

**DODGE** DATA & ANALYTICS

# Green and Healthier Homes:

Engaging Consumers of all Ages in Sustainable Living



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# SmartMarket Report

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## Green and Healthier Homes: Engaging Consumers of all Ages in Sustainable Living SmartMarket Report

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## About Dodge Data & Analytics

Dodge Data & Analytics is the leading provider of data, analytics, news and intelligence serving the North American commercial construction industry. The company's information enables building product manufacturers, general contractors and subcontractors, architects, and engineers to size markets, prioritize prospects, target and build relationships, strengthen market positions, and optimize sales strategies. The company's brands include Dodge, Dodge MarketShare™, Dodge BuildShare®, Dodge SpecShare®, Dodge DocuPro and Sweets.

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## Introduction

Since Dodge Data & Analytics (DD&A) and the National Association of Home Builders (NAHB) first began research on green home building in 2006, the market understanding of green has evolved. The research analyzed in this report—including a quantitative study of home builders and remodelers, and qualitative interviews with recent homebuyers—demonstrates the degree to which **some aspects of green, especially energy conservation, have become an expected practice in the industry, and how commitment to green homes is expected to continue to grow.**

Recent homebuyers expect homes built in the last five years to be more energy efficient and generally greener than those built earlier. This expectation is evident across the buyers of newer and older homes alike, reflecting a general consumer sentiment. The evolving consumer expectations about what qualifies as high performance have influenced the builders and remodelers, driving the bar higher for green. This is evident in the levels of green activity reported in the current study, which are quite similar to those reported in 2014 and 2011, including the expectation of increased green activity. **Over half (51%) of builders expect that more than 60% of the homes that they build will be green by 2020, and over one third (36%) of remodelers expect the same level of green in their projects.**

One factor driving the growth of green in the residential sector is the association of green homes with healthier homes. **Most (83%) of homebuilders and remodelers believe consumers are willing to pay more for a healthier home,** even more than those who believe that consumers will pay more for a green home. As the building industry's attention shifts to the impacts of buildings on the health of their occupants, the focus on health has the potential to boost the green residential market even further.

**Another area supporting the growth of green residential building is the increase in the use of renewable technologies,** with a 7% jump in the use of solar photovoltaic technologies between 2013 and 2014 alone reported by builders. Around half also expect to use solar (48%) and groundsource heat exchange (52%) technologies by 2018.

Demographics may also encourage growth in green home building. **More builders and remodelers believe that mature home buyers, age 55 and older, are influenced by home performance factors, such as energy efficiency, healthier indoor living environment and the durability of a home, than are younger buyers.** The baby boomer generation is large and relatively affluent, which supports a stronger green market currently, but there are also indications that demand may grow among millennials. The interviews with home buyers, combined with the findings of other DD&A studies, suggest that greater experience with or understanding of home performance leads to higher use of green and healthier practices. As the millennials become experienced home buyers, their increased knowledge, combined with their general concern about the environment, could create even greater demand for high-performing homes.

However, the research also reveals **concerns about the cost of building green are growing, with a sharp spike in the percentage of builders who report a 5% or higher incremental cost for green in 2015 (77%), compared with those in 2014 (60%) or 2011 (58%).** The issue of cost must be addressed by the industry in order to see the full potential of the green market achieved, especially as consumers have the expectation that a new home is green and therefore may not be willing to pay a premium for that level of performance.

DD&A would like to thank NAHB for its continuing support of this critical research and Ply Gem for their partnership in this study that allowed us to bring these findings to the market.



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**Stephen A. Jones** leads DD&A's Industry Insights Research division. He is active in numerous industry organizations and frequently speaks at industry events around the world. Before DD&A, Jones was vice president with Primavera Systems (now part of Oracle), a global leader in project management software. Prior to that, he was principal and a Board of Directors member with Burt Hill, a major A/E firm (now merged with Stantec).



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**Donna Laquidara-Carr** currently provides editorial direction, analysis and content to DD&A's *SmartMarket Reports*. Prior to this position, she worked for nearly 20 years with DD&A's Dodge division, where she gained detailed insight into the construction industry.

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Front Cover:  
Barley|Pfeiffer Architects and Ray Tonjes  
Builder, Inc. worked with the home owners  
in Austin, Texas to extensively remodel an  
existing home to improve performance.

This page:  
Left: Screened exterior porch with fireplace  
for the home in Austin, Texas. Right: Use of  
all natural fabrics at EcoManor in Atlanta,  
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# Executive Summary

## Builders remain committed to green building, with trends like healthier homes, net zero homes and use of renewables gaining in importance.

The findings demonstrate that, despite increasing concerns about higher costs, home builders and remodelers are increasingly building green. Older and more experienced home buyers help drive a focus on performance, and emphasizing the healthier aspects of green homes may be a potent way to increase interest among consumers.

## Continued Growth Anticipated in Green in the Residential Sector Through 2020

Nearly one third of home builders (31%) report that they are currently doing more than 60% of their projects green, and over half (51%) expect to be doing that level of green work by 2020. These findings demonstrate that home builders still see green as an important trend in their industry, and one to which they need to commit.

The percentage of remodelers who report doing more than 60% of their projects green currently or who expect to be doing that level of green work in the future is less than the percentage of home builders. However, the growth of those doing this significant level of green work among remodelers is very steep, with the percentage who expect to be that highly involved in green by 2020 being two and a half times greater than the percentage currently doing green at that level.

Both of these findings suggest that firms that work in the residential sector, from building product manufacturers to service providers, need to continue to promote their green capabilities and innovate to develop better ways to serve this growing market.

## Cost of Green is a Growing Challenge for Home Builders and Remodelers

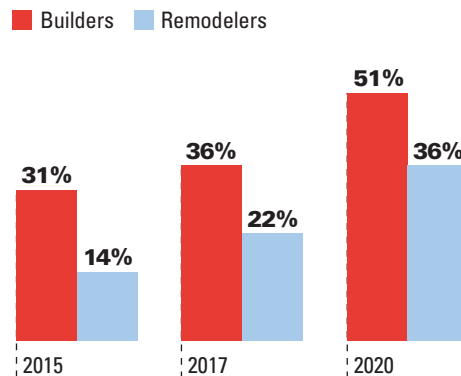
The growth in green building expected in the industry comes despite the growing perception that the cost of building green is an obstacle to more green commitment. Over three quarters (77%) of builders report that building green costs 5% or more than the cost to build a standard home, and an even high percentage of remodelers (83%) agree.

Higher first costs is also reported to be an obstacle by 76% of home builders and remodelers, a 12-point increase over those who reported it an obstacle in the 2011 study.

Consistent with the findings of the previous Green Homes SmartMarket Reports from 2011 and 2014, builders with a high level of green involvement (those who do more than 60% of their projects green) report a

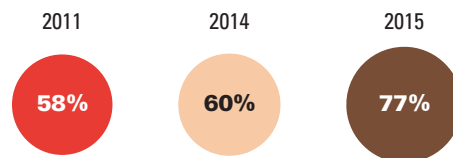
## Dedicated Involvement in Green Activity Over Time (Builders and Remodelers Reporting That Over 60% of Their Home Projects Are/Will Be Green)

Dodge Data & Analytics, 2015



## Percentage of Builders and Remodelers Who Report a 5% or Greater Incremental Cost for Building Green (According to Home Builders)

Dodge Data & Analytics, 2015



lower additional cost to building green than those who do less green building.

As the residential market continues to emerge from the recent recession and new builders who are less experienced with working in green in this sector are drawn to the growing volume of work, the concern with higher first costs for building green may still continue to increase. **Industry resources, from associations to building product manufacturers, can potentially influence these costs by providing low-cost, high-performance solutions and by increasing training about doing green affordably in the industry.**

### Multiple Factors Encourage New Green Home Construction

The five top triggers that will encourage more green building activity—customer demand, energy cost increases, green product availability and affordability, recognition by appraisers of greater value in green homes and code, ordinance and regulation changes—were all selected by between 65% and 68% of home builders. This is a shift from previous studies, in which a couple of triggers were selected by over 70%.

**With no single factor driving new green home construction, the industry should continue to provide incentives, such as affordable green products and higher green home appraisals, to continue to encourage growth in green in the residential sector.**

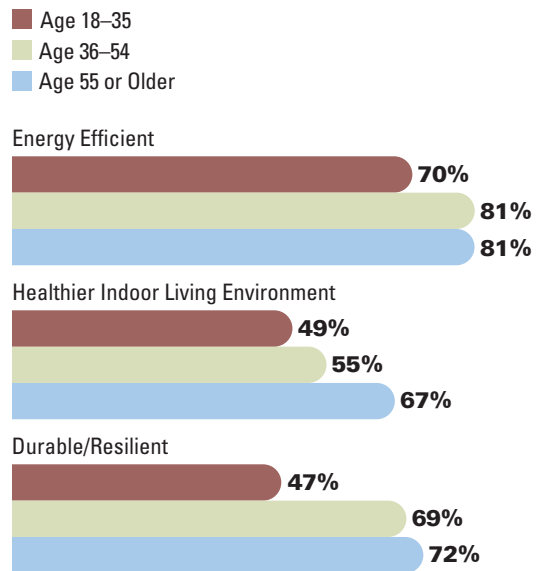
### Buyers Age 55 and Older Are Important Drivers of Green Building

A common perception is that the millennial generation is increasing the demand for green because of their commitment to sustainability. However, the study findings demonstrate that builders find the highest demand for specific, high-performance green aspects of a building, such as energy efficiency, a healthier indoor living environment and durability, among home buyers and home owners facing retirement (age 55 and older).

While income disparities between younger and older buyers no doubt play a role in greater customer demand for high performance features among older buyers, data from the *Drive Toward Healthier Buildings SmartMarket Report* in 2014, along with the findings of a series of in-depth interviews with nine home owners for this study, reveal that experience with homes is also a factor. The more knowledge home owners have about high-performance features in their homes, the more likely

### Criteria Considered Influential by Age Group for Home Buyers (According to the Percentage of Builders/Remodelers Who Consider Them Influential)

Dodge Data & Analytics, 2015



they are to consider this as a factor in their home buying decisions or employ them in their existing homes.

This conclusion has a couple of implications:

- Home builders should market their entry level homes on overall sustainability, and their retirement homes on specific performance features.
- Those marketing to younger buyers may need to consider how to better educate their audience on what can lead to a high performance home.

### Focus on Health Can Help Drive Greater Sustainability in the Residential Market

Most (83%) builders and remodelers believe that consumers will pay more for healthier homes. This is a higher percentage than those who believe that customers will pay more for a green home (69% of builders and 78% of remodelers). This clearly suggests the value of emphasizing the healthier aspects of green homes.

However, the in-depth interviews do offer one note of caution. At least one of the nine recent home buyers interviewed expressed a concern about how a home could be demonstrated to be healthier and felt that this categorization was more nebulous than green, for which specific performance can be demonstrated.

Home builders and remodelers seeking to capitalize on the interest in healthier homes must be prepared to specifically address how their homes are healthier.

### Renewables Use Continues to Increase, With High Future Growth Expected

Every type of renewable technology included in the survey increased by at least two percentage points between the 2013 levels measured in the last study and the current 2015 levels of use. Solar photovoltaic, in particular, jumped from 12% to 19% in those two years. Around half of respondents also expect to use solar photovoltaic (48%) and ground source heat exchange (52%) technologies by 2018.

In addition, more than 20% of home builders report having built a Net Zero/Net Zero Ready home, and more than half (58%) of builders who do 90% or more of their projects green are doing Net Zero/Net Zero Ready homes.

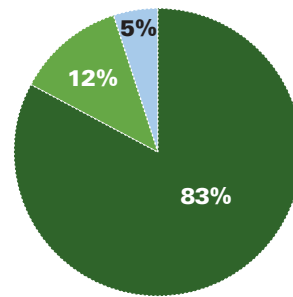
A few conclusions can be drawn from these findings:

- Builders seeking to remain competitive in green may need to consider renewable options.
- Builders seeking to build their green business should also focus on being able to offer Net Zero homes.

### Willingness of Home Buyers and Home Owners to Pay More for a Healthier Home (According to Home Builders and Remodelers)

Dodge Data & Analytics, 2015

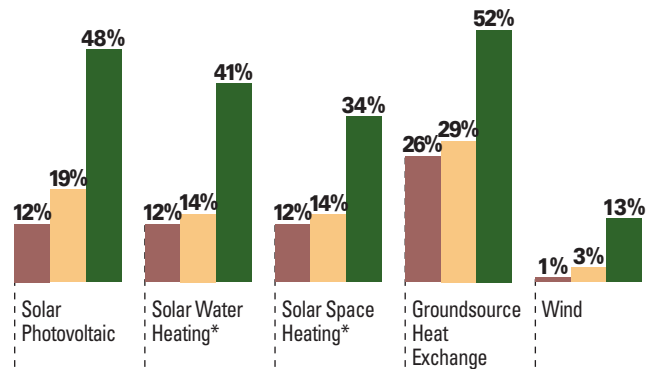
- Willing to Pay More
- Not Willing to Pay More
- Don't Know



### Use of Specific Renewable Technologies Over Time (According to Home Builders and Remodelers)

Dodge Data & Analytics, 2015

- Used in 2013
- Used in 2014
- Expected to be Used in 2018



\*For 2013, Solar Water Heating and Solar Space Heating were combined under the category Solar Thermal.



# Data: Introduction

**R**esidential construction has experienced a particularly tumultuous decade. Throughout the peaks and valleys experienced in the residential market, studies of home builders conducted by Dodge Data & Analytics since 2006 have demonstrated a steadily growing, engaged interest in green homes. That level of engagement is still clearly evident in this most recent study, and the history of these reports allows a rich analysis of longitudinal trends.

This SmartMarket Report largely focuses on single family homes and remodeling projects, but it also expands the scope of the study in two important ways: by looking at **how different generations of buyers prioritize sustainability**, and by looking at the **rising interest in healthier homes**.

An examination is conducted of how home buyers in three different age groups are influenced by green and healthier home features in their buying decisions (see the age groups in the Note About the Data to the right). Builders were asked about the green home priorities of each age group, as long as at least 25% of their customers fell in that group.

One possibly surprising conclusion that can be drawn from the findings is that **more mature home buyers, those 55 and older, are the most important drivers of green currently in the market**. They are most aware of the products and features of green homes and care most about the specific performance of the home when it comes to energy, improved indoor air quality and other green features. A series of in-depth interviews with nine home buyers (three from each age group) offers some insight into why the older buyers are also those most likely to encourage green building. In addition to their generally greater affluence than younger buyers, older buyers also have more experience with homes in general, and experience and knowledge are key drivers for specific concerns about home performance.

This SmartMarket Report also features **new data on the use of healthier building features, products and construction activities**, along with the builders' assessments about consumer interest in healthier homes. A higher percentage of builders believe that consumers will pay more for a healthier home versus a green home. **As the green building movement matures in commercial construction, health is poised to become the next critical trend**, and these findings suggest that prioritizing health in building design and construction is equally supported by market factors in the residential sector.

## Note About the Data

**The data in this report are based on an online survey of 249 professionals in the residential home building sector. Each professional was asked to indicate their primary function in 2014, and based on those responses, they are included in the analysis as follows:**

- 177 single family builders/developers, who, for the sake of brevity, are referred to as home builders
- 55 single family remodelers
- 17 multifamily builders/remodelers

**The main analysis in this text examines the responses of the home builders and remodelers. Because of the small sample size of multifamily builders and remodelers, their responses are analyzed separately for notable trends when compared with the study of multifamily builders and remodelers published in the 2014 *Green Multifamily and Single Family Homes SmartMarket Report*. That analysis is on page 36.**

**The following variables are also frequently used in the analysis:**

- Longitudinal analysis contrasting the current findings with those from the 2014 and 2011 Green Homes SmartMarket Reports.
- The level of green involvement is analyzed among home builders only, given the smaller number of remodeler responses. Home builders fall into the following categories:
  - Low involvement: Less than 16% of their home building projects are green
  - Medium involvement: 16% to 60% green projects
  - High involvement: 60% or more green projects
  - Dedicated green builders: 90% or more green projects
- Age of clients
  - Age 35 and under, also referred to as millennials
  - Age 36 to 54
  - Age 55 and older

# Data: Green Residential Building Market

## Level of New and Remodeled Green Home Building Activity

GREEN AND HEALTHIER HOMES: ENGAGING CONSUMERS OF ALL AGES IN SUSTAINABLE LIVING DATA

### New Single Family Homes

As with previous studies, builders doing new single family homes report that they expect their level of green building activity to increase notably over the next five years. **By 2020, over 80% expect that more than 16% of the homes they build will be green.**

Interestingly, the actual percentage of green projects reported in the previous two years, current year, two years from now and next five years has remained notably consistent with the previous two studies in 2011 and 2014, which seems to suggest that the results have not changed much between the three studies. However, it is likely that the findings may actually reflect a growing sophistication in understanding the elements of a green home and a maturing green market. As builders get consistently greener in their approach, they are less likely to consider their previous projects to be as green as they had posited them to be in the past.

As in the past, the most critical shift comes in the high percentage of those who expect to be dedicated green builders, doing more than 60% of their projects green.

### Single Family Remodeling Projects

The firms doing single family remodeling projects also see a similar shift that lags only slightly behind the new residential building market. These findings are also consistent with previous studies, and they suggest an equally steady if slightly less universal drive toward green in the remodeling sector.

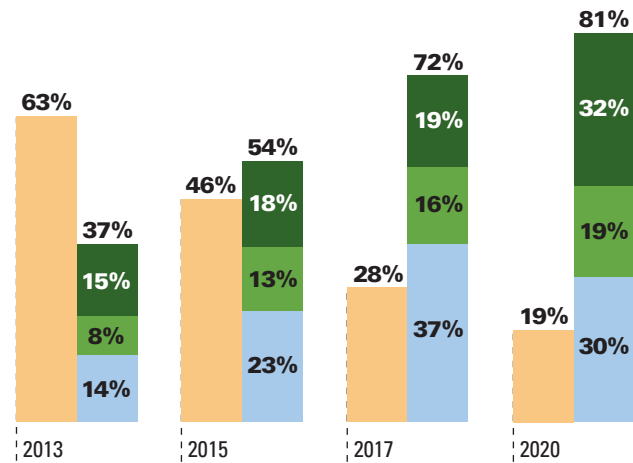
Two factors likely contribute to this lag among remodeling firms. The scope of some remodeling projects may be too small to allow some projects to fulfill the full requirements of green as defined in this study. (For the full definition provided to respondents, see the study methodology on page 52.) In addition, the scope and goals of a remodeling project are most frequently determined by the home owner, in contrast to new home building, where the builder or developer is more likely to determine whether to make a home green or not. Green remodelers can have a great deal of influence on client decisions—as the 25% of remodelers who expect over 90% of their projects to be green by 2020 suggests—but the home owner is still typically the ultimate arbiter on what is involved in the home to a much greater degree on a remodeling project than on a newly built home.

### Involvement in Green Activity Over Time

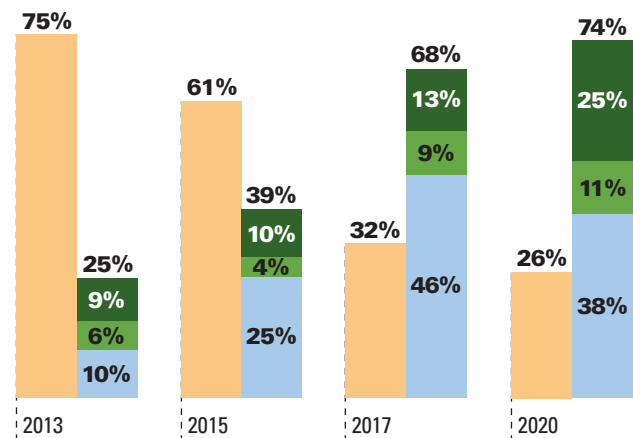
Dodge Data & Analytics, 2015

- Less Than 16% of Projects Green
- 16%–60% of Projects Green
- 61%–90% of Projects Green
- More Than 90% of Projects Green

#### Builders of New Single Family Homes



#### Single Family Remodelers



Home builders and remodelers agree that there is a cost to making their projects green. As in previous studies, home builders note a slightly lower cost than remodelers for the cost of building green. This may be due to the ability of home builders to repeat many of the same features and practices on new homes, allowing them to leverage their material buying and expertise across numerous projects, whereas remodeling projects are more customized by customer.

### Comparison With Previous Studies

One surprising finding in this study, however, is that there is a notable increase in the cost of building green over the last few years. The last study, published in the 2014 *Green Multifamily and Single Family Homes SmartMarket Report*, already reported a nominal increase in the average percentage of additional cost to build a new green home, and this study confirms that this may be a trend:

- **2008: 10% premium to build new green single family homes**
- **2011: 7% premium**
- **2014: 8% premium**
- **2015: 10% premium**

Remodelers report a similar increase, with an average 12% premium reported, compared with the 9% in 2014 and 8% in 2011.

