-4462, 24 Hartwell Avenue, Lexington, MA 02421

[www.analytics.construction.com](http://www.analytics.construction.com).

[Construction\\_Intelligence@mcgraw-hill.com](mailto:Construction_Intelligence@mcgraw-hill.com)

Copyright © 2006, McGraw-Hill Construction, ALL RIGHTS RESERVED

**Acknowledgements:** The authors wish to gratefully thank the following individuals for allowing their projects to be featured as well as accompanying photos: *Green Builder Magazine*, particularly John Wagner and Ron Jones for the use of the Vision House profile; Don Ferrier for the use of his "Heather's Home" profile; and Pardee Homes. Thanks to Joann Gonchar and Jessica Harris-Wolking from McGraw-Hill Construction for editorial reviews and comments. Additionally, McGraw-Hill Construction would like to acknowledge the following individuals from NAHB for their assistance with securing photo rights and providing content related to NAHB, the NAHB *Model Green Home Building Guidelines*, and case study information: John Ritterpusch; Emily English; and Calli Barker Schmidt. A final thanks to Ray Tonjes, Chairman of the NAHB Green Building Subcommittee, for his leadership in supporting the research contained in this report.

**Executive Offices:**

McGraw-Hill Construction  
2 Penn Plaza  
New York, NY 10121-2298

**SmartMarket Reports**

[www.smartmarket.construction.com](http://www.smartmarket.construction.com)

**McGraw-Hill Construction****One Name for Industry-Leading Information and Intelligence**

**McGraw-Hill Construction**, North America's leading provider of information and intelligence solutions to the \$4.6 trillion global construction industry, makes it easy for design and construction professionals to cut through the clutter, make better decisions and grow their business.

**A trusted source** for more than a century, McGraw-Hill Construction continues to transform the global construction industry by setting new standards through connecting people, projects and products.

**McGraw-Hill Construction** drives industry growth with critical sales and marketing solutions:

- McGraw-Hill Construction Network®: Online, integrated information solutions to find work, do work and manage opportunities
- McGraw-Hill Construction Network for products: Online, integrated solution to find building products, specs and more
- McGraw-Hill Construction Media/Marketplace: Connecting Buyers and Sellers
- McGraw-Hill Construction Research and Analytics: Gaining Insight and Intelligence

This report is printed using soy-based inks on New Leaf Reincarnation Matte, made with 100% recycled fiber, 50% post-consumer waste, processes chlorine-free with a cover on New Leaf Primavera Gloss, made with 80% recycled fiber, 40% post-consumer waste, processed chlorine free. By using this environmental paper, McGraw-Hill Construction saved the following resources (calculations provided by New Leaf Paper, based on research conducted by Environmental Defense and other members of the Paper Task Force):

- 14 fully grown trees
- 5,200 gallons of water.
- 8 million BTUs of energy
- 682 pounds of solid waste
- 1,394 pounds of greenhouse gases