The chart at right makes it clear, however, that this is not just a general lift in cost across the board. There are two areas where there is a significant difference.

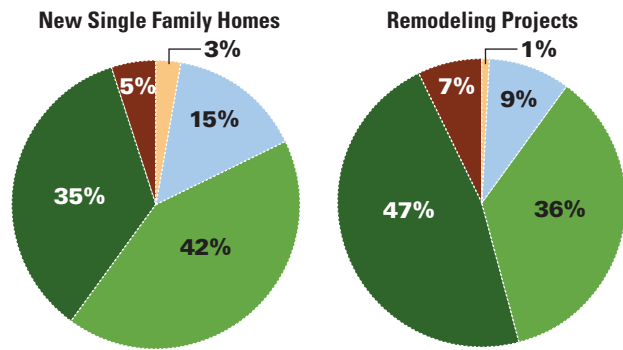
- **Half as many respondents in the current survey believe that green will add a premium of 1% to 4%, compared with previous years.**
- **More than twice as many respondents in the current survey doing new green homes believe that green adds a premium of 15% or more, compared with previous years.**

It is important to note that the highest percentage of respondents still fall in the 5% to 10% range for a green premium, which is clearly still where the median cost lies.

### Incremental Cost of Incorporating Green Features and Practices (According to Home Builders and Remodelers)

Dodge Data & Analytics, 2015

- No/Insignificant Costs
- 1%–4%
- 5%–10%
- Greater Than 10%
- Don't Know



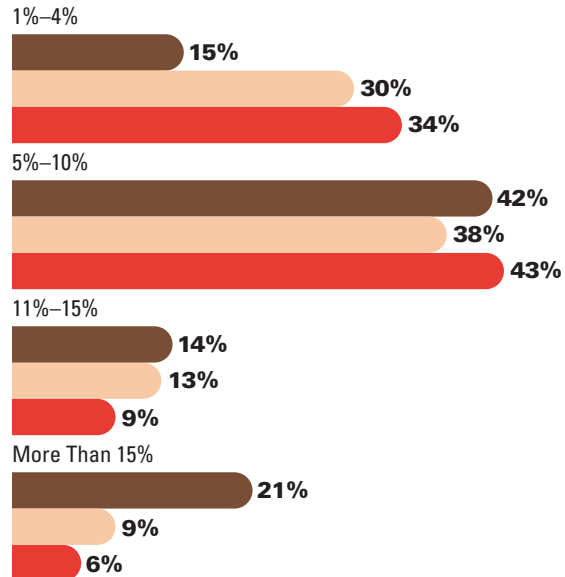
### Incremental Cost of Incorporating Green Features and Practices in New Homes (According to Home Builders Over Time)

Dodge Data & Analytics, 2015

- 2015
- 2014
- 2011

#### No/Insignificant Costs

- 3%
- 4%
- 4%



There are several factors that are likely contributors to this perception of increased cost.

- First, the reinvigorated housing market, with its substantial percentage of green projects, may be helping to inflate the cost of green products and skilled green workers. The fact that the premium now matches the findings conducted before the market crash lends credence to this being a factor.
- Second, greater consumer knowledge about green and the increased presence of green homes on the market may lead consumers to expect a higher level of performance in their green homes than previously, which may force builders to invest in more expensive building products and systems that can deliver that higher level of performance in order to be competitive as green builders.
- Third, many building product manufacturers have been developing new green products to meet increased market demands, and these higher-performing products may also be more expensive.
- Fourth, regionally and nationally, some of the government incentives to build green have expired, which also may create greater challenges in building green projects affordably.

### Variation by Level of Green Involvement

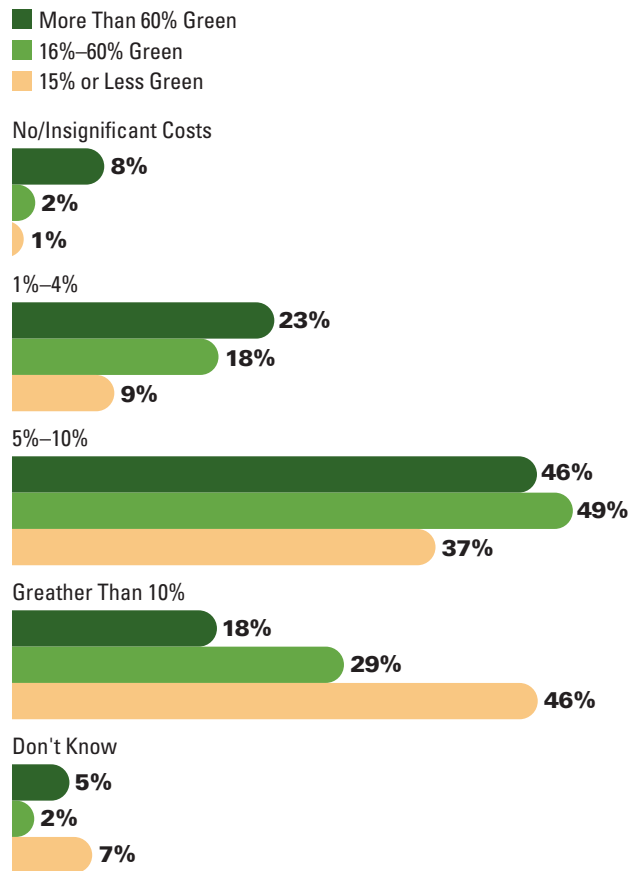
As in previous studies, there is clear evidence that experience with green building helps reduce the perception of a green premium among home builders.

- **Nearly half (46%) of builders who build less than 16% of their projects as green homes report that green has a premium of more than 10%, more than double the percentage of builders doing more than 60% green homes.**
- **A significantly higher percentage of those who do more than 60% green homes report that green has no additional cost (8%) or that it has a small premium of 1% to 4% (23%), compared with those who build less than 16% of their homes green.**

This reinforces the findings from early studies that demonstrate that a higher level of green involvement by builders decreases their cost of building green.

### Incremental Cost of Incorporating Green Features and Practices in New Homes (By Level of Green Involvement)

Dodge Data & Analytics, 2015



## Willingness of Customers to Pay for Green

One of the most important factors helping to drive the residential green building market is the fact that customers not only want green homes but are willing to pay more for them. Consumer recognition of the value of green, in terms of reduced monthly operating costs, higher quality and healthier indoor environment, has encouraged the market to invest in the premium cost of building green.

**Since 2011, there has been a notable increase in the percentage of home builders and remodelers who find that their customers are willing to pay more for a green home.** The increase first became evident in 2014, and for the most part, the current findings demonstrate that customers are willing to invest in green homes during the economic recovery. In fact, the recovery may be a factor in this finding: as home values begin to rise, customers may be more willing to see green as an important element for increasing the future value of their home.

**In addition, home builders and remodelers have both become more confident about whether or not customers will pay more for green since 2011.** In both cases, the percentage of respondents who are uncertain about the responses of their customers has decreased nearly by half. This may be one indicator that the home green building market is moving into a more mature phase, where both builders and remodelers have a greater awareness of the costs and benefits of building green.

**However, there has also been a significant increase from 2014 of new home builders who believe customers won't pay more for a green home.** This is different from remodelers, where the percentage has remained relatively steady. This increase may be due to the fact that high performance is increasingly associated with newer homes, as the in-depth interviews with recent home buyers revealed (see page 22) and reflect the mainstreaming of green in the residential marketplace.

### Amount Customers Are Willing to Pay for Green

#### HOME BUILDERS

The highest percentage of home builders (55%) who find that customers will pay more for green believe that the additional price premium amounts to 1% to 4% more. However, a large percentage (33%) also find that customers will pay between 5% and 10%.

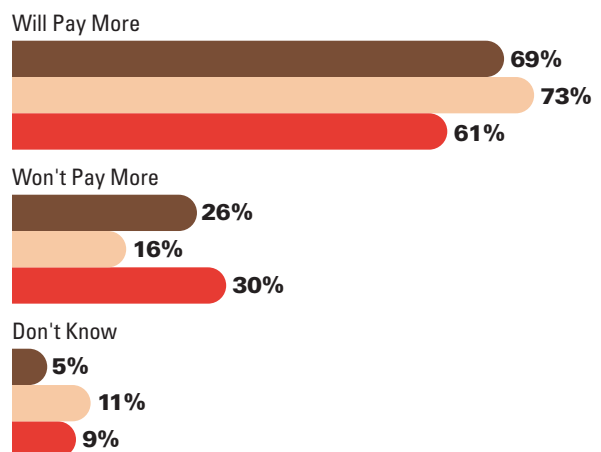
In addition to the increase in the percentage of home builders who find their customers will pay more for green in 2015 than they did in 2011, a higher percentage also believe that customers will pay 5% or more, compared

### Willingness of Customers to Pay for Green Homes (According to Home Builders and Remodelers)

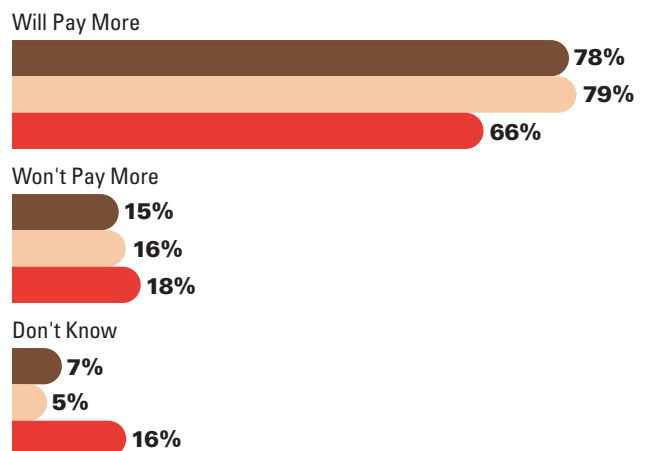
Dodge Data & Analytics, 2015



#### Home Builders



#### Remodelers



# Green Residential Building Market

## Willingness of Customers to Pay for Green

CONTINUED

GREEN AND HEALTHIER HOMES: ENGAGING CONSUMERS OF ALL AGES IN SUSTAINABLE LIVING DATA

with the 2011 study:

- **Percentage of Home Builders Who Find Customers Will Pay More for Green: 5% to 10% More**
  - 2015: 33%
  - 2011: 26%
- **Percentage of Home Builders Who Find Customers Will Pay More for Green: More Than 10% More**
  - 2015: 12%
  - 2011: 9%

This shift is accompanied by a decrease in those who believe customers will only pay 1% to 4% more, which has decreased by 10 percentage points from 65% in 2011 to 55% in 2015.

These findings demonstrate that home builders are seeing greater customer willingness to invest in green. The increased percentage of builders who find customers will pay more for green supports the increase in the percentage of builders who expect to be largely or solely dedicated to green building within five years (see page 8).

### REMODELERS

**While the highest percentage of remodelers (48%) who find that customers will pay more green believe that customers will pay between 1% to 4% more, nearly as many (42%) believe that they will pay 5% to 10% more.**

Unlike the home builders, the distribution of the remodelers who believe that their customers will pay for green has remained consistent between 2011 and 2015 in terms of how much extra customers will pay, with the same percentage for each category reported in 2011.

The lack of change in remodeler estimates of the additional amount that a customer will pay for green may be influenced by the fact that customers often determine the degree of green investment in remodeling projects, compared with home builders, who often build in anticipation of market interest, rather than directly in response to it.

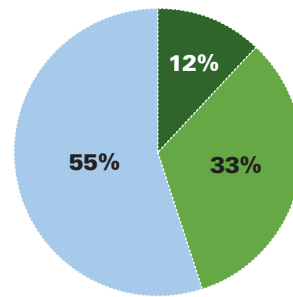
### VARIATION BY LEVEL OF GREEN INVESTMENT

**Most (83%) of the home builders who are dedicated green builders (more than 90% of their home building projects are green) find that customers will pay more for green, compared with 62% of those who do less than 16% green projects.** This confirms the findings of the previous studies demonstrating that more experience and commitment to green typically yields lower cost premiums and higher price premiums.

### Additional Amount Customers Are Willing to Pay for New Homes (According to Home Builders)

Dodge Data & Analytics, 2015

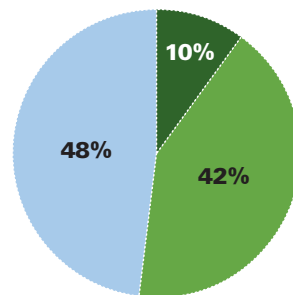
- More Than 10% More
- 5%–10% More
- 1%–4% More



### Additional Amount Customers Are Willing to Pay for Green Remodeling Projects (According to Remodelers)

Dodge Data & Analytics, 2015

- More Than 10% More
- 5%–10% More
- 1%–4% More



Dedicated green home builders (over 60% building green) also find that their customers are willing to pay a higher percentage than the rest of the respondents. **The highest percentage of dedicated green home builders (43%) believe their customers will pay 5% to 10% more for a green home, and an additional 21% believe that they will pay more than 10% more.**

## Ease of Marketing for New Green Homes

The changes in how easy or challenging the marketing of green homes is for builders in the residential sector may suggest a maturing green market.

- **In 2011, the percentage who found it easier to market green homes was only marginally higher than those who found it more difficult, but both were notably higher than those who felt it made no difference.** The recession was still a dampening force on the housing market in 2011, and green could be an important differentiator. However, a high percentage also found green homes more challenging to market, perhaps due to the perception of higher costs in a buyer's market.
- **In 2014, there was a notable uptick in the percentage who found it easier to market green homes.** The study for the 2014 report took place largely toward the end of 2013, when the recovery was just beginning to become evident. This rising tide may also have assisted in the marketing of green.
- **In 2015, the percentage of those who find it easier to market green homes declines, but the majority of the shift goes to those who feel there is no difference in marketing green homes compared with traditional homes.** The higher percentage of builders who find no difference in marketing green homes versus traditional homes may be due to a few different factors:
  - Home buyers may find that potentially higher costs are balanced out by better performance and lower operating costs for the home.
  - After several years of increasing market share, green home building may seem more like common practice.
- **The drop that occurred in the 2014 study among those who find green homes difficult to market is largely sustained in the current study, which suggests better informed consumers who understand and are more open to marketing messages about high performance homes.**

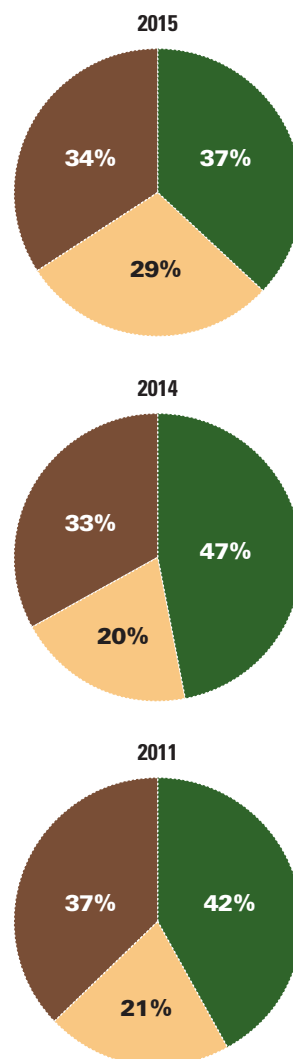
### Variation by Level of Green Involvement

Not surprisingly, builders with more green experience find it easier to market these homes than do those with less experience. **A majority (53%) of dedicated green builders (those who do more than 90% of their homes green) say that green homes are easier to market, which is more than twice the rate (25%) of builders doing less than 16% of their homes green.** This demonstrates again that green experience contributes to making green building easier and more cost effective.

### Level of Ease in Marketing New Green Homes (According to Home Builders)

Dodge Data & Analytics, 2015

- Easier/Much Easier
- No Difference
- Difficult/Much More Difficult



# Turning an Existing House Into a High-Performance Home

## Existing Home Remodel

AUSTIN, TEXAS

Jay and Jacque Forrest were looking for a home in which to retire in Austin, Texas that met the following criteria: They wanted to downsize, and they wanted to be located near their daughter. Because there were no affordable lots available near her home, the Forrests looked at existing homes that they could remodel to meet their needs. They found a good prospect that had an additional advantage of a view of a cliff and a stream.

They wanted the home to be as efficient as possible, but they were initially concerned about what could be done. According to Jay, "As a remodel, you have limitations. You have compromises you have to make."

### Getting the Right Team

They credit much of their success to the selection of an architecture firm and a builder with a lot of experience with high-performance homes. Jay Forrest states, "Between the two of them [architects Peter Pfeiffer and Alan Barley, and builder Ray Tonjes], they had good ideas of what would work well and should be done to the house."

Despite the challenges of working with an existing building, the owners, architects and builder worked together to set a goal for being near-net neutral, a goal they were able to accomplish because of the extensive renovation that was done to the house. The efficiency target was specifically chosen to maximize the value for the owners, because, according to Forrest, "you get much less back [for power generated by the home] than what you pay." He reports, in their all-electric home,

they are still able to produce about 80% to 90% of the power they used through the installation of photovoltaic solar panels. "We're blown away," says Forrest, "by the fact that our neighbors have \$300 to \$400 electric bills [per month], and our highest bill this summer has been \$45."

### Achieving High Levels of Energy Efficiency

Rather than focusing on one or two specific practices, Forrest insists that the "integration of appropriate elements into a cohesive whole is how we were able to achieve our high energy efficiency." The key elements he identifies are the use of a double roof that has a galvanized steel roof over the original one with an air gap between the two which acts as a radiant barrier and flushes out the hot air, use of foam insulation in the walls and to seal off the attic, use of insulated double-pane windows, use of LED lighting and the use of a high-efficiency variable refrigerant flow heat pump air conditioning.

The air conditioner is a valuable strategy in this home because, as the builder Ray Tonjes explains, it ramps up slowly and runs more continuously, in contrast to a more typical system that, "when it kicks in, it is full on, and when it hits a designated temperature, it is fully off." Tonjes says that the ability to run at a variable level "makes for tremendous increased efficiency" because it is never operating at full speed and therefore can operate much more efficiently than a traditional system.

Having these fundamental elements required a more extensive remodeling of the home, including

removing all the sheet rock to allow them to get the foam insulation in the walls. For this project, the decision had already been made to replace the home's existing aluminum wiring and water lines, so the commitment to a more extensive project was acceptable to the home owners. However, Forrest believes that level of intervention in the home is necessary to achieve the high level of efficiency they have been able to attain. He states, "It is very difficult to pursue high energy efficiency in isolated steps. One really needs to get the structural and primary factors in place first, like the insulation and roof."

However, once those elements are in place, Forrest says, "it was easy and attractive to pursue smaller details that would be less significant if the house were not highly efficient." Those strategies included adding an on-demand hot water circulation system and adding an electric heater to the bathroom floor.

One element that Tonjes discussed was using extended eaves where necessary to ensure that all the windows are shaded. Tonjes states, "One of the most effective design features that you can do is shade your windows, especially those to the east and west." While the site included natural shading on the western-facing windows, for other areas with windows with more sun exposure, the eaves were extended for shade.

### Creating a Better Occupant Experience

In addition to being highly efficient, the home was also reworked to improve the occupant experience, improving daylighting and indoor air



## Existing Home Remodel AUSTIN, TEXAS



The screened in porch with fireplace improves the efficiency of the home and the occupant experience, including indoor air quality in the house.

quality. According to Forrest, “The house was really kind of a dungeon when we bought it. It was really dark on the inside.”

Several strategies helped them to address this issue. They added double-glass front doors with a transom window to the north and double-wide glass doors on the south to provide natural light while minimizing heat gain. Tonjes sees the addition of more natural light as an important goal. He says it makes the house “very comfortable,” a “significant factor, especially for retirees who are home more.”

In addition, to take advantage of the views that had appealed to them when they first purchased the property, the architect Peter Pfeiffer recommended that they open up the back of the house that looks out on the view and add a screened porch. The porch had the added advantage of being on the southwest side of the house, which allowed it to serve, as Forrest states, “as a buffer and sun protection for the windows

and doors in their living room.” In addition, they made the decision to move the fireplace in the den to the screened porch as well, which not only increased the potential for more frequent use, but also improves the indoor air quality.

The tight seal on the house also required attention to its airflow. As Tonjes points out, “The big thing is sealing up the house better, and then we also have a passive fresh air intake that keeps the house with positive pressure. When the AC’s running, you never get into negative pressure, where you are bringing in outdoor pollutants and humidity.

The home owners are also impressed with a membrane that keeps air from the attached garage from contaminating the home. They notice that “none of the odors from outside seem to come in.”

### Material Reuse

The home owners were very committed to the reuse of materials and equipment removed from

### Project Facts and Figures

#### Architect

Barley|Pfeiffer Architecture

#### Builder

Ray Tonjes Builder, Inc.

#### Size

2,266 Sq. Ft. (Conditioned Space)

#### Type of Work

Remodel and Addition (house originally constructed in 1972)

#### Completed

2014

### Energy-Efficient Strategies

- Foam Insulation in Walls, Attic
- Solar Photovoltaic System
- Double Ventilated Roof
- Sealed Attic
- Insulated Double-Glazed Windows
- Variable Refrigerant Flow Heat Pump Air Conditioner
- Extended Eaves
- LED Lighting Throughout Home

the home due to the extensive remodeling. They had limited opportunities to do so within the home, but they took advantage of opportunities like reusing bricks from the facade to create a storage room. The existing air conditioning system, which was fairly new, was reused by Tonjes on another project. The architect took beam and deck materials and made them into furniture. Other features removed, like ceiling fans, door handles and doors were donated to Habitat for Humanity. ■

## Impact of Green Incentives on the Residential Market

**The combination of many incentives on the federal, state and local levels can be a powerful driver for green residential construction, but making incentives that are appealing to consumer attitudes and easy to use are critical for effective deployment.**

Many advocates of green building credit federal, state and local green incentive programs with expanding adoption of green building throughout the United States, but the direct impact of any one program is difficult to measure. Consumer attitudes can play a significant role, and some results suggest that the ability to combine incentives from a number of sources may be the most effective strategy.

### Cumulative Influence of Multiple Incentives

"It's hard to separate the effects of one program versus another," says Shawn Gallagher, vice president of state affairs at the Solar Energy Industries Association.

In California, for example, the state's \$2 billion California Solar Initiative, which runs between 2007 and 2016, provides funds to reduce the cost of new solar energy installation. However, Gallagher notes that by combining the CSI funds with the existing federal Investment Tax Credit for solar, costs can be reduced by up to 50%. "That combination is what has made it a very successful program," he adds.

In a September 2015 report, Environment America noted that multiple green incentives and policies were in effect in states with the highest cumulative solar electricity capacity per capita in 2014. The study found that nine out of the top 10 states allow creative financing

options, have strong net-metering policies, and have strong statewide interconnection policies.

### Successful Incentive Strategies

Daniel Bresette, director of government relations at the Alliance to Save Energy, says he sees success in rebate programs. Bresette says that contractors are more likely to be aware of available rebates and are motivated to help customers take advantage of them. "The most effective programs are those that satisfy the contractors and streamline the process for the home owner," he says. "If there are forms to submit, the contractor can help with that. The good programs make it easy to do that."

Ultimately, Bresette says it's about making the process easy for consumers. "Good programs strive to reduce the amount of active involvement on the home owner's part," he adds.

Billie Kaumaya, federal legislative director with the National Association of Home Builders, agrees that good programs are those that are easy for consumers to take advantage of, and she regards federal tax credits as the cornerstone of incentives programs. "We've found the easiest and fastest way to build green and more energy efficiently are tax credit programs," she says. "These are the easiest for the consumer to understand. We've found that there are a lot of creative

ways to provide incentives, but tax credits seem to work the fastest."

And their impact can be profound. Kaumaya noted that the federal 45L tax credit—which offers a \$2,000 credit to builders of new homes that exceed minimum energy code specifications—applied to only 0.7% of the market when it was enacted in 2006. By 2011, 11% of new homes were eligible for the 45L program.

Consumer attitude can help drive what types of green incentives will be effective in different states. In northern California, for example, public desire to produce low- and no-carbon energy helped drive use of the California Solar Initiative, he says. However, in Georgia, property rights were a central argument for passing a third-party leasing bill in 2015.

### Challenges Ahead

With multiple models for incentive programs in use around the country, how these programs are structured continues to evolve. Kaumaya noted that, on the federal level, some legislators have suggested moving future incentives to a performance-based model, which could lead to fewer home owners taking advantage of incentives. "[Under a performance-based model], you're getting a credit for what you're actually achieving, not what you designed to achieve," she says. "The problem is, those are harder to sell to the consumer because they are asked to invest in something that they may or may not get." ■

# Data: Triggers and Obstacles for Green Homes

## Most Influential Criteria for Purchasing a New Home

GREEN AND HEALTHIER HOMES: ENGAGING CONSUMERS OF ALL AGES IN SUSTAINABLE LIVING DATA

Home builders were asked the generational makeup of their clients for three different age groups:

- Age 18–35
- Age 36–54
- Age 55 and older

The home builders who reported that more than 25% of their clients fell into any of these age groups were then asked to rate the influence of several different criteria on the home purchasing decision of each group. The chart at right represents the percentage of home builders who believe these criteria are influential/very influential.

This finding seems to contradict popular wisdom that younger buyers prioritize green. **The three most influential green criteria generally—energy efficiency, health impacts and durability—are noted as influential by a much lower percentage of home builders for those age 35 and under than they are for other groups, especially those 55 and older.**

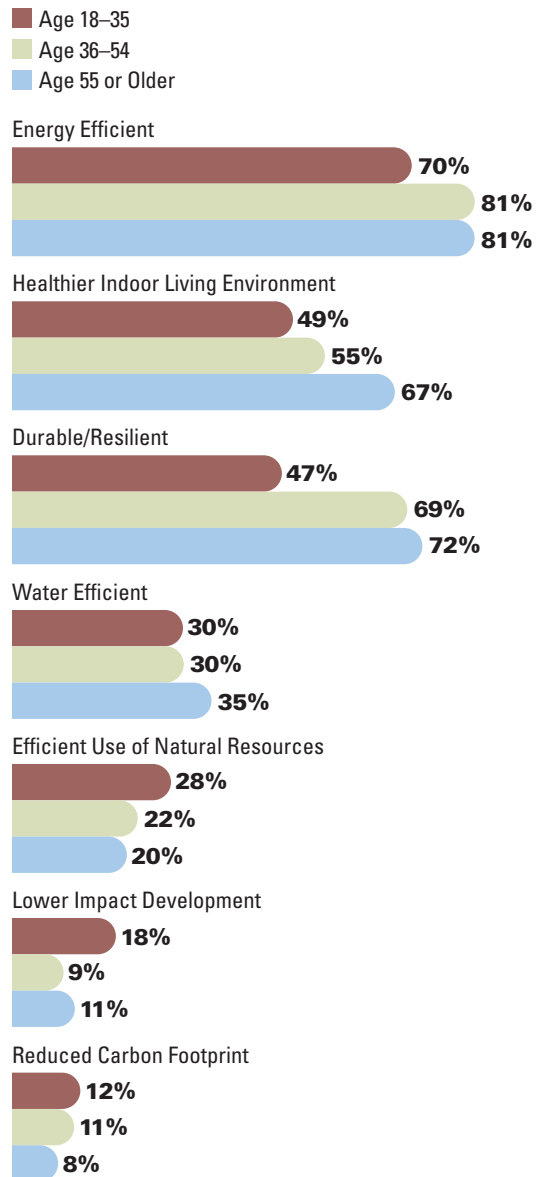
A few factors may contribute to these results:

- Homebuyers under age 35, many of whom may be first-time home buyers, may be strictly limited in terms of their options by budget, which could crowd out factors that they would like to prioritize.
- Greater experience with home ownership in general may make these factors more important to buyers who are age 55 and older.
- There is evidence that millennials feel strongly about a green lifestyle but that they are more aware of and engaged by a general goal of doing good for the planet than for the immediate, tangible impacts of green building on their lives. (See page 24 for more information.)

The ratings for efficient use of natural resources, lower impact development and reduced carbon footprint may support the difference in how millennials view green. While the rankings are relatively low across the board, more builders believe that these general impacts are highly influential for the youngest generation of buyers than those builders who believe that they influence buyers who are 55 and older. This supports the notion that younger buyers are more influenced by the broader impacts of their behavior on the world at large, while older buyers are more focused on the specific financial and physical performance of their home. This is an important distinction to keep in mind when attempting to market green or healthier homes to these audiences.

### Criteria Considered Influential by Age Group for Home Buyers (According to the Percentage of Builders/Remodelers Who Consider the Factors Influential)

Dodge Data & Analytics, 2015



## Triggers for Green Building Activity

### Home Builders

The chart at right reflects the percentage of home builders who believe that the triggers listed have a high/very high impact on encouraging their green building activity. By comparing the 2015 findings with previous studies, the chart reveals the triggers that have remained consistently high scoring over time: **customer demand, and green product availability and affordability.**

In addition, it shows which triggers are changing over time. **The main trigger that has seen growth over previous studies is appraisers recognizing greater value in green homes.** This may be due to the fact that in some regions of the US, appraisals influenced by home performance are becoming more common. It is notable that 79% of dedicated green builders (those who do more than 60% of their projects green), consider this factor influential, suggesting that some knowledge of green is necessary to capitalize on this benefit.

A few triggers are trending lower since 2011:

- **Energy Cost Increases:** Relatively steady energy prices over the last few years have made this trigger less urgent in the current study.
- **Higher Quality:** The decline may be due to green becoming a norm in the housing market. However, it is still a critical trigger for committed green builders, with 72% indicating it is impactful. As more builders increase their level of green building, this factor may again rise in importance.
- **Government or Utility Incentives:** Government incentives established several years ago may not always be renewed. For more information on the state of government incentives for residential green building in the US, see page 16.

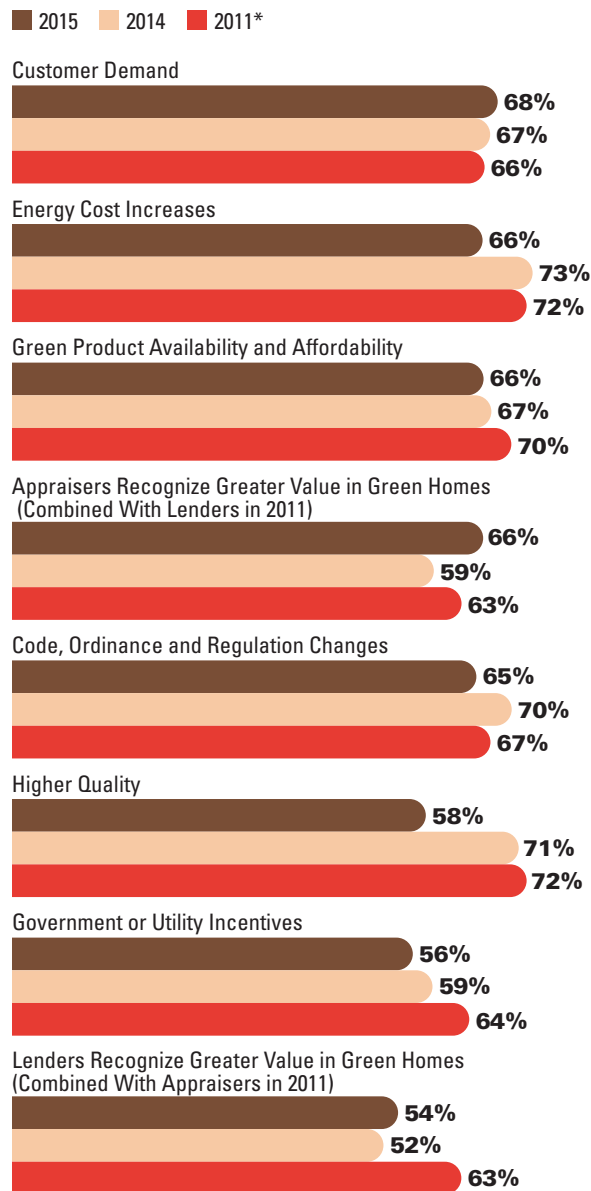
One notable difference between the current study and the previous ones is the change from one or two top triggers driving most builders to the more general influence of several factors.

- In 2015, the top five triggers were selected by approximately two thirds of the respondents in a very tight cluster, but no single trigger exceeds 70%.
- In 2014 and 2011, the responses for higher quality and energy cost increases both exceeded 70%, demonstrating more unanimity about the influence of these particular factors.

There is also a slightly lower percentage selecting the majority of the triggers in 2015 than in previous years. All of this may indicate a maturing market, in which the

### Triggers Considered Impactful by Home Builders to Increase Green Building Activity (According to Those Rating Their Impact as High/Very High)

Dodge Data & Analytics, 2015



\*2011 percentages for builders solely practicing new construction.

demand for green is driven by a variety of factors, rather than just one or two key drivers.

### Remodelers

Unlike home builders, remodelers do have two key triggers driving them to build green, and the influence of these triggers has increased since 2011.

■ **Code, Ordinance and Regulation Changes:**

The percentage of remodelers impacted by code, ordinance and regulation changes has increased steadily since 2011. Clearly, increased use of green codes, ordinances and regulations continue to impact the home renovation market.

■ **Energy Cost Increases:** This finding is surprising, since the relatively flat energy costs in the past few years should have a similar influence on remodelers and builders. It may simply reflect the high level of consumer awareness of how green improvements can help save energy, and greater consumer demand to reduce energy costs may influence remodeler perceptions of this trigger.

**The influence of lenders recognizing the greater value of green homes is also a trigger that appears to be gaining influence among remodelers.** The remodelers' focus on lenders rather than appraisers suggests that remodelers see greater benefit from their customers getting easier access to financing for their green projects, rather than customer interest in increasing the value of their homes by making them greener.

Several triggers have declined in influence since 2011.

■ **Customer Demand:** The shift in the percentage who consider customer demand influential is small, but it has also been steady since 2011. While this shift could reflect less customer demand for green in general, it could also be due to more remodelers taking the initiative to incorporate green into their projects. The high percentage of remodelers who expect to have 60% or more of their remodeling projects be green in the next two to five years (see page 8) supports the latter inference, since it is unlikely that they expect the majority of their customers to prioritize green.

■ **Higher Quality:** As with builders, this may be due to an increase in customers who perceive improved home performance as an expectation rather than a differentiator on quality.

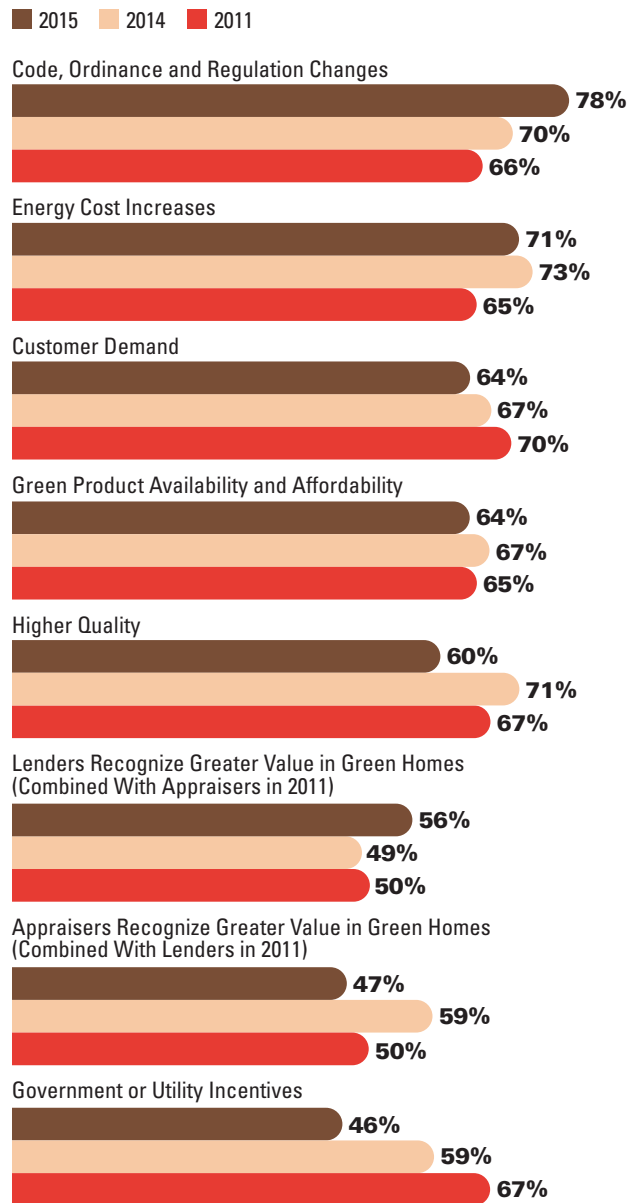
■ **Government or Utility Incentives:** Home builders also note the declining influence of incentives.

### Variation by Type of Customer

Only about one third of builders and remodelers whose clientele is composed of at least 50% of those in the 18 to

### Triggers Considered Impactful by Remodelers for Increasing Green Building Activity (According to Those Rating Them as High/Very High)

Dodge Data & Analytics, 2015



35 age bracket consider energy costs highly impactful, compared with over two thirds of those with an older clientele. This supports the conclusion that younger buyers are less attuned to specific elements of home performance than the idea of doing green as a lifestyle.

## Obstacles to Green Building Activity

Overall, there is wide industry agreement on the top obstacles to green building activity. The percentage of builders and remodelers who consider these issues to be impactful or highly impactful closely corresponds for each of the top three obstacles:

- **Consumers Unwilling to Pay Additional Cost**
  - Home Builders: 80% believe this has a high/very high impact
  - Remodelers: 76%
- **Higher First Costs**
  - Home Builders: 76%
  - Remodelers: 76%
- **Overall Economic Conditions**
  - Home Builders: 68%
  - Remodelers: 66%

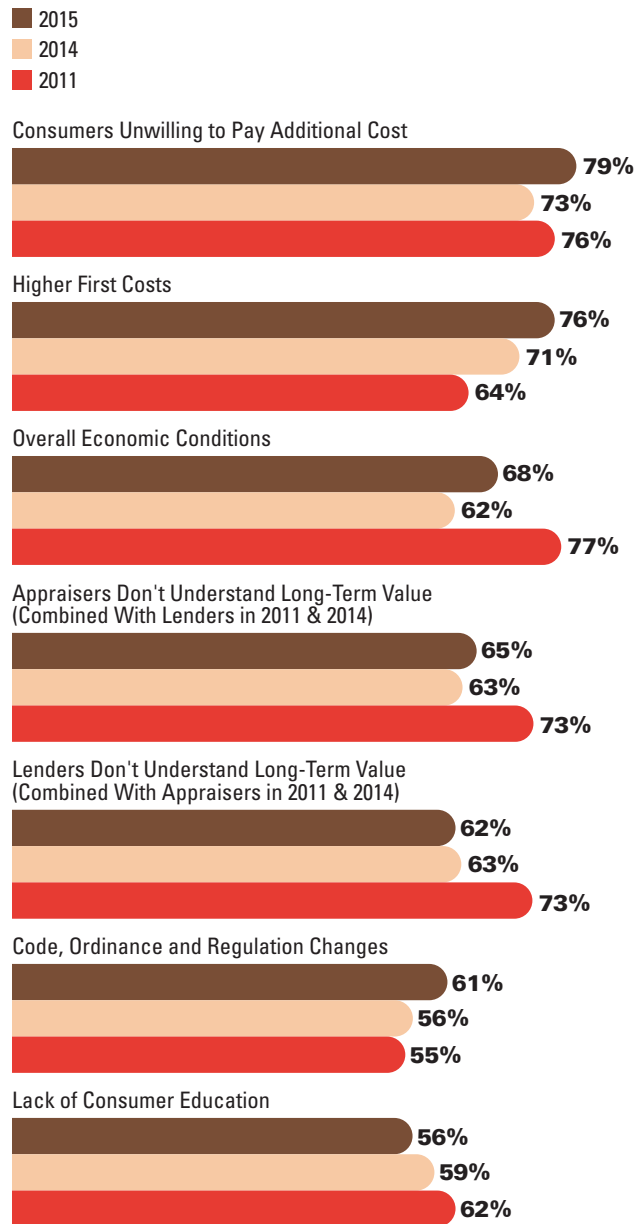
In fact, the only notable difference between home builders and remodelers is that the fourth highest percentage of remodelers consider lack of consumer education an obstacle, but this is the lowest obstacle out of the seven included in the study according to home builders. Given the importance of customer demand in remodeling, a better educated consumer is clearly a bigger advantage in promoting more green remodeling work.

**These findings demonstrate that cost is still a major consideration in the residential market when it comes to green building.** In fact, while consumer reluctance to pay more for green has remained steady in the last three studies, the percentage with concerns about higher first costs have grown consistently since 2011. This corresponds to the finding that home builders and remodelers are reporting a higher cost premium to build green than they were in 2014 (see pages 9 and 10 for that finding and a discussion of the factors that may be contributing to the increased costs).

Consistent with findings in previous studies, however, a much lower percentage (47%) of builders who do more than 90% of their home building projects green consider higher first costs an issue than those who do less than 16% of their homes green (71%). This is also consistent with the finding that dedicated green builders also experience a lower cost premium to build green (see page 10). This finding suggests that as home builders increase their commitment to green building, this obstacle may be reduced.

### Obstacles to Green Building Activity (According to Home Builders and Remodelers Who Consider Them Impactful/Highly Impactful)

Dodge Data & Analytics, 2015



Several obstacles have also declined considerably since 2011.

- **While overall economic conditions are still an important obstacle, they are cited by a much lower percentage of respondents than those concerned about them in 2011.** While the recovering economy may present challenges like rising labor and material costs, it is not expected to have as negative an impact as the deep recession experienced in the residential sector.
- **Builders and remodelers are also less likely to believe that lack of understanding of the value of green on the part of appraisers and lenders is an obstacle.** Greater awareness in the industry about the value of green has helped reduce the impact of these obstacles.

### Variation by Type of Customer

Two obstacles are reported by a lower percentage of builders and remodelers whose clients fall between the ages of 18 and 35 than the other groups:

- **Higher First Costs: Slightly over half of those with 50% of their clients between 18 and 35 find higher first costs to be a highly impactful obstacle, compared with about three quarters of those who have an older clientele.** This finding is surprising since younger buyers may face more financial challenges. This could be influenced by the general perception that this generation is more committed to green.
- **Lack of consumer education is considered an obstacle by twice as high a percentage of those with 50% of their clients age 55 and older than those whose clients are largely between the ages of 18 and 35.** As with the previous obstacle, this may be due to a more widespread perception of commitment to green by the younger generation, although the rest of the findings in the study suggest that clients who are age 55 or older do value energy cost savings, healthier indoor living environments and durability more than younger home buyers and home owners. (See page 17.)

# Data: Home Owner Insights

## Insights From Home Owners

### On Greener and Healthier Homes

**In-depth interviews of recent home buyers reveal that energy performance and health impacts have a notable influence on their decisions either for purchase or for their long-term plans for their homes, even though these factors are not identified initially as the primary drivers for home purchases.**

The findings reported in the SmartMarket Report reveal builder and remodeler expectations about the value of green and healthier homes for consumers. In order to shed further light on this important area, Dodge Data & Analytics conducted 30-minute confidential interviews with nine home owners who had purchased a home in the last year to determine the degree to which green and healthier features influenced their current purchase and how they anticipate that these factors would influence them in the future. The home owners interviewed included three who are age 35 or younger, three between the age of 36 and 54, and three who are 55 or older.

While the group of owners interviewed is too small to create a portrait of generational differences, their responses do offer some insight into the age-based differences reported by builders in terms of the home buyer responses to green and healthier homes and features.

#### **Green is Influential But Not a Primary Driver of Home Purchases**

Before being questioned about specific green features in their homes, the in-depth interview (IDI) participants were asked what were the main factors that influenced the purchase of their home. The factors cited included condition of the home, location (including the neighborhood), the type of home

and the price.

However, when asked to rate the influence of specific green elements on their decision to buy their home, they made the impact of these factors clear:

- **Most of the interviewees reported that durability and energy efficiency were influential in their decisions.**
- **While less unanimous, around half (four to five) found healthier indoor air environment, reduced carbon footprint, water efficiency and lower impact development influential.**
- **In fact, the only factor that was not considered influential by any of the interviewees was the efficient use of materials.**

The interviews also offered a chance to dive a little deeper into how and why these factors were influential in their purchases, and the following trends emerged from their responses.

#### **THERE IS CONSENSUS THAT GREEN ELEMENTS IN GENERAL—AND ENERGY EFFICIENCY IN PARTICULAR—ARE ASSOCIATED WITH NEW (OR NEWER) HOMES**

Only two of the nine interviewees purchased a newly built home. The rest all purchased existing homes, with two built in the 2000s, two built in the 1990s and the remainder built between 1950 and 1984.

Both interviewees who bought new homes said that their desire

for durability and energy efficiency helped drive their purchase of a new home, and the interviewees who bought a relatively recently built home also highlighted features like a healthier indoor living environment that they would expect because their home was newly constructed.

Many of those who did not buy a new or newer home believed that they had to make compromises in terms of home performance because their home is not new, although many noted updates that were done that they considered influential in their decision to buy the home.

■ **Interviewee (under 35):** "I think that's part of buying a new home. You get all those wonderful things. As a [first-time] home buyer, you don't have many opportunities to select [energy efficiency]. It is probably one of the first things you've got to give on and improve as time goes on."

■ **Interviewee (35-54):** "I wanted to make sure I didn't have a 30-year-old furnace ... it was actually under 10 years old, which is still fairly energy efficient."

#### **MISSING GREEN ELEMENTS CAN BE ADDRESSED AFTER THE HOME IS PURCHASED**

Many of the interviewees who moved into older homes also reported that they planned to improve energy efficiency and other areas of top concern. As one interviewee (35-54) states, "We bought the home, then



we had our first [utility] bill, and we ended up putting in more energy-efficient air conditioning. And we just changed out a pool pump, which saved 35% off our electricity bill.”

**EXPERIENCED AND KNOWLEDGEABLE HOME BUYERS PLACE MORE EMPHASIS ON GREEN/HIGH-PERFORMING ELEMENTS**

The influence of the home buyers’ experience with other homes, knowledge about home building or knowledge about environmental issues is a critical factor in determining how they prioritize features.

- Factors related to moisture are mentioned by those who have had moisture problems in homes before.
- Awareness of the potential for efficient systems in previous homes drives either the selection of the new home and/or the improvements they intend to make after they move in.

One young interviewee (under 35) had family members who are in the construction industry, and his knowledge made him look for things like the R factor of his roof and insulation, compared with another first-time home buyer, who associates energy performance with having efficient appliances.

This finding sheds light on a key finding of the builder study in this SmartMarket Report, which demonstrates that builders expect older buyers (age 55+) to generally prioritize most aspects of green home building directly related to performance more than younger buyers. The older the home buyer, the more likely they are to have experienced good and bad features

in previous homes and to be more cognizant of ways to address the issues they find.

However, the interviewees also reveal that knowledge due to being a science teacher or having relatives in the construction industry can also be a powerful influence in encouraging how they prioritize these factors. Therefore, one critical factor for encouraging more green home construction is to educate potential home owners more about what they can and should expect from their homes.

**GREEN CERTIFICATION DID NOT INFLUENCE THEIR RECENT PURCHASE, BUT ALL WOULD PAY EXTRA FOR A GREEN CERTIFIED HOME**

Nearly all the interviewees made it clear that home rating systems did not influence their decision in buying the home, although several did discuss EnergyStar ratings of their appliances and systems as important.

However, all said that they would pay extra for a green certified home. All of the participants who are 35 and under said they would pay between 1% and 5% more. There was much greater variability among older interviewees, with one in each category selecting 1% to 5%, one in each category selecting 6% to 9% and one in each category selecting 10% more. This clearly demonstrates that all the participants value high-performing homes, and the variation in the amount is likely due to budget concerns more than any other issue.

**RESPONSES TO INFLUENCE OF HEALTHIER HOMES VARY**

There was no consensus in terms of the valuation of a healthier home, but a few interesting trends emerge.

- Not surprisingly, those with children or with family members with health concerns place greater emphasis in general on healthier home features.
- A few interviewees voiced concerns about how they could know for certain whether a home was healthier or not.
- Those who did not express concerns about verifying a home’s health impacts generally reported that they would pay more for a home certified to be healthier.
- A few were confused about the attempt to distinguish between green and healthier homes, operating on the assumption that green homes are also healthier by definition.

**STRONG INTEREST IN SOLAR ENERGY/RENEWABLES COUNTERBALANCED BY CONCERNS ABOUT COST**

When asked about lower carbon footprint, the majority of interviewees associated the term with the use of renewables in general and solar in particular. Four of them also identified solar as an element of a green home, and all of them identified it as an element that they wish they had. They generally agreed that they liked having a lower impact on the environment and being off the grid, but most did not look at solar panels as a way to save money.

When asked why not, two reasons emerged:

- Very few of the homes they were able to consider included solar panels.
- Most of them are concerned about the cost of solar. ■

## Millennials in the Market

Will their home buying decisions live up to their green reputation?

**The home buying patterns of millennials have not necessarily reflected their green attitudes, and a deeper understanding of how they act upon their green principles, as well as the challenges they face as first-time home buyers, is necessary to understand them as a potential green market.**

Compared with other generations, millennials, the generation now aged from about 20 to 35, are more likely to choose bikes and transit over cars, pay more for responsibly-made products, scrutinize the corporate social responsibility of employers, favor green energy policies, support stricter environmental laws, and attribute global warming to human causes. So it stands to reason that they'd prioritize environmentally responsible materials, technologies, and building practices in their home buying decisions. Right?

Not so fast.

Strong currents running beneath this generation's green surface could surprise home builders expecting quicker sales or premium prices from an appeal to millennials' green values.

### Generation Squeeze

As a generation, millennials face significant obstacles to buying a home of any kind, green or otherwise. According to a 2014 study from the Pew Research Center, two thirds of college graduates entering adulthood are burdened with student debt, and, compared to 20 years ago, the average debt they shoulder has increased by about 80%. Those who did not graduate college may not have student debt to pay, but their employment prospects are much worse. On top of that, according to a report by the White House

Council of Economic Advisers, the recession that coincided with the entry of many millennials to the job market is expected to have a long-term adverse effect on their earning potential. They can expect to earn 2.5% to 9% less per year for at least the first 15 years of their careers. Factor in inflation, and two earners today barely make what a single earner brought home in the 1970s.

A significant factor in inflation has been the cost of housing. According to *The Economist's* 10-city index, between 1993 and 2013 alone, housing prices in real terms rose by almost 50%. In many of the cities where millennials might most want to live, their annual incomes fall thousands short of what's needed to buy an average home. So it's no surprise that millennials' rate of home ownership in early 2014 set the lowest record since the U.S. Census Bureau began tallying home ownership by age in 1982.

"This is a group of people who are financially just so squeezed that additional costs for green building may be one thing further than they can stretch for," says Paul Kershaw, founder of Generation Squeeze, a nonprofit organization advocating for a fairer deal for young adults.

But if they could stretch for green, would they?

### Skin-Deep Green

"The general understanding of millennials is that they're greener," says Lee Ann Head, a researcher with

Shelton Group, a marketing firm focused on energy efficiency and sustainability, "but when you start looking deeper, there's a lot of talking and not a lot of doing."

For example, according to a recent study from Shelton, millennials consistently report lower rates of participation in environmentally responsible behaviors that have no financial cost. In recycling and water conservation, for example, millennials participate less than any other age group. Millennials are also more likely than other generations to say they understand terms such as low VOC or net zero, but no more likely than other generations to get the meanings for those widely misunderstood terms correct. And, while millennials take up connected and smart home technologies in significantly higher numbers than other generations, it's not to improve environmental performance, or even to lower energy bills, says Head.

The driver is convenience.

All of this suggests a disconnect between millennials' values and their understanding of, or commitment to, the behaviors, technologies and products that could implement those values in their homes.

But even if millennials are not yet walking the walk, the fact that they say they value environmental responsibility is significant. "It's normative for that age group," says Head, "and any time something's normative, you begin to see change." ■

# Data: Green Building Products, Practices and Features

## Most Important Green Practices

### For New Homes and Remodeling Projects

GREEN AND HEALTHIER HOMES: ENGAGING CONSUMERS OF ALL AGES IN SUSTAINABLE LIVING DATA

Home builders and remodelers were asked to rank the top three most important green practices to improve a home's performance out of a list of seven options. The chart at right represents the practices selected as first, second or third by at least 10% of home builders and remodelers.

It is not surprising that **energy efficiency tops the list, with nearly all respondents selecting it in their top three.** This finding is also consistent with previous studies. However, it is worth noting that it was ranked first by approximately two thirds of the respondents, which, while impressive, also suggests that other factors are recognized as critically important as well.

**Use of durable materials is consistently an important green practice for the residential sector, and it appears to be gaining in importance for both builders and remodelers,** but especially among builders, 21% of whom also selected it as their top-ranked option.

■ **Durability Ranked Among the Top 3 Green Practices:**

- 2015: Builders 70% and Remodelers 68%
- 2014: Builders 48% and Remodelers 57%

**Another important practice to improve a home's green performance for both builders and remodelers is the creation of healthier indoor living environments.** Since this was not asked about in the previous studies, there is no benchmark for its performance. In the current study, it is not only selected by over two thirds of builders and remodelers as among the top three most important practices, but it also is selected by 11% overall as the most important practice out of the list of seven. This variable may increase in importance if the industry continues to give more attention to healthier buildings.

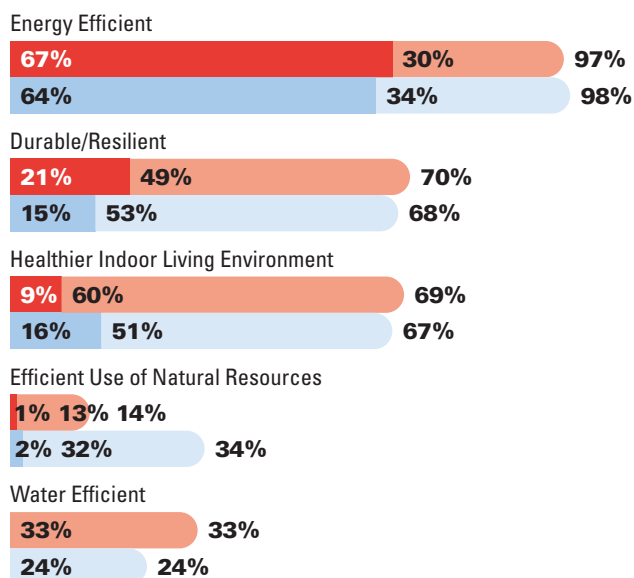
**Water efficiency also is chosen by one third of builders and about a quarter of remodelers as one of their top three practices, but no builders or remodelers select it as their most important practice.** This may be due to the relatively low cost of water in the US, which makes these savings a lower priority for many consumers and builders.

The two factors ranked in the top three by less than 10% of builders include lower impact development and reduced carbon footprint. These are important environmental efforts, but they do not offer the home owner any direct financial benefit, which may be why they are less commonly recognized as a top green practice. This suggests that builders and remodelers regard home performance in terms of impact on the home owner more than in general green terms.

### Green Practices Ranked First as Most Important for Improving a Home's Performance (According to Home Builders and Remodelers)

Dodge Data & Analytics, 2015

■ Home Builders—Ranked 1st ■ Home Builders—Ranked 2nd or 3rd  
■ Remodelers—Ranked 1st ■ Remodelers—Ranked 2nd or 3rd



## Green Products and Practices Overview

### Top Green Products and Practices

The chart at the right represents the 10 products and practices considered important by the highest percentage of home builders and remodelers.

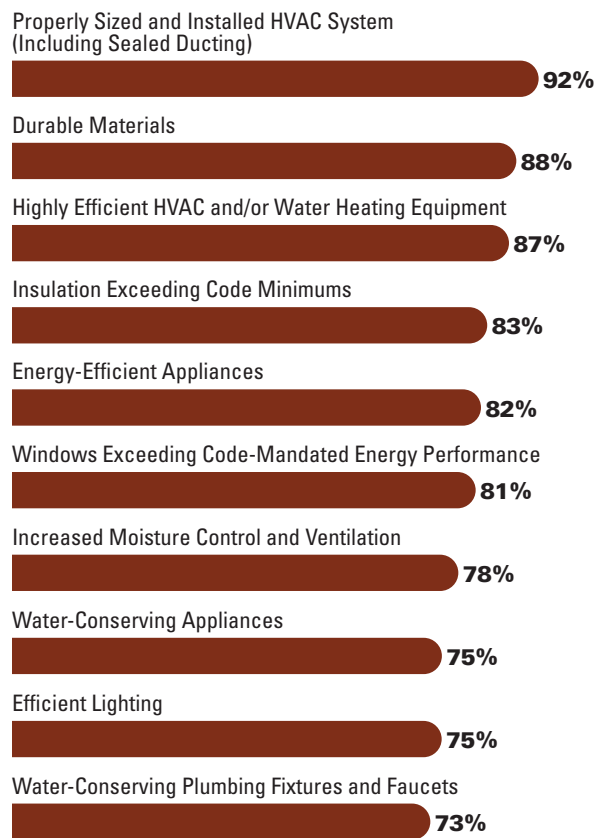
**Not surprisingly, products/practices that improve energy efficiency dominate the top five.** This is consistent with the findings throughout the study that show the value home builders and remodelers place on energy efficiency in a green home.

However, **durable materials are selected by the second highest percentage of respondents as important**, more than most of the energy-efficient products and practices. Durability has consistently been an important factor in the green residential sector, no doubt related to the perception of higher quality in green homes. However, it is the only materials and resource conservation product or practices to make the top 10.

Water efficiency has two products/practices that make the top 10, and increased moisture control and ventilation, which impacts indoor environmental quality, is also highly rated. This demonstrates that, despite the clear emphasis placed on energy, most builders and remodelers do recognize that other practices are essential to achieve green homes.

### Top 10 Most Important Green Products and Practices (By Percentage of Builders and Remodelers Who Consider Them Important/Very Important)

Dodge Data & Analytics, 2015



#### Note About the Data

Previous green residential studies published by Dodge Data & Analytics have featured data about the importance of products and practices in four categories to achieve a greener home. In the previous studies, two separate questions were asked: Respondents first identified the products and practices that they use and then they rated their importance.

For the current study, a different approach was taken.

Respondents were asked to evaluate the importance of products and practices directly, with the option of indicating that they did not use those products or practices.

This change in methodology prevents direct comparison for percentage differences between the previous findings and the current findings. However, the general trends about the importance of specific products and practices in each category can still be determined, and

reference is made in most sections to how the findings compare in a more general way to the previous findings.

Interestingly, the current study reveals that builders and remodelers largely agree about the importance of most products and practices. Therefore, the charts throughout this section represent the combined choices, with any differences mentioned in the analysis.

## Energy Efficiency: Products and Practices

**Building products and practices that improve energy efficiency are widely recognized as important**, a finding similar to Dodge Data & Analytics' previous studies. When asked to rate the importance of eight products and practices, over 80% of home builders and remodelers deemed five of the eight important or very important. The percentage who rated each practice as important/very important was also approximately the same between builders and remodelers.

**Consistent with the findings in the 2014 Green Multifamily and Single Family Homes SmartMarket Report, properly sized and installed HVAC equipment, highly efficient HVAC systems and/or water heaters and insulation exceeding code minimums were rated as important by the highest percentage of respondents.** All three of these measures are critical to achieve good energy performance.

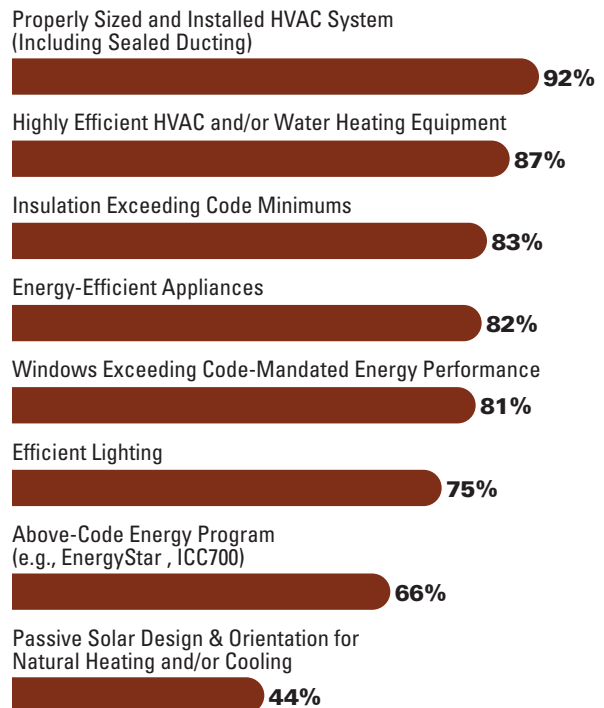
### Variation by Level of Green Involvement

Four energy-efficient products and practices had significant differences in terms of how they were rated according to the level of green involvement of home builders:

- **97% of home builders who do more than 90% of their projects green consider using a highly efficient HVAC system or water heater important, compared with 80% of those doing less than 16% of their projects green.** The near unanimity of those committed to green building about the importance of HVAC systems demonstrates the energy-savings returns for the investment in highly efficient heating or cooling systems.
- **97% doing more than 90% green homes also consider insulation exceeding code minimums important, compared with 74% of those doing less than 16% of their projects green.** Those with more green experience nearly universally recognize that insulation has a large impact on energy use with a relatively low initial cost.
- **92% doing more than 90% green homes consider efficient lighting important, compared with 66% of those doing less than 16% green homes.** Experience also demonstrates that efficient lighting is important to improve home performance.
- **83% doing more than 90% green homes consider use of an above-code energy program important compared with 51% of those doing less than 16% green homes.**

### Energy-Efficient Products/Practices (Percentage of Builders and Remodelers Rating Them as Important/Very Important)

Dodge Data & Analytics, 2015



Programs such as EnergyStar™ or ICC700 National Green Building Standard™ allow owners to benchmark their savings against industry averages. They also provide third-party verification of the performance of the home. Those with more experience in green building recognize the value that these programs provide to the home owner.

## Water Efficiency: Products and Practices

Improving water efficiency is an essential part of green building due to increasing concerns about the availability of potable water across the U.S., but the relatively low cost and apparent availability of water in areas other than those suffering severe droughts can mask its importance for consumers and builders alike. This may contribute to the fact that it is only ranked by one third of home builders and about one quarter of remodelers in their top three green practices, and by none of the respondents as the top practice to improve home performance (see page 25).

The undervaluation of water efficiency is evident in the importance builders and remodelers place in specific water efficiency practices.

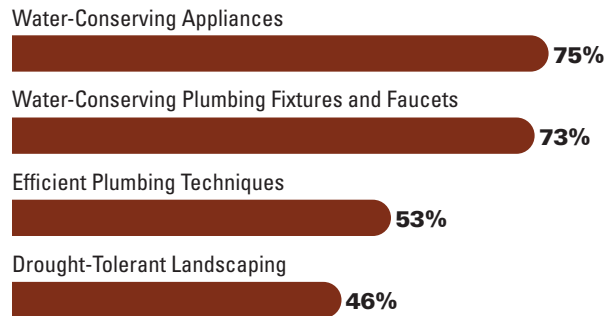
- Those products and practices that are highly visible to home buyers and owners, such as appliances and water-conserving plumbing fixtures and faucets, are considered important by over 70% of builders and remodelers. While this percentage is substantial, it is lower than the ones received by most of the energy efficiency products and practices (see page 27).
- The use of efficient plumbing techniques like minimizing pipe runs, which involves greater investment in expertise and time, is only considered important by around half (53%) of respondents.
- Drought-tolerant landscaping, which may not be as appealing to many home buyers and owners, is also considered the least important, selected by less than half (46%).

### Variation by Level of Green Involvement

As the chart at the right reveals, a significantly higher percentage of home builders who do more than 60% green projects consider water conservation products and practices important. This finding is telling because it demonstrates that more experience with green building increases awareness of the importance of water conservation. This should help increase the use of water conservation practices and products as many home builders plan to increase their level of green involvement.

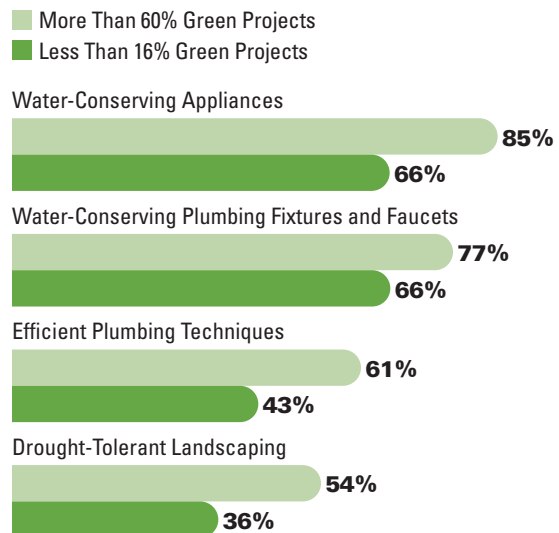
### Water Efficiency Products and Practices (Percentage of Builders/Remodelers Rating Them as Important/Very Important)

Dodge Data & Analytics, 2015



### Water Efficiency Products and Practices (Percentage of Builders by Level of Green Involvement Rating Them as Important/Very Important)

Dodge Data & Analytics, 2015



## Materials and Resource Conservation: Products and Practices

The materials and resource conservation products and practices considered most important in the current study are consistent with the findings reported in the 2014 *Green Multifamily and Single Family Homes SmartMarket Report*: Builders and remodelers are both more focused on reducing the materials sent to landfills than on reducing the impact of extraction.

- **Durability is considered important by the highest percentage of builders and remodelers (88%).** In fact, durability is second only to energy efficiency in terms of the general practice considered most important to achieve a green home (see page 26).
- **The second highest percentage (67%) consider reduction of construction waste an important practice.** Reduction of construction waste can also have a positive cost impact for builders and remodelers, but it often requires additional effort on their part.
- **The percentage (62%) who consider the use of prefabricated components and/or engineered wood products to be an important green strategy is nearly as high as those seeking to reduce construction waste.** That is consistent with the 2014 findings as well. Examples of prefabricated components include the use of modular construction, trusses or structural insulated panels (SIPs). These are also valuable for reducing construction waste.

### Variation by Firm Type

While the percentages of builders and remodelers who consider the top three product/practices important are very close, **a significantly higher percentage of builders consider certified, sustainably harvested lumber (42%), and use of reclaimed and reused building products (46%) important for creating a green home than do remodelers (28% and 25%, respectively).**

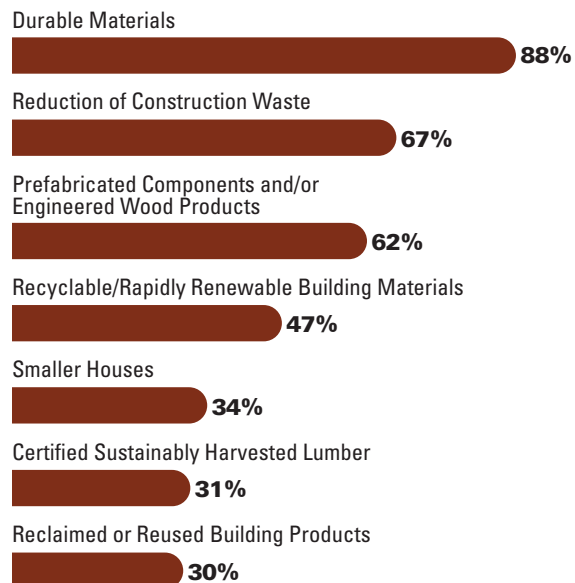
It is possible that builders may be able to capitalize on economies of scale to promote their use of these two kinds of products. Builders are also more likely to certify projects than remodelers are, and each of these earn points in certification systems.

### Variation by Level of Green Involvement

**The use of recyclable/rapidly renewable building materials is considered important by 56% of home builders who do 16% or more of their home building projects green, compared with 32% of those doing little green building.** This demonstrates that even minimal

### Materials and Resource Conservation Products and Practices (Percentage of Builders/Remodelers Rating Them as Important/Very Important)

Dodge Data & Analytics, 2015



green experience is enough to demonstrate the value of these products.

On the other hand, only builders dedicated to green (more than 90% of their homes are green) see much greater importance in the use of certified, sustainably harvested lumber, with 44% of dedicated green builders considering that factor important, compared with just 26% of those doing fewer green homes. This may suggest dedicated builders have a greater awareness of the importance of green across the product lifecycle, or they could be more concerned with achieving green certification on their projects.

## Improved Indoor Environmental Quality: Products and Practices

Home builders and remodelers generally agree on the importance of building products and practices that enhance indoor environmental quality, as they do on most of the other categories of building products and practices. However, the residential sector as a whole is widely split in terms of the importance of specific products and practices.

- **Increased moisture control and ventilation is recognized by most respondents (78%) as important to improve the performance of a green home.** Most people expect a green home to also be healthier, and controlling moisture and maintaining sufficient ventilation are widely recognized as important factors to prevent a home from having a negative impact on health. In fact, the recognition of its importance ranks with the highest energy efficiency products and practices.
- **The use of low VOC materials falls in the middle range of importance, with 60% rating it at that level.** Use of green building certification systems has widely raised industry awareness of the need to avoid VOCs. It is possible that it would rank higher if there were greater awareness among home owners as well.
- **Less than half consider MERV 8+ filtration and/or air cleaning systems important.** This appears to be a shift down in importance from the 2014 findings reported in the *Green Multifamily and Single Family Homes SmartMarket Report*, but a change in the way the question was asked may account for that difference (see page 26). Previous findings suggest that those who use these methods find them very important, but that their use is low. The current study also suggests more industry education is needed on the importance of these strategies.

### Variation by Level of Green Involvement

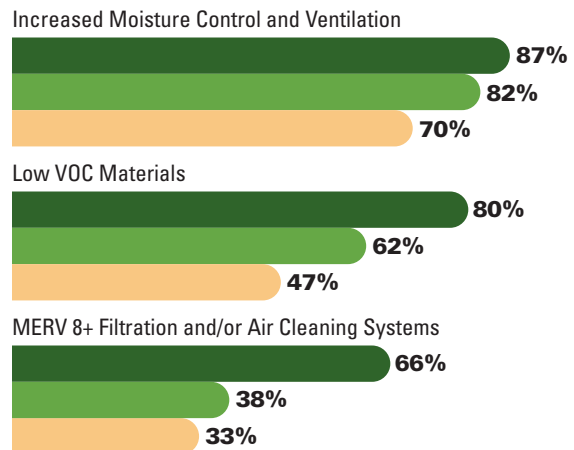
The distinction between home builders heavily involved in green and those less involved is more distinct on all three indoor environmental quality products/practices than they are for any other category.

- **Even a moderate level of green building work (16% or more green projects) increases the likelihood that builders will consider increased moisture control and ventilation important.**
- **As involvement in green increases, the recognition of the importance of using low VOC materials increases consistently.**

### Importance of Improved Indoor Environmental Quality Products and Practices (According to Home Builders by Their Level of Green Involvement)

Dodge Data & Analytics, 2015

- More Than 60% Green
- 16%–60% Green
- 15% or Less Green



- **Only builders with a relatively high level of green involvement (over 60% of their projects are green) widely recognize the importance of MERV 8+ filtration and/or air cleaning systems.**



## Most Trusted Sources of Green Product Information

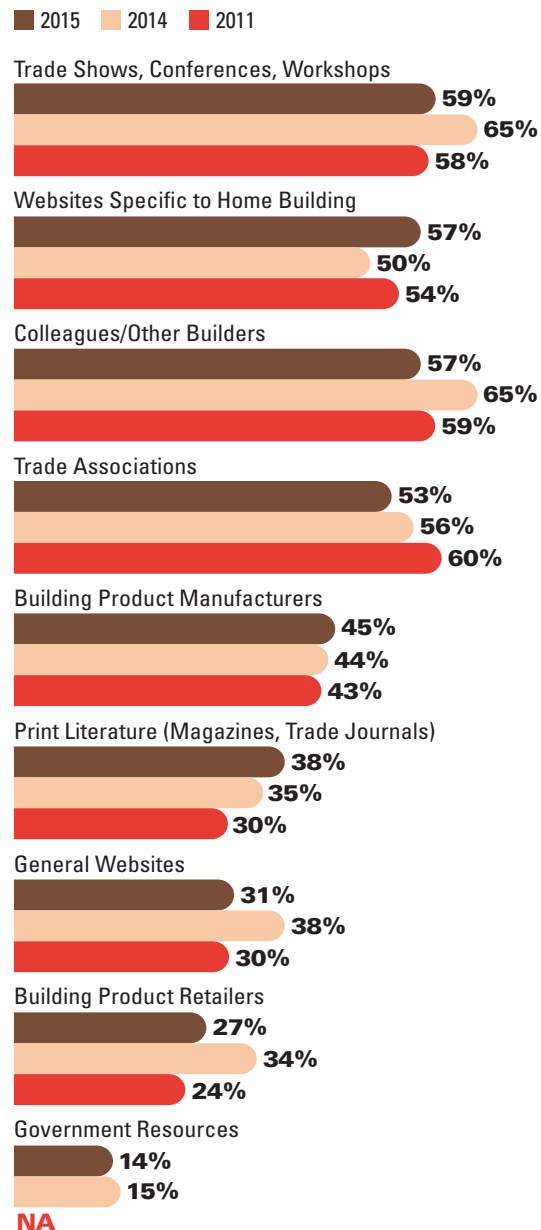
As with previous studies, home builders and remodelers in the current study were asked about their most trusted sources of green building product information. While the question specified that the most trusted sources were to be indicated, they were allowed to pick as many choices from the list of options as they thought appropriate.

When comparing the current findings to those from the studies published in 2011 and 2014, a few interesting findings emerge:

- **Trade shows/conferences are the most trusted sources for green product information in the current study.** This is similar to the findings from the 2014 study, where trade shows and conferences also ranked first, along with colleagues/other builders. However, both the 2014 and 2015 findings reveal the increased importance of this factor compared with the 2011 study, when it ranked a close third. This demonstrates the importance of attending these shows for building product manufacturers seeking traction with industry professionals and for home builders/remodelers seeking to stay current on new green products.
- **Colleagues/other builders are consistently among the top two most trusted sources of green building product information.** Clearly they are very interested in information from their peers, whom they may consider to be unbiased. The continuing importance of this factor demonstrates that green building product manufacturers need to cultivate professional advocates of their products.
- **Websites specific to homebuilding continue to gain in importance when comparing their overall ranking by year.** While the percentage selecting these websites as a most trusted source of information appears to have risen and fallen over the last four years, when looking at how they compare with other sources of information, there has been a steady growth, from fourth place in 2011 to third place in 2014 to tied for second place in 2015. This increased importance, compared with other sources of information, suggests that building product manufacturers need to have a full web strategy in place for providing information on their products.

### Most Trusted Sources of Green Product Information (According to Home Builders and Remodelers)

Dodge Data & Analytics, 2015



- **There is a smaller differential among the top four most trusted sources in 2015 than there was in 2014.** In 2015, only 6 percentage points separate the top four responses, but in 2014, there was a 15 percentage point spread among the top sources of information. This suggests that, in the current study, few builders and remodelers consider just one or two sources important. Building product manufacturers and suppliers should therefore plan to utilize multiple strategies to maximize their potential impact on building professionals.

### Variation By Type of Builder

Out of this extensive list of sources of product information, only three have a significant difference in the percentage of home builders and remodelers who consider them one of their most trusted sources of information. In each case, the remodelers are more likely to include these sources among their most trusted than builders, which suggests that those seeking greater awareness of their products in the remodeling market should have a plan for each of these in their marketing strategy.

- **71% of remodelers trust other builders/colleagues, compared with 54% of home builders.**
- **69% of remodelers trust websites specific to home building, compared with 54% of home builders.**
- **11% of remodelers trust home improvement shows, compared with 3% of builders.**

### Variation by Level of Green Involvement

**For the most part, there is no significant difference in the percentage of home builders who report trusting sources of green product information by their level of green involvement,** even when comparing those doing more than 90% of their projects green with those who do less than 16% green projects. This suggests that building product manufacturers do not have to adopt a specific strategy in their marketing to target firms doing the most green work.

The one exception to this finding is government resources. Nearly one quarter (23%) of those doing 16% or more of their projects green list government resources as a trusted source of information, compared with 9% of those doing less than 16% of their projects green.

## Top-of-Mind Green Product Brands

### Ability to Name a Top-of-Mind Green Product Manufacturer or Brand

Three quarters or more of home builders and remodelers can name a top-of-mind green company or brand for seven of the 10 product types included in the survey. For the most part, the responses are comparable to those from the 2014 survey, although there are a few notable differences.

- **For the top four product categories, there is a small percentage increase over the 2014 findings for single family builders/remodelers.** Appliances had a sizeable 8 percentage point increase, but the other three categories (doors and windows, paint/wall finishes and insulation) all experienced only nominal 2 percentage point increases.
- **There was a 5 percentage point drop in builders/remodelers who can name a green HVAC brand compared with the 2014 findings.** This may be particularly relevant given the importance placed on using HVAC systems to achieve green results and suggests a possible opening for creating better brand awareness.

### Top-of-Mind Brands Most Frequently Reported

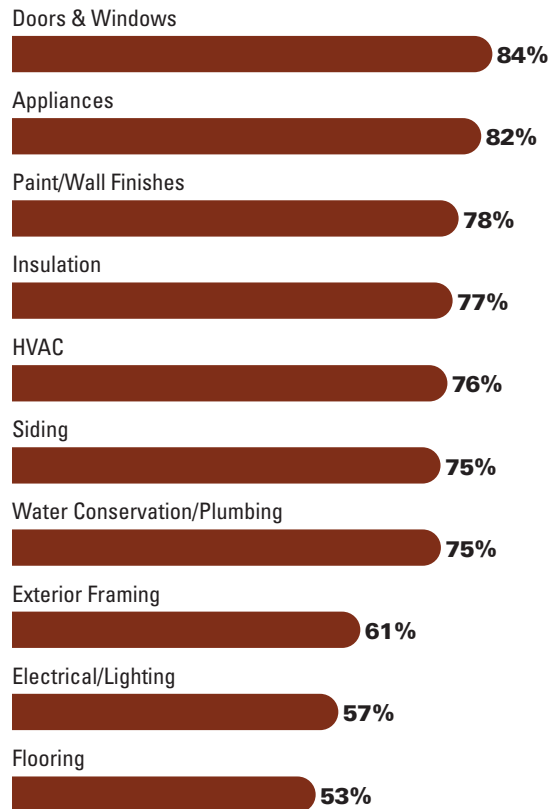
The table on the next page lists the top-of-mind brands reported by single family home builders and remodelers. Unlike in previous studies, where the update has led to more brands named in many categories, only two categories saw an increase in the number of brands that were named by more than 5% of respondents between 2014 and 2015.

- **HVAC:** It is surprising to see growth in the number of HVAC brands, given the decline in the percentage of respondents who can name an HVAC brand.
- **Siding:** Only one brand of siding was top-of-mind for green until 2011, when it increased to two brands. The addition of a third brand, however, did not materially impact the percentage of respondents who could name a brand in this category overall.

On the other hand, this is the first time where several categories saw a decrease in the number of brands that could be named by 5% or more of the respondents.

### Ability to Name a Top-of-Mind Green Company/Brand by Product Type (According to Home Builders and Remodelers)

Dodge Data & Analytics, 2015



- **Insulation had the biggest drop**, from five brands named in 2014 to three in the current study. The top brands, however, have remained with a consistently high percentage of respondents, suggesting consolidation of their position as green insulation providers.
- **Four other categories experienced a drop of one brand, including water conservation, appliances, exterior framing and electrical.** In all four categories, the top brands retained their position.

This probably suggests some maturity in the green marketplace for brands, with leaders more clearly established. However, only in a few categories are there brands that are truly dominant, which suggests that there is still the potential for firms to make a committed effort to associate their company or brand with green.

### Top-of-Mind Green Product Brands Reported by More Than 5% of Respondents

Dodge Data & Analytics, 2015

Product Category	2006	2008	2011	2014	2015
<b>Doors &amp; Windows</b>	<ul style="list-style-type: none"> <li>• Andersen (15%)</li> <li>• Pella (11%)</li> </ul>	<ul style="list-style-type: none"> <li>• Andersen (17%)</li> <li>• Pella (12%)</li> <li>• Marvin (8%)</li> </ul>	<ul style="list-style-type: none"> <li>• Andersen (18%)</li> <li>• Pella (14%)</li> <li>• Marvin (12%)</li> <li>• Therma-Tru (6%)</li> </ul>	<ul style="list-style-type: none"> <li>• Andersen (16%)</li> <li>• Marvin (14%)</li> <li>• Jeld Wen (13%)</li> <li>• Pella (12%)</li> </ul>	<ul style="list-style-type: none"> <li>• Andersen (20%)</li> <li>• Pella (12%)</li> <li>• Marvin (11%)</li> <li>• Jeld Wen (5%)</li> </ul>
<b>Insulation</b>	<ul style="list-style-type: none"> <li>• Owens Corning (29%)</li> </ul>	<ul style="list-style-type: none"> <li>• Owens Corning (26%)</li> </ul>	<ul style="list-style-type: none"> <li>• Owens Corning (25%)</li> <li>• Icynene (9%)</li> <li>• CertainTeed (6%)</li> </ul>	<ul style="list-style-type: none"> <li>• Owens Corning (22%)</li> <li>• Icynene (7%)</li> <li>• CertainTeed (6%)</li> <li>• Dow (5%)</li> <li>• Johns Manville (5%)</li> </ul>	<ul style="list-style-type: none"> <li>• Owens Corning (23%)</li> <li>• CertainTeed (7%)</li> <li>• Icynene (6%)</li> </ul>
<b>Water Conservation/ Plumbing</b>	<ul style="list-style-type: none"> <li>• Kohler (22%)</li> </ul>	<ul style="list-style-type: none"> <li>• Kohler (21%)</li> <li>• Delta (14%)</li> </ul>	<ul style="list-style-type: none"> <li>• Kohler (32%)</li> <li>• Delta (16%)</li> <li>• Moen (14%)</li> <li>• Toto (6%)</li> </ul>	<ul style="list-style-type: none"> <li>• Kohler (29%)</li> <li>• Delta (18%)</li> <li>• Moen (17%)</li> <li>• American Standard (3%)</li> </ul>	<ul style="list-style-type: none"> <li>• Kohler (29%)</li> <li>• Delta (18%)</li> <li>• Moen (10%)</li> </ul>
<b>HVAC</b>	<ul style="list-style-type: none"> <li>• Trane (17%)</li> <li>• Carrier (12%)</li> <li>• Lennox (10%)</li> </ul>	<ul style="list-style-type: none"> <li>• Trane (17%)</li> <li>• Carrier (14%)</li> <li>• Lennox (13%)</li> </ul>	<ul style="list-style-type: none"> <li>• Trane (20%)</li> <li>• Carrier (12%)</li> <li>• Lennox (8%)</li> </ul>	<ul style="list-style-type: none"> <li>• Carrier (20%)</li> <li>• Trane (16%)</li> <li>• Lennox (9%)</li> </ul>	<ul style="list-style-type: none"> <li>• Trane (15%)</li> <li>• Carrier (10%)</li> <li>• Lennox (10%)</li> <li>• Bryant (5%)</li> </ul>
<b>Paint/ Wall Finishes</b>	<ul style="list-style-type: none"> <li>• Sherwin-Williams (21%)</li> </ul>	<ul style="list-style-type: none"> <li>• Sherwin-Williams (32%)</li> <li>• Benjamin Moore (8%)</li> </ul>	<ul style="list-style-type: none"> <li>• Sherwin-Williams (39%)</li> <li>• Benjamin Moore (12%)</li> </ul>	<ul style="list-style-type: none"> <li>• Sherwin-Williams (37%)</li> <li>• Benjamin Moore (10%)</li> </ul>	<ul style="list-style-type: none"> <li>• Sherwin-Williams (45%)</li> <li>• Benjamin Moore (8%)</li> </ul>
<b>Appliances</b>	<ul style="list-style-type: none"> <li>• N/A</li> </ul>	<ul style="list-style-type: none"> <li>• GE (34%)</li> <li>• Whirlpool (13%)</li> </ul>	<ul style="list-style-type: none"> <li>• GE (26%)</li> <li>• Whirlpool (15%)</li> <li>• Bosch (7%)</li> <li>• KitchenAid (6%)</li> </ul>	<ul style="list-style-type: none"> <li>• GE (33%)</li> <li>• Whirlpool (11%)</li> <li>• Bosch (7%)</li> <li>• Kenmore (6%)</li> </ul>	<ul style="list-style-type: none"> <li>• GE (26%)</li> <li>• Whirlpool (13%)</li> <li>• Bosch (8%)</li> </ul>
<b>Siding</b>	<ul style="list-style-type: none"> <li>• James Hardie (11%)</li> </ul>	<ul style="list-style-type: none"> <li>• James Hardie (19%)</li> </ul>	<ul style="list-style-type: none"> <li>• James Hardie (38%)</li> <li>• CertainTeed (11%)</li> </ul>	<ul style="list-style-type: none"> <li>• James Hardie (42%)</li> <li>• CertainTeed (12%)</li> </ul>	<ul style="list-style-type: none"> <li>• James Hardie (38%)</li> <li>• CertainTeed (7%)</li> <li>• LP (7%)</li> </ul>
<b>Ext. Framing</b>	<ul style="list-style-type: none"> <li>• Trex (31%)</li> </ul>	<ul style="list-style-type: none"> <li>• Trex (27%)</li> </ul>	<ul style="list-style-type: none"> <li>• Trex (24%)</li> </ul>	<ul style="list-style-type: none"> <li>• Trex (18%)</li> <li>• Azek (7%)</li> </ul>	<ul style="list-style-type: none"> <li>• Trex (19%)</li> </ul>
<b>Flooring</b>	<ul style="list-style-type: none"> <li>• N/A</li> </ul>	<ul style="list-style-type: none"> <li>• N/A</li> </ul>	<ul style="list-style-type: none"> <li>• Shaw (9%)</li> <li>• Armstrong (7%)</li> <li>• Bamboo (6%)</li> </ul>	<ul style="list-style-type: none"> <li>• Armstrong (10%)</li> <li>• Shaw (6%)</li> <li>• Bamboo (5%)</li> </ul>	<ul style="list-style-type: none"> <li>• Mohawk (8%)</li> <li>• Shaw (7%)</li> <li>• Armstrong (5%)</li> </ul>
<b>Electrical/ Lighting</b>	<ul style="list-style-type: none"> <li>• N/A</li> </ul>	<ul style="list-style-type: none"> <li>• N/A</li> </ul>	<ul style="list-style-type: none"> <li>• N/A</li> </ul>	<ul style="list-style-type: none"> <li>• Progress (9%)</li> <li>• LED (8%)</li> <li>• GE (6%)</li> </ul>	<ul style="list-style-type: none"> <li>• LED (8%)</li> <li>• Progress (6%)</li> </ul>

## Transparent New World

### How product disclosure is transforming building products

**The rising influence of product disclosure and transparency in the commercial building product market is beginning to influence the desire for transparency in the residential market as well. Manufacturers need to be ready for disclosure demands by better informed consumers.**

A revolution in product transparency is sweeping through the building industry, generating product data that go beyond familiar terms like R-value and recycled content to include big-picture indicators of environmental and health impacts throughout a product's lifecycle. These new data, which are being likened to the nutrition labels we see on food products, are intended to enable users and specifiers to make better-informed choices among building products, which in turn will raise market demand for products that are more benign.

"Transparency is fueling innovation," says Eric Corey Freed, vice president of global outreach at the International Living Future Institute. "It's forcing manufacturers to measure things they didn't measure before, and make things they didn't make before."

#### Ready or Not

One of the main drivers behind the trend is the building product disclosure and optimization credits in LEED version 4, launched in 2013. LEED for Homes does not yet include these credits, which in part explains why the transparency trend has taken hold in the commercial construction market, while the residential market remains focused on energy efficiency as its prime directive—for now. But as manufacturers with product

lines in both sectors apply the transparency paradigm throughout their operations, and as consumer awareness of building products' health impacts grows, transparency will take off in the residential sector too.

"If builders aren't thinking about this, they're going to be asked about it by moms who want to know what their kids are going to be exposed to," says Gale Tedhams, director of products and supply chain sustainability at Owens Corning.

#### What to Expect

The residential building products most likely to find themselves on the front line of the transparency revolution are the ones consumers experience most directly, such as paints and finishes, flooring, cabinetry and countertops. As the things home owners see and touch, these are the products they care about most, and replace most frequently. From there, the demand for product transparency will spread through the house to include fixtures, appliances and products such as insulation and sealants used behind walls—particularly if they affect indoor air quality.

"It's going to become part of just what people expect," says Tedhams, "and they really don't want to pay more for it. It's an expectation that we're going to have to figure out how to meet."

#### Emerging Products

As manufacturers rise to the challenge, two types of products will emerge. The first will be improved versions of familiar products: batt insulation, for example, that's made with a plant-based polymer resin instead of a formaldehyde-based binder, so that the product maintains its performance while improving its environmental and health profile. The second type of product will be entirely new: drywall from recycled juice boxes, for example, or countertops from post-industrial aluminum scrap.

"Some of these products will border on sci-fi," predicts Freed, "materials that heal themselves, or get stronger over time, or clean the air through nanotechnology."

There are a few early adopters who are already looking for products with enhanced transparency for residential projects. "Having this information will enable our procurement choices to support our sustainability goals," says Penny Martyn, green building manager at the University of British Columbia. Ahead of LEED for Homes, the university's in-house rating system includes a materials transparency and optimization credit for its campus and neighborhood housing projects. "We need to promote the idea and concept of transparency, and ask for it," says Martyn, "and then try and understand the low-hanging fruit, and act on them." ■

## Multifamily Green Building Trends

**Trending data suggests a maturing green market in the multifamily sector compared to the 2014 study, but one that has still not embraced the use of healthier building products and practices like the single family market.**

The 2014 *Green Multifamily and Single Family Homes SmartMarket Report* included the responses of 38 builders who work primarily in the multifamily sector. The study conducted this year was smaller in scope, both for the survey itself and for the sample. However, the 16 responses received, while too small for a full statistical analysis, do suggest some basic trends when compared with the 2014 findings and the findings in the current survey among single family builders.

### Green Residential Building Market

Overall, the findings suggest that the shift to green in the multifamily market is even more pronounced than it was in the previous study.

#### ■ Level of Green Building Activity:

- In 2014, multifamily builders showed a strong shift toward more involvement in green building in the next two to five years, but only a small percentage (18%) expected to be dedicated green builders (doing more than 90% of their projects green) within five years.
- While the shift to greater green building involvement is similar in the current study, almost half of the 16 respondents expect to be dedicated to green by 2020.

#### ■ Additional Cost of Building Green:

The 2015 responses are consistent with 2014, with nearly half of multifamily respondents believing that there is a 5% to 10% cost premium to build green.

#### ■ Willingness to Pay More for Green Home:

- In 2014, the highest percentage (roughly one third) believe that multifamily customers will pay between 5% to 10% more for a green home.
- In 2015, about one third (again the highest percentage) believe customers will pay between 1% and 4% more.
- A notably higher percentage in 2015 report that they don't know how much extra customers will pay when compared to 2014.

#### ■ Ease in Marketing Green Homes:

This finding also stayed consistent with the 2014 report, with over half of respondents reporting that green homes are easier to market, a much higher percentage than the single family home builders in the current study.

In all, these findings suggest a maturing green market in multifamily building, with greater expectation that projects should be green reducing the green premium customers will pay, but with green still providing significant advantage in marketing projects. In addition, the higher percentage of multifamily builders who expect to be dedicated green builders also suggests greater market maturity over the past year.

### Healthier Homes

Since questions about the use of healthier building features, products and construction activities were not asked in the 2014 study, the most interesting trends from this part of the current study come from a comparison with the percentage of single family builders who report using them.

The only healthier building features and products used by a notably higher percentage of multifamily builders than single family builders are acoustical comfort and insulated siding.

However, there is a general trend for a higher percentage of single family builders to use most of the other healthier features, products and construction practices included in the current study (see pages 38 to 41), with the greatest differential for the following, suggesting an opportunity for increased use of these in the multifamily sector:

#### ■ Features

- Dedicated fresh air systems

#### ■ Products

- Carbon monoxide detectors
- Water-resistant backerboard in damp areas
- No-/low-formaldehyde products
- Humidity control systems

#### ■ Construction Practices

- Protection of onsite building materials from moisture/ weather damage ■

# Data: Healthier Homes

## Willingness of Homebuyers/Owners to Pay More for a Healthier Home

GREEN AND HEALTHIER HOMES: ENGAGING CONSUMERS OF ALL AGES IN SUSTAINABLE LIVING DATA

Home builders and remodelers were asked the percentage of their clients that fall into three age groups: 35 and under, 36 to 54, 55 and older. Those who had at least 25% of their clients in any age group were then asked whether clients in that age group would be willing to pay more for a healthier home and how much more they would be willing to pay.

The findings reveal that **most builders and remodelers believe that home buyers and home owners of all ages are willing to pay more for a healthier home.** For each age group, at least 80% of the respondents find that they will pay more for a healthier home, and there is only a four percentage point difference between them.

This finding is notable because it exceeds the percentage of builders/remodelers who believe that home buyers/owners will pay more for green (see pages 11 and 12). It shows that builders and remodelers believe that the concept of healthier homes resonates with consumers, a supposition well supported by previous Dodge Data & Analytics research in this area (see pages 42 and 43). It also demonstrates that green builders and remodelers can benefit from capitalizing on the impact of green building approaches on home owner health.

However, some differences do emerge by the age of the consumer in terms of how much more builders and remodelers believe that consumers are willing to pay. Out of the subset of builders and remodelers who believe that consumers will pay more for a healthier home:

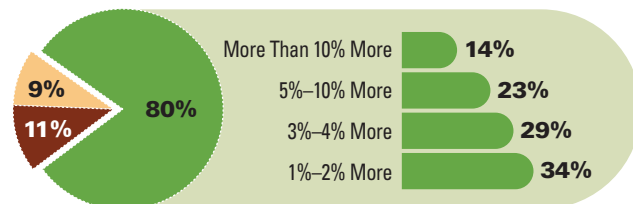
- **52% believe that consumers who are 55 or older will pay an additional 5% or more for a healthier home.** This result demonstrates that builders/remodelers believe that the value of a healthier home is not limited to those raising a family but is of wider interest. It suggests that marketing in this area is likely to be quite successful.
- **The lowest percentage (37%) believe that those in the youngest age group (age 35 and under) will pay more than 5%.** This result is consistent with the findings about influential factors for purchasing decisions, in which health was ranked low for buyers and owners 35 and under (see page 17).
- **The findings for those in the middle-age group (age 36 to 54) vary.** The highest percentage (36%) say these clients will pay only 1% to 2% more, and the lowest percentage (5%) say they will pay at least 10% more, suggesting that for many, these clients will pay less for health. However, a relatively high percentage (35%) believe that they will pay between 5% and 10% more, which suggests that for some, health is a high priority.

### Willingness of Home Buyers/Owners to Pay More for a Healthier Home (According to Home Builders and Remodelers)

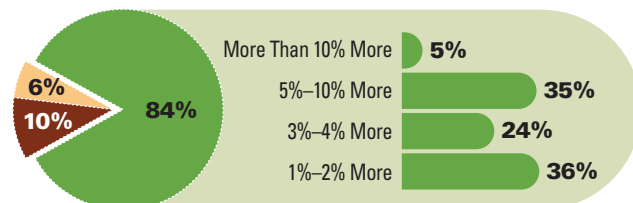
Dodge Data & Analytics, 2015

- Willing to Pay More for a Healthier Home
- Not Willing to Pay More for a Healthier Home
- Don't Know

#### Age 18–35



#### Age 36–54



#### Age 55 or Older



## Use of Healthier Home Features

There are several features in homes that have been demonstrated to have a positive impact on the health of the occupants, but their use varies widely.

- **For the most part, a similar percentage of home builders and remodelers report use of these features, but any significant differences are noted below.**
- **The level of green involvement, on the other hand, is an influential factor in determining the degree of use of many healthier home features.**

**The most widely used healthier home feature is the use of adequate sunlight/daylighting throughout the home.**

Adequate daylighting is a critical health strategy in the home since access to sunlight positively impacts the mental health of the occupants. Not only is this a popular practice among green builders, but it can also make the home more visually enticing for buyers, which no doubt contributes to its wide level of use, even among those who do a moderate level of green building (16% to 60% of their projects green). Daylighting needs to be managed carefully, however, to avoid glare and to avoid increased energy use to keep spaces cool.

**Most (80%) home builders and remodelers who are dedicated green builders (do over 60% of their projects green) use non-chemical pest prevention, a much higher percentage than builders doing less green work.** Non-chemical pest prevention consists of using sealing, caulking and screening rather than chemicals to keep out pests, which can have an important impact on the air quality within the home. A relatively robust percentage (64%) of those who do a moderate level of green building also report using this feature, a much higher percentage than those who do little green building (46%).

**The degree of green involvement is very influential in whether or not a builder or remodeler is likely to use a dedicated fresh air system.** Nearly three quarters (74%) of dedicated green builders make this investment in their homes, compared with just 18% of those doing little green building. Since this is part of the mechanical system, it is used by a significantly higher percentage of builders (48%) than remodelers (27%). It is more likely to increase the cost of the mechanical system, but it can also have a big impact on the air quality in a home.

Acoustic comfort has not been included as a credit on many green home rating systems, and this may account for the fact that there is less difference in its use across the three levels of green involvement than for any other healthier home feature. It may also explain why it is

### Use of Healthier Home Features (According to Home Builders and Remodelers)

Dodge Data & Analytics, 2015

	Total	More Than 60% Green	16%–60% Green	15% or Less Green
Adequate Sunlight/Daylighting Throughout the Home	72%	80%	87%	62%
Non-Chemical Pest Prevention Methods	61%	80%	64%	46%
Dedicated Fresh Air System	43%	74%	62%	18%
Acoustic Comfort	30%	38%	40%	26%
Exhaust Fan in Garage	9%	20%	9%	6%

not more widely used in general, even though it is an important factor for comfort, as well as for health factors like sleep quality.

The use of exhaust fans in garages is clearly still an emerging feature for those doing a lot of green building and those doing very little alike, although it is more likely to be used by dedicated green builders.



## Use of Healthier Building Products

In many ways, the use of healthier building products mirrors the use of healthier building features. **While there are only a few notable differences in their use by home builders and remodelers, there are numerous, significant differences in their use based on the level of green involvement reported by the respondent.** These findings demonstrate the importance of the green building movement in promoting the construction of healthier homes.

### Building Products That Improve Air Quality

Based on overall use, there are three categories of building products that improve indoor air quality: those that are widely used, those in moderate use and those rarely used.

#### WIDE USE

**Carbon monoxide detectors are clearly the most widely used of all building products that impact indoor air quality.** According to the National Conference of State Legislatures, as of January 2015, 29 states have laws, with varying requirements, about carbon monoxide detector use in homes, which no doubt has contributed to their wide use. In addition, public awareness of the risks posed by the accumulation of carbon monoxide in the home, including illness and death, has increased significantly in the last decade, due to public outreach programs. This may be creating consumer demand for these products in homes.

#### MODERATE USE

Two products are used by approximately two thirds of the overall respondents. However, unlike the carbon monoxide detectors, these are far more widely used by dedicated green builders and remodelers (those doing more than 60% of their projects green) than by those doing less green building.

- **66% use low-/no-VOC products.** While many consumers are not familiar with volatile organic compounds, the requirements and points given to their avoidance by green building rating systems has created widespread industry awareness among builders/remodelers. Therefore, it is not surprising that 73% of those doing a moderate level of green building and 85% of dedicated green builders/remodelers are using these products, while only 52% of those doing little green building use them.
- **60% use low-/no-formaldehyde products.** Green building rating systems have also called attention to

### Use of Healthier Building Products That Improve Air Quality (According to Home Builders and Remodelers)

Dodge Data & Analytics, 2015

	Total	More Than 60% Green	16%–60% Green	15% or Less Green
Carbon Monoxide Detectors	83%	87%	84%	84%
Low-/No-VOC Products	66%	85%	73%	52%
Low/No Formaldehyde Products	60%	79%	64%	45%
Air Purification System	28%	41%	33%	18%
Merv 8+ Filters or Higher	26%	51%	24%	16%
Central Vacuum	23%	23%	27%	20%
Insulated Siding	20%	20%	18%	25%

the need to avoid these products, and their use largely parallels that of low-/no-VOC products.

#### LOW USE

Less than 30% of builders and remodelers overall are using four products that impact indoor air quality.

- **A relatively high percentage of dedicated green builders/remodelers use air purification systems (41%) and MERV 8+ filters or higher (51%) compared with those doing less green building.** Clearly, green building experience impacts the willingness of builders/remodelers to invest in these systems.

GREEN AND HEALTHIER HOMES: ENGAGING CONSUMERS OF ALL AGES IN SUSTAINABLE LIVING DATA

- **Level of green building involvement has no impact on the use of a central vacuum system and insulated siding.** Greater industry awareness of the benefits of these products on improving indoor air quality is necessary.

**VARIATION BY TYPE OF BUILDER**

Carbon monoxide detectors are the only building product impacting indoor air quality with a difference in use by home builders (77%) and remodelers (93%).

**Building Products That Control Moisture Levels**

Two out of three of the building products that control moisture levels have different levels of use reported by home builders and remodelers.

- **Water-resistant backerboard is used by 77% of builders and 93% of remodelers.** However, their use is not strongly influenced by the level of green involvement, with pretty strong use across the board. This suggests that controlling moisture in this way is not associated with green building in the industry.
- **73% of remodelers use bath fans/humidistats on timers, compared with 58% of builders.** This may be influenced by greater awareness of comfort as a factor with home owners, compared with home buyers. In this case, a higher level of green involvement is also associated with a higher level of use, with around 70% of those who do at least a moderate level of green building using these, compared with 49% of those who do little green building. The timers allow these to be energy-saving devices as well as ones that impact moisture levels, which may make them a relatively low-cost measure that impacts two important areas for greening a home.
- **Use of humidity control systems is moderate, both among builders and remodelers, and across all levels of green involvement.** As health becomes a bigger factor for consumers and in green building rating systems, it is possible that the use of these systems could increase, especially among those with a high level of green involvement.

**Use of Healthier Building Products That Control Moisture Levels**  
(According to Home Builders and Remodelers)

Dodge Data & Analytics, 2015

	Total	More Than 60% Green	16%–60% Green	15% or Less Green
Water-Resistant Backerboard in Damp Areas	81%	87%	78%	76%
Bath Fans/Humidistats on Timers	61%	69%	70%	49%
Humidity Control System	45%	49%	56%	39%

## Use of Healthier Construction Activities

Much of the discussion about building healthier homes focuses on the materials used in the homes and the building features: making sure to avoid products that emit volatile organic compounds (VOCs), creating spaces with lots of sunlight and creating spaces that encourage more physical activity. However, there are actions during and immediately following construction that can be taken by home builders and remodelers that make the house healthier both during construction for the workers and for the occupants of the home after construction is complete.

**The most common healthier building practice is protecting onsite building materials from moisture and weather damage, which is used by 79% of all respondents.** This is just good building practice, and therefore, the level of green involvement does not significantly influence the incidence of use.

**Two-thirds of home builders and remodelers provide maintenance education to home owners on systems.** As with other aspects of home performance, home owner knowledge can influence their awareness of whether a home's systems, such as air handling systems, have a positive or negative influence on occupant health. Even a moderate level of green building involvement increases the likelihood that a builder or remodeler will provide this education to home owners, probably because of greater concern that their home performance meets owner expectations.

The remaining four practices are used more widely by dedicated green builders and remodelers (those doing more than 60% of their projects green), compared with those doing less green building.

- **A high percentage of dedicated green builders (72%) use non-toxic and low-VOC cleaning products during construction.** Awareness of the impact of VOCs and toxins is influential in builder/remodeler decisions for both building products and cleaning products.
- **Over half of dedicated green builders do indoor contamination control during construction and third-party testing of combustion appliances/backdrafting.**
  - A higher percentage of remodelers (55%) than home builders (36%) do indoor contamination control as well. Customer concerns about indoor contamination during construction may account for this differential, which suggests that home builders in general need to be more aware of the impact of indoor contamination on their own workers and on occupants in a new home.
  - Third-party testing of combustion appliances/backdrafting is important to ensure that hot water

### Use of Healthier Construction Activities (According to Home Builders and Remodelers)

Dodge Data & Analytics, 2015

	Total	More Than 60% Green	16%–60% Green	15% or Less Green
Protect Onsite Building Materials From Moisture/Weather Damage	79%	79%	82%	73%
Maintenance Education for Home Owners on Systems	66%	77%	78%	60%
Using Non-Toxic and Low-VOC Cleaning Products During Construction	51%	72%	51%	40%
Indoor Contamination Control During Construction	40%	54%	27%	34%
Third-Party Testing of Combustion Appliances/Backdrafting	30%	54%	31%	18%
Pre-Occupancy Flushing of Indoor Air	16%	28%	16%	10%

heaters and furnaces are sufficiently vented to avoid the build-up of carbon monoxide in the home. While carbon monoxide detector use is prevalent (see page 39), most builders and remodelers who are not doing more than 60% green do not take this step.

Only a small percentage of builders or remodelers, even among those dedicated to green building, do pre-occupancy flushing of indoor air. Pre-occupancy flushing of indoor air can lengthen the amount of time before the home can be occupied. Even dedicated green builders may opt for measuring air quality in the home before occupancy instead, which is less time consuming, but they take the risk of the home not passing the initial test.

# Data: Home Owner Insights

## On Healthier Homes

### Findings From the DD&A Home Owner Survey

#### On Healthier Homes

**Home owners place great value on having a healthier home, but their understanding about the ways that homes can impact their health is limited, offering a great opportunity to drive the healthier home market through more home owner education.**

In 2014, Dodge Data & Analytics conducted a survey of home owners about the use of healthy design and construction practices in their homes. The findings were published in *The Drive Toward Healthier Buildings SmartMarket Report*. The study revealed that home owners consider having a healthier home very important, but they do not always understand exactly how homes can influence their health. Creating a more educated consumer can help drive the demand for using healthier products and practices in the residential sector.

#### Home Owners Value Healthier Homes

The majority of home owners who participated in this study stated that

they would pay more for a healthier home (60%) than a traditional one. An even higher percentage (70%) report that they would be willing to pay more for healthier home products and practices.

Home owners also consider impact on health an important criterion when they make building product purchasing decisions. Between 65% and 70% consider a building product's health impact equally or more important than factors such as comfort, performance, cost, aesthetics and durability. In fact, the highest percentage consider health impacts more important than aesthetics or cost, a surprising finding that demonstrates the value they place on healthier products.

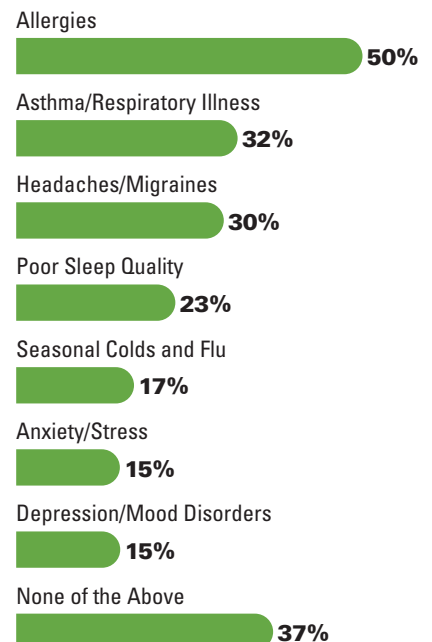
Home owners who reported that at least five healthier building products or practices were used for their home were also asked about the home's impact on their health.

- 39% reported that they were able to sleep better.
- 31% reported their mood was improved from living in the home.
- 31% also reported being more comfortable when home.
- 30% reported that they or their family experienced fewer illnesses.
- However, 34% did not note any impact from being in a healthier home.

#### Health Conditions Affected by Home Factors

(According to Home Owners)

The Drive Toward Healthier Buildings SmartMarket Report, Dodge Data & Analytics, 2014

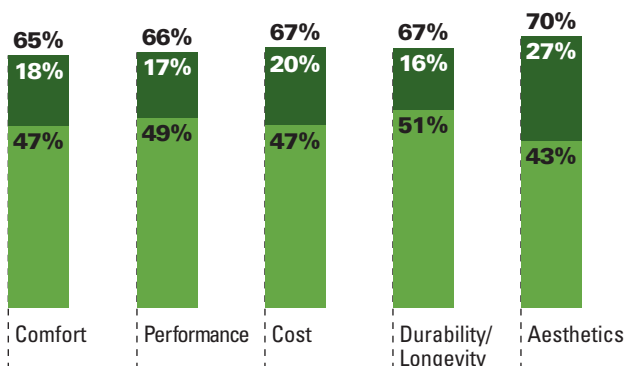


#### Importance of Health Impacts Versus Other Factors When Making Product Purchase Decisions

(According to Home Owners)

The Drive Toward Healthier Buildings SmartMarket Report, Dodge Data & Analytics, 2014

- Health More Important
- Health of Equal Importance

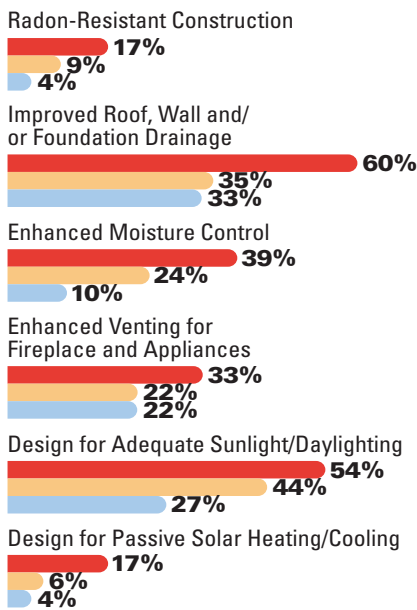


### Healthier Design/ Construction Practices (Use of and Lack of Knowledge by Age of Home Owner)

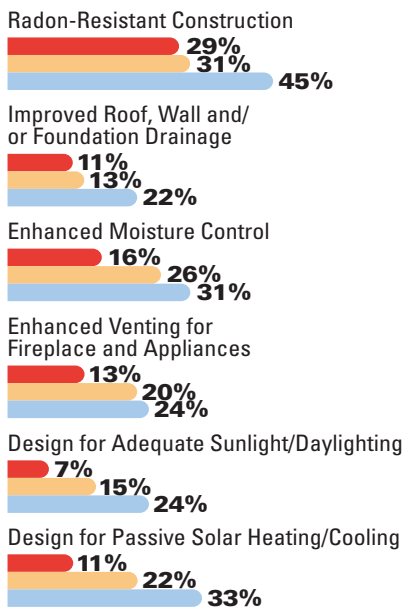
The Drive Toward Healthier Buildings SmartMarket Report,  
Dodge Data & Analytics, 2014

60 or older 40-59 20-39

#### Use of Healthy Design/Construction Practices



#### Lack of Knowledge of Healthy Design/ Construction Practices



Since 76% of the survey respondents did not track health and home data, it is not surprising that health impacts, which are often subtle and influenced by multiple factors, may not always have been noted by the home owners. The fact that at least 30% do report experiencing these benefits, given these mitigating factors, is telling. However, it also suggests that greater awareness of how homes can influence their health could help home owners to be more aware of any benefits they may be deriving from being in healthier homes.

### Home Owners Do Not Understand the Impact of Homes on Health

The lack of specific data tracked on the home's influence on their health is just one indicator of the lack of general knowledge in many of the home owners surveyed about how their houses can impact their health.

When asked about the health conditions that are influenced in general by the products and practices used in homes, the only condition widely recognized as influenced was allergies. Most home owners did not recognize that a healthier home could also influence conditions like headaches/migraines, sleep quality, anxiety/stress, depression or their experience with seasonal colds and flu. This gap reveals that chemicals and air impurities are a concern, but most home owners do not consider other factors like daylighting and views, appropriate ventilation and acoustical comfort as relevant to their home's impact on health.

Unfortunately, the study also indicated that doctors are unlikely to be able to increase home owner awareness of the influence of these

critical elements on their health. A separate study of physicians included in the SmartMarket Report notes that 68% of general practitioners do not see any connection between the health of their patients and the buildings they occupy.

### Knowledge and Use of Healthier Building Products and Practices Influenced by the Age of the Home Owner

Age of the home owner had little influence on most of the factors previously discussed. However, older respondents were more likely to use several healthier building products and practices, and lack of knowledge about those products and practices is reducing the level of their use among younger home owners.

As the chart at left indicates, use of specific healthier building practices was far more common among those over age 60 than those under 40. On the other hand, a much higher percentage of respondents under 40 were unfamiliar with most of the building practices mentioned.

All of this supports the findings by the home builders in this study that older home owners, especially those at or near retirement age, are far more likely to understand and be focused on the specific features that improve home performance. Greater experience with home ownership may account for the knowledge gap, and it certainly provides insight into why home builders and remodelers believe that their older consumers are the most likely to seek specific high-performance home features, from green practices to healthier ones. ■

# Prioritizing Health Impacts as a Critical Part of Creating a Sustainable Home

**EcoManor**  
ATLANTA, GEORGIA

When Laura and Rutherford Seydel built their green home in 2007, they decided, not only to certify that the home was green through the fledgling LEED for Homes program, but also, according to Laura Seydel, to use it to “provide a blueprint for others as they wanted to build their own LEED certified homes that [would provide] some good ideas about what they could do.” Their impressive commitment to energy, water and materials conservation, as well as their use of renewables, helped them to earn LEED gold certification.

However, their commitment to a sustainable home exceeded the LEED parameters at that time. Shortly before they began building

their home, Laura Seydel, along with her father and son, participated in one of the “first intergenerational toxic body burden studies done in the US.” Seydel describes getting the results, which revealed that each had unacceptably high levels of different toxins, including high levels of flame retardant and Teflon-type chemicals in her son, as “a very eye-opening experience.” It led her to make “a commitment that we would do everything in our power, not only to achieve an environmentally friendly home, but a healthy home as well.”

An important partner in that effort was Jillian Pritchard Cooke, president of DES-SYN, the firm responsible for interior design on the project and part of Seydel’s “Dream Green

Team.” Expertise in this area was needed because the understanding of the need for healthier building products for homes was still limited and highly specialized. Even finding low-VOC paints was a challenge when the home was built. In fact, the paint expert at their local big-box home improvement retailer told them, “That doesn’t exist; there is no such thing,” and they had to examine the paints on the shelves themselves to demonstrate that it did.

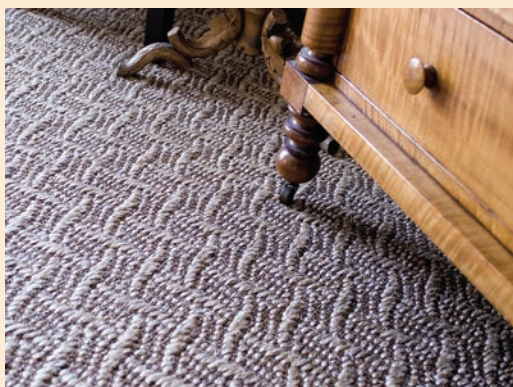
## Home Building Decisions Made to Improve Health

The health impact of products informed all the materials they selected for the home, not just the paints. Seydel states, “From stains to finishes, obviously paint, the air



All materials used in the Ecomanor were selected with conscious attention to their impact on the indoor air quality of the home. In addition, the Seydels have tested the air quality to help them address any issues missed.

Another key health strategy employed is the use of large windows, which promoted airflow throughout the house and let in natural light.



## EcoManor ATLANTA, GEORGIA

stats

### Project Facts and Figures

#### Architect

Harrison Design Associates

#### Designer

DES-SYN

#### Landscape Architect

Ed Castro Landscape

#### Builder

DeLaney Rossetti Construction

#### Completed

2007

### Healthy Home Strategies

- Low-VOC Paints, Stains, Sealants
- Natural Fiber Fabrics on Furniture and Rugs
- Use of Special Household Cleaning Products and Soaps
- Soy-Based Insulation
- Formaldehyde-Free Cabinets
- Properly Sized HVAC System with HEPA Filters
- Controlled Ventilation
- Wide Use of Natural Light Through Windows and Light Tubes

GREEN AND HEALTHIER HOMES: ENGAGING CONSUMERS OF ALL AGES IN SUSTAINABLE LIVING

filtration systems, we really tried to get that right. All the fabrics that we used and the vegetable-dyed carpets. We bought wool over synthetic carpets because of off-gassing issues.”

While some options involved investing in more expensive materials, they also employed strategies that could be adopted inexpensively by any builder. Seydel mentions that light tubes were used in the master bathroom and closet to provide natural light in spaces that would typically lack it. Both Seydel and Cooke agree that access to natural light is a key health benefit of EcoManor.

Seydel was also ultimately pleased with the aesthetics and comfort of all the materials involved. “I love the fact that we got all these beautiful elements that Jillian and her team put together for us. All-natural fabrics and aged hardwood floors that came from downed trees in Florida, aged beams and natural surfaces. I think the home feels just great. And it looks great.”

### Challenges

However, their efforts also demonstrated that even the most conscious efforts cannot eliminate the presence of toxins in a home. A mistake when the insulation in the roof was mixed caused it to off-gas more than it should have. A flooring adhesive that also off-gassed was used without approval when the floors were installed.

One of the most striking examples, though, came from the kitchen cabinets. After learning that cabinets with formaldehyde can off-gas for 15 years, Seydel was particularly careful to get cabinets marketed to people

with upper-respiratory diseases as formaldehyde free. However, when they had the air tested after they moved in, she states that she was, “shocked to find out that our kitchen cabinets—not the doors but the boxes—were loaded with formaldehyde.”

Cooke is careful to observe that these are not just examples of atypical errors: “The thing that most people don’t realize is that every home is toxic.” Even home owners who do everything right

like the Seydels, she points out, cannot eliminate the presence of toxins. In fact, she asserts that outside influences once the home is occupied, from packages arriving in the mail to a dog interacting with toxins in a neighbor’s yard, will inevitably introduce some toxins into an environment.

She believes that highly efficient homes should be designed with this factor in mind. “The best thing [Seydel] did was [to choose] big, huge windows, lots of patterns for air to flow.” She points out the need to balance efficiency and health. “We are building our buildings to be so tight that we’ve coined the phrase ‘tight box syndrome.’” Attention needs to be given, even in a highly efficient home, to allow toxins to escape. “To be off of net zero and not have such a tight box and to be able to have a home that breathes really creates a much healthier environment,” says Cooke.

### Health Outside the Home

The Seydels’ concerns about the impacts of their home extended beyond its walls. Seydel states, “We made a commitment to have the most sustainable, environmentally sensitive and healthy yard for us, for our pets and for nature that we can have.” Their strategies to achieve this include not using chemicals, planting clover for bees, leaving part of the yard in its natural state, and having an edible yard with fruits and vegetables. Again, for her, this is important, not just on its own, but as a means to educate and demonstrate the possibilities of a healthy, sustainable home. ■

# Data: Renewable Energy and Net Zero Homes

## Use of Renewable Energy in Residential Projects

GREEN AND HEALTHIER HOMES: ENGAGING CONSUMERS OF ALL AGES IN SUSTAINABLE LIVING DATA

The previous green residential study, published in the 2014 *Green Multifamily and Single Family SmartMarket Report*, was the first in this series to begin tracking the use of renewable energy in residential projects. The latest study now provide trending data that indicates that more builders of residential projects are using renewables, with some significant gains for specific technologies.

### Use of Renewable Energy on All Projects

The percentage of home builders and remodelers offering renewable energy on at least some of their projects is increasing.

- 65% reported offering renewable energy in 2013 in the previous study.
- 76% in the current study say that they offer renewable energy on their projects in 2015.
- 85% expect to offer renewable energy by 2018.

However, the percentage of respondents who incorporate renewable energy into all their projects did decline between 2013 and 2015, from 8% to 3%. The largest increase between 2013 and 2015 is in the category of those who offer renewable energy as an option on the request of the owner. **This suggests that market demand is an important factor driving the increase in renewables.**

One notable finding from the current study is that there is no statistically significant difference in the percentage of builders who use renewable energy between those doing more than 60% of their projects green and those doing a lower percentage of green projects. Dedication to green building is not driving the general trend toward an increase in the use of renewables, which is another indication of the importance of market forces as a driver.

It is likely that these findings demonstrate a shift away from considering renewables to be a green activity, associated with general concern for the environment and reducing climate change, and consumer sentiment instead regarding renewables as saving money on energy costs and reducing dependence on foreign sources of fuel. They may also be driven by an increase in leasing programs for solar photovoltaic panels that keep the upfront cost minimal for the home owner.

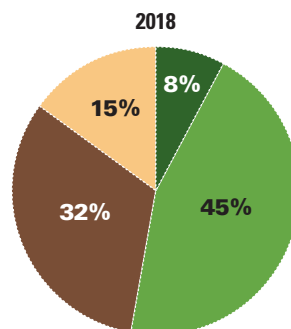
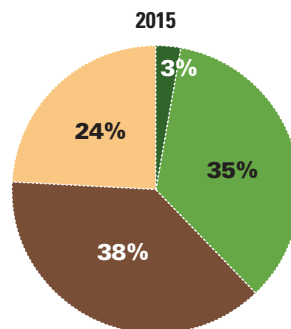
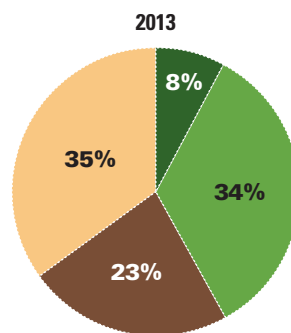
### VARIATION BY AGE OF CLIENTS

Interestingly, a higher percentage of home builders and remodelers with 50% or more of their clients at age 55 or older (86%) offer renewables, compared with those with more than half their clients in the 36–54 age group (73%)

### Use of Renewables Over Time (According to Home Builders and Remodelers)

Dodge Data & Analytics, 2015

- Renewable Energy Incorporated Into All Projects
- Offer Renewable Energy as an Option
- Do Not Offer Renewable Energy Except Upon Owner Request
- Do Not Offer Renewable Energy





or especially with those with half their clients 35 and under (44%). There may be many reasons contributing to the particularly low performance among builders/remodelers with a high clientele who are 35 and under, including the cost of incorporating renewables and concerns about issues arising during resale with leased renewables.

### Use of Specific Renewable Technologies

In the current survey, respondents were asked about their use of specific renewable technologies in 2014 and their anticipated use of them by 2018. The chart at right compares those findings with the use of technologies reported for 2013 in the previous study.

One notable finding is that all renewables saw increased use between 2013 and 2014. **By far, the greatest growth in that period was in the use of solar photovoltaic technologies, which increased by 7 percentage points, a striking growth over a one-year period.** However, even the smaller gains are notable over such a short period of time.

Use of photovoltaics has seen such strong growth because of the availability of leasing programs in some areas of the country and because the cost for those who purchase a PV system has dropped significantly. In fact, in May 2014, *Forbes* reported the cost of solar had dropped by 60% since the beginning of 2011.<sup>1</sup> The data on growth reported in the findings in this study are supported by the reported growth in residential solar in the 2015 report issued by the Solar Energy Industry Association.<sup>2</sup>

**The chart also demonstrates that builders and remodelers expect to see very strong growth by 2018 in the use of all of these technologies.**

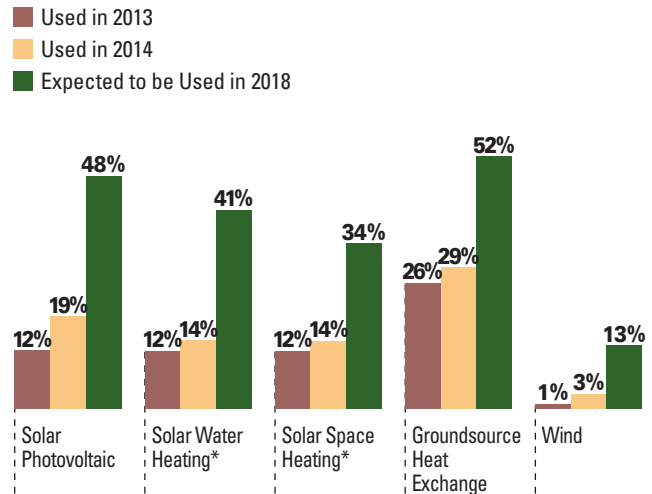
- Solar photovoltaic technology continues to have the most rapid acceleration expected.
- However, the highest percentage continues to be those who expect to use groundsource heat exchange.

### LEVEL OF USE OF TECHNOLOGIES

While the data are not included in the chart at right, respondents were also asked about their level of use of each of these technologies, by selecting categories that increased in 25% intervals.

### Use of Specific Renewable Technologies Over Time (According to Home Builders and Remodelers)

Dodge Data & Analytics, 2015



\*For 2013, Solar Water Heating and Solar Space Heating were combined under the category Solar Thermal.

- Across all the technologies surveyed, over half of the home builders and remodelers reported that they fell in the lowest (1%–25%) category.
- All home builders and remodelers who used wind technologies fell in this lowest category.
- The technology with the highest percentage of builders/remodelers using them on more than 25% of their projects is groundsource heat exchange (45%), but solar photovoltaic (42%) and solar space heating (42%) are not far behind.

These findings reveal a strong commitment to the industry to these technologies in particular, but also to the use of renewables in general for the immediate future.

1. Tusher, Christine. "Everything You Need to Know About Adding Solar Panels at Home." *Forbes*. posted online May 17, 2014. Accessed September 23, 2015. <http://www.forbes.com/sites/houzz/2014/05/17/everything-you-need-to-know-about-adding-solar-panels-at-home/>

2. GTM Research and Solar Energy Industry Association, *U.S. Solar Market Insight Report*, Q1 2015. Accessed September 23, 2015. [http://www.seia.org/sites/default/files/resources/Y3p3Vn70KQ12015SML\\_0.pdf](http://www.seia.org/sites/default/files/resources/Y3p3Vn70KQ12015SML_0.pdf).

## Net Zero and Near-Net Zero Energy Homes

Net zero and near-net zero energy homes are a growing trend in the industry, especially among builders committed to green building.

In fact, **21% of home builders report that they have built a net zero or near-net zero energy home in the last two years.** This relatively high percentage, nearly one quarter of the industry, suggests that **net zero is no longer seen as an impossibly expensive or fringe goal only pursued by a handful of builders dedicated to green, but an increasingly important trend that builders need to be prepared for.**

Experience with green building, though, is a critical factor in the percentage of builders who build net zero/near-net zero energy homes. Almost none (3%) of the builders who report building less than 16% of their homes green have done a net zero/near-net zero home. Experience in achieving high performance in a home's energy use is critical to undertake net zero construction, and the more green experience builders have, the better prepared they will be to undertake these projects, as the findings support.

- **Moderately Green Builders (16%–60% Green Homes):** 22% have built a net zero/near-net zero home in the last two years.
- **Largely Dedicated Builders (61%–90% Green Homes):** 28% have built a net zero/near-net zero home in the last two years.
- **Dedicated Green Builders (Over 90% Green Homes):** **58% have built a net zero/near-net zero home** in the last two years.

Those dedicated to green also built more net zero homes than their peers, with an average of nine net zero homes compared with an average of 3.5 for those doing less green building. However, when it comes to building near-net zero homes, rather than those that are already considered fully net zero, those doing less green building average about the same number of homes as the dedicated green builders.

### Variation by Age of Client

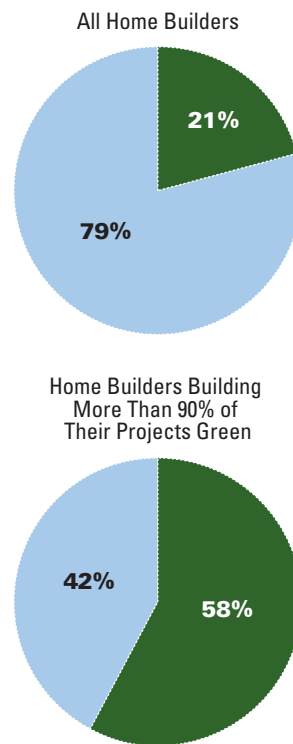
**Builders whose clientele consists of 50% or more of those who are age 55 or older are doing more net zero/near-net zero homes.** Thirty percent report doing those homes, compared with approximately 12% of those whose clientele consists of younger buyers. This finding corresponds to the tendency of the builders with an age 55 or older clientele to report building greener homes. It

### Percentage of Home Builders Who Have Built a Net Zero Home in the Last Two Years (By Level of Green Building Involvement)

Dodge Data & Analytics, 2015

■ Yes ■ No

#### Has Built a Net Zero/Net Zero Ready Home in the Past 2 Years



also affirms the closer attention paid by that age group to specific aspects of home performance like energy use. It may also be related to the fact that older buyers are often able to invest more money initially into the home.

# Interview: Thought Leader



Thomas Kimbis, Vice President of Executive Affairs & General Counsel, Solar Energy Industries Association (SEIA)

**Tom heads SEIA's relations with the White House and executive branch agencies. He also provides legal services to SEIA as general counsel and leads development of a national industry strategy to promote solar energy growth across US markets.**

## **How would you describe the growth in use of solar for residential homes?**

The dominant market sector in the US remains utility scale; however residential is growing steadily and quickly... The residential solar market in Q2 2015 hit another record quarter with a 70% increase over Q2 2014. That's now on pace to hit a cumulative total of 2GW installed in 2015. That's really remarkable.

Meanwhile, the average price of a residential PV (photovoltaic) install has dropped to \$3.50 per watt. That's roughly 50% lower than it was in 2010, and two-thirds lower than it was when the Investment Tax Credit was passed in 2006. That's the total installed cost. The cost of panels has dropped even more dramatically, but, of course, there's are still efficiencies to be made in the soft costs related to anything other than the hardware.

## **What is driving increased use?**

There's no doubt that the federal Investment Tax Credit (ITC), which passed in 2006 and was extended in 2008 for eight years, has been a fundamental driver for residential solar in the US. That 30% credit disappears for residential systems after 2016 ... [It] has helped spur, over the last five years, the investment of private dollars into the sector. That has meant scaling of technologies—which lowers the cost—and availability of private capital—both

tax equity as well as other forms of capital investment. [These factors] have made it easier for solar companies to expand, to enter new markets and to drive down the cost.

We're also seeing consumers becoming increasingly aware of solar as a competitive option. We've seen strong neighborhood effect, which is to say people seeing others whom they trust go solar and seeing that it works, it's affordable and it's reliable. It's something that is more familiar to Americans today than ever before.

When you take those things in combination, you've got a technology that is no longer a niche choice for Americans. It's a mainstream power source today.

## **What are the barriers to adoption of solar in residential?**

There is still a lot of education to be done. Many Americans don't realize they have this choice when it comes to selecting their electricity source. There are states that still prohibit the dominant models of third-party-owned system, such as the state of Florida. Bad state policy can inhibit the growth of solar. We've seen that happen.

You also have some ongoing disputes over net-metering within certain states and whether customers can get fair market value for [the electricity] they are sending back in the grid. That's something we're fighting hard for. Those fights continue.

## **Any concerns about political risks?**

SEIA and the solar industry are pushing hard to extend the Investment Tax Credit. We asked for a five-year extension. There's always risk when it comes to having policy extended.... However, we feel we have bipartisan support for an extension. We have 174,000 Americans working in this industry who are ready to speak and be heard. Their jobs matter. A Bloomberg study came out [recently] looked at the impact [on the industry] with and without the ITC. It found that from 2016 to 2017, there would be nearly an 8GW difference in the amount of solar deployed across the US. [New installations] would drop from 11GW in 2016 to 3.2GW in 2017, if it expires.

## **What is the future outlook for residential solar?**

Individuals want to have that freedom to choose their power source. The ITC is a critical point in determining how serious America is about supporting solar energy and giving it this final push over the goal line to become more competitive. We're competitive in many states today, but not all of them. So, I'm very bullish on solar. ■

# Achieving Below-Net Zero on a Budget Through Close Attention to Details

**Net Zero House**  
COUPEVILLE, WASHINGTON

**S**ue and Robert Payton wanted to build a retirement home that was energy efficient and took advantage of passive solar. However, they only began to consider net zero when they found Ted Clifton at Clifton View Homes. They were so impressed with his recommendations that they abandoned the home plans they had already created and started to work with him on a house that not only achieves below-net zero results but also emphasizes occupant comfort. As their testimonial for Clifton states, "We often comment on how comfortable and peaceful [the house] is."

## Reaching the Efficiency Needed for Below-Net Zero

Clifton notes that the orientation of the house is not one that is typically considered optimal for achieving net zero performance. "[The house] completely defies the common logic as far as the need to have the long side facing south. [It] is nearly square, about 33 by 30, and it's almost exactly a 45-degree angle to the east, west, south, north axis." The size of the house and the angle of the lot forced the orientation. In addition, about half of the windows are on the southwest facing wall, in order to take advantage of a water view.

From bottom to top, though, the house is designed to achieve a high level of efficiency. Clifton explains that the house has an insulated concrete form (ICF) daylight basement foundation, with four inches of XPS foam under the basement slab. The ICFs have an R-value of around 23, and the walls,



Solar panels can cover the entire electricity load of the home because of small details like using the slope of the site to allow daylight into the basement.

including the XPS foam, drywall and siding, are approximately R-25.

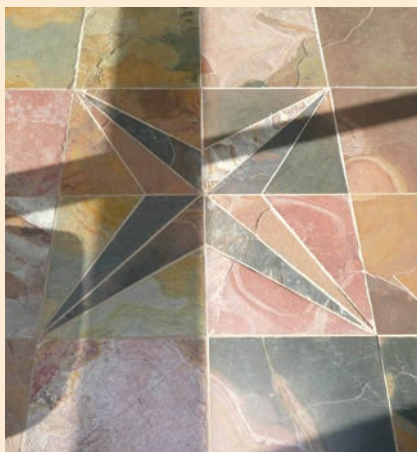
Thermal massing is also important to achieve maximum efficiency. "The main floor is an inch and a half slab over wood framing," Clifton explains, "with an additional three quarter inch of grout and slate tiles over the entire main floor." This was a particularly important strategy for the results they achieved, according to Clifton. "This was one of the first houses where we used thermal mass on the second floor of a house above a wood-framed floor, and it was phenomenally successful. One of the things we realized from this is not only how well the thermal mass absorbs the direct heat from the sunshine, but also how well it transfers it ... . The energy you put into that floor is going to travel 25 feet across the house in the same amount of time as it'd go through a six-inch wall. In effect, wherever the

heat lands on the floor, it doesn't just stay there. It goes to the rest of the house."

The roof of the house received the same amount of attention as the rest. Clifton says, "We did a truss package with a 14-inch raised heel ... and we left the bottom cords extending all the way out to the fascia, so we had a vented soffit. We also installed a solar-powered vent fan... . When the sun's on the west side, it is powering that fan, keeping the attic cool."

The result of these design decisions, along with a highly efficient heating and hot water system, is that their 5.6 KW photovoltaic array is able to provide all the power needed. In fact, between October 2012, when the solar array was installed, and December 2014, Clifton reports that the Paytons had a net credit of 2,272 kilowatt hours.

## Payton Net Zero House COUPEVILLE, WASHINGTON



The decorative slate floor over the concrete slab functions as a thermal mass that stores and transfers heat.

The overall performance allowed them to just use double-paned windows, rather than the triple-paned windows typically installed in a net zero home.

### Building on a Budget and Conserving Materials

From the start, the owners worked with Clifton to make sure the house stayed within their budget. His strategy for keeping costs down was to “keep things simple.” He explains, “The first thing you can do is keep the surface area small. The plan was simple.” One example he gives is taking advantage of the fact that the master bath had a door to the hallway to avoid putting another bathroom on the main floor. Another example, and one that the owners discuss in their testimonial, is having the laundry room also function as the coat closet, which also helped the overall flow of space in that section of the house.

The Paytons were also able to take advantage of Robert’s employment

at Home Depot to use materials in their home that would be designated as trash or were bargain basement items, such as using cutoffs to make butcher block countertops. Clifton states, “The coolest thing [Robert] did is he took all the pallets that products like roofing had been delivered on, and he surface planed and edge joined all that pallet wood to make stair treads. All the stair treads from the lower floor to the upper floor are made out of wood that would otherwise have gone to the dump.”

### Improved Indoor Air Quality

With a home tightly sealed to achieve a high level of efficiency, particular attention needs to be paid to indoor air quality. Clifton says, “In tight homes, when the range fan works, it’s trying to suck in air ... you need to supply makeup air.” To tackle this challenge, he installed a powered, MERV 19 HEPA filter with an 8-inch inlet that “will passively allow the pathway for filtered air to come into the house instead of sucking air underneath doorways and things like that. When the range fan is running and the HEPA filter powers up, you’ve got 240 CFM of fresh air coming into the house along with 206 CFM that you have going out of the house. All the air coming in, in effect, is filtered air.”

He also avoided products that off gas and used low-VOC paints to avoid air contamination.

### Other Green Strategies

Water use reduction was also a strategy employed. In addition to the dual flush 1.2 gallon toilets, their use of rain gardens, with grass only over

the septic tank, eliminates the need for watering.

Careful attention is also paid to construction waste, which they reduced by 70% compared with a typical project. Clifton states, “We are so good at our use of lumber that ideally, when we’re done building a house, the scraps would fit in a single wine box.” ■

#### Project Facts and Figures

##### Builder

Clifton View Homes

##### Type of Project

Net Zero Home

##### Size

Over 1,500 Sq. Ft. (Conditioned)

##### Completed

2011

##### Construction Cost

\$239,000

##### Green Certification

5-Star Green Built Certified

#### Key Green Strategies

- ICF Daylight Basement Foundation (R-23) With XPS Foam Under the Slab
- Floor Construction: Inch and Half Slab Over Wood Framing
- 5.6 KW Solar Photovoltaic Array
- Powered MERV 19 HEPA Filter
- 70% Reduction of Construction Waste Over Traditional Construction

# Methodology:

## Green and Healthier Homes Study Research

GREEN AND HEALTHIER HOMES: ENGAGING CONSUMERS OF ALL AGES IN SUSTAINABLE LIVING

### Quantitative Survey of Builders and Remodelers

The purpose of this study was to examine green building market trends and activities among home builders and remodeler/renovators and continue analysis of trends from 2014 and 2011.

The research findings in this report are based on an online survey of the US home builder and remodeler community as represented by the National Association of Home Builders (NAHB) membership database. The survey was conducted from April 14th to May 8th 2015, and took an average of 16 minutes to complete.

- A select group of NAHB members who identified as either single family or multifamily home builders or remodelers were invited to respond to the survey.
- Firms of all sizes who did some work in the United States during 2014 were included in this group.
- Potential participants were offered a \$10 Amazon.com™ gift card as an incentive to participate.

A total of 249 responses are included in the final analysis.

- **177 single family builders/developers (referred to in the analysis as home builders)**
- **55 single family remodelers**
- **17 multifamily firms**

Many respondents perform multiple tasks such as builders who also do remodeling. Respondents were classified into one of the three aforementioned groups based on their response to a question on what their primary function was in 2014.

The total sample size used in this survey benchmarks at a 95%

confidence interval, with a maximum margin of error of 6.21% for dichotomous items.

### DEFINING GREEN BUILDING

In the survey, green building was defined as referring specifically to homebuilding, home remodeling/renovating and land development that incorporate environmentally sensitive site planning, resource efficiency, energy and water efficiency, improved indoor environmental quality, and homeowner education, or projects that would comply with the ICC 700 National Green Building Standard or other credible rating systems.

### ANALYTIC FACTORS

The following analytic factors are used in the analysis.

- **Comparison to Previous Studies:** While Dodge Data & Analytics (formerly McGraw Hill Construction) has conducted four previous studies with home builders in partnership with NAHB since 2006, the addition of remodelers in the 2011 study has led most of the comparisons in the analysis to be with the 2011 and 2014 studies.
- **Level of Green Involvement:** A full representation of the level of green activity for home builders and remodelers is available on page 8.
- **Age of Clients:** Builders were asked to report the percentage of their clientele in the three categories listed below, and the analysis focuses on those who report 50% or more of their clientele in each category.
  - Age 18 to 35: 10% of builders
  - Age 36 to 54: 47% of builders
  - Age 55 and older: 49% of builders

### Home Buyer In-Depth Interviews

Nine in-depth interviews lasting approximately 30 minutes were conducted with people who had purchased a home within the last year. The home buyers ranged between 29 and 60 years of age, three between 29 and 35, three between 36 and 54, and three between 55 and 60.

### HOMES PURCHASED

Three of the homes were located in California, and two were in Texas. The remaining homes were located in Arkansas, Arizona, Georgia, Illinois, New York and Pennsylvania.

Two of the homes were newly built. Of the remaining, two were built in the 2000s, two were built in the 1990s, one was built in the 1980s, one was built in the 1960s and the final one was built in the 1950s.

The homes ranged in size from 1,700 to 4,200 square feet, with five falling between 2,300 and 2,800 square feet. ■

## Resources

Organizations and websites that can help you get smarter about green and healthier homes.

### DODGE DATA & ANALYTICS

#### Dodge Data & Analytics

Main Website: [construction.com](http://www.construction.com)

Dodge: [construction.com/dodge](http://www.construction.com/dodge)

Research & Analytics:

[construction.com/dodge/  
dodge-market-research.asp](http://www.construction.com/dodge/dodge-market-research.asp)

Sweets: [sweets.com](http://www.sweets.com)

SmartMarket Reports:

[analyticsstore.construction.com](http://analyticsstore.construction.com)

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National Association of Home Builders

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

#### Partner

Ply Gem: <http://www.plygem.com/wps/portal/plygem>

#### Federal Government

US Department of Commerce, National Institute of Standards and Technology (NIST): [www.nist.gov](http://www.nist.gov)

US Department of Energy

- Main website: [www.energy.gov](http://www.energy.gov)
- Office of Energy Efficiency and Renewable Energy (EERE): [energy.gov/eere/  
office-energy-efficiency-renewable-energy](http://energy.gov/eere/office-energy-efficiency-renewable-energy)
- Building America Program: [energy.gov/  
eere/buildings/building-america-bringing-  
building-innovations-market](http://energy.gov/eere/buildings/building-america-bringing-building-innovations-market)

Energy Star: [www.energystar.gov](http://www.energystar.gov)

WaterSense: [www3.epa.gov/watersense/](http://www3.epa.gov/watersense/)

#### NonProfit Organizations

Alliance to Save Energy: [www.ase.org](http://www.ase.org)

American Council for an Energy-

Efficient Economy: [aceee.org](http://aceee.org)

The American Institute of Architects Green

Housing Network: [http://network.aia.org/  
hkc/home/greenhousingnetwork](http://network.aia.org/hkc/home/greenhousingnetwork)

ASHRAE: [www.ashrae.org](http://www.ashrae.org)

Database of State Initiatives for Renewables  
& Efficiency: [www.dsireusa.org](http://www.dsireusa.org)

International Code Council: <http://www.iccsafe.org>

International Living Future Institute Tools +

Resources: [living-future.org/lpc/tools](http://living-future.org/lpc/tools)

International WELL Building Institute:

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

National Institute of Building Sciences: [www.nibs.org](http://www.nibs.org)

New Buildings Institute: [newbuildings.org](http://newbuildings.org)

US Green Building Council: [www.usgbc.org](http://www.usgbc.org)

#### Other Resources

BuildingGreen, Inc: [www2.buildinggreen.com](http://www2.buildinggreen.com)

EcoManor: [www.ecomanor.com/index.html](http://www.ecomanor.com/index.html)

Green Builder Magazine:

[www.greenbuildermedia.com/magazine](http://www.greenbuildermedia.com/magazine)

Home Innovation Research Labs:

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

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