



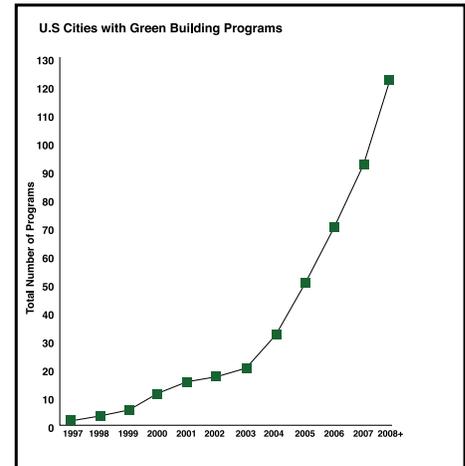
JELD-WEN WINDOWS & DOORS PRESENTS

# GREEN BUILDING: AN INTEGRATED APPROACH TO CONSTRUCTION

By Rob Worthington



120 by the end of 2008. In 2007, spending on sustainable construction reached \$1200 billion — up 2200% from \$53 billion in 1995. Architects and builders are not the only ones aware of the importance of green building principles — 88% of builders working on sustainably designed projects said that they were being pushed to do so by consumers who were seeking more efficient, healthier homes.



Specifying the proper window is no less critical than installing it properly. Architects should be familiar with proper installation methods and installation problems in order to aid them in the selection process.



## PHILOSOPHY OF GREEN BUILDING

Building “green” is an industry direction. Originally focused on commercial buildings, the trend is increasingly expanding into residential projects. Green building takes into account materials used, design methods and construction techniques, and the impact a building will have on the environment. Site orientation, indoor health and air quality, waste removal and reduction, use of recycled or sustainable materials, landscaping, and more are all considered in the planning, design, and execution of a green project. The green-built philosophy is one that considers renewability, energy and resource efficiency, life-cycle assessment, and environmental impact.

Between 1997 and 2007, the number of US cities with green building programs grew from just a handful to more than 90; that number is expected to reach

**Between 1997 and 2007, the number of U.S. cities with green building programs grew to over 90 and is expected to reach 120 by the end of 2008.**

Source: American Institute of Architects

Why build green? Green buildings are, by their own nature, good design. A green building is designed to provide a healthy and comfortable, cost-effective, and visually pleasing environment. The term “green” is

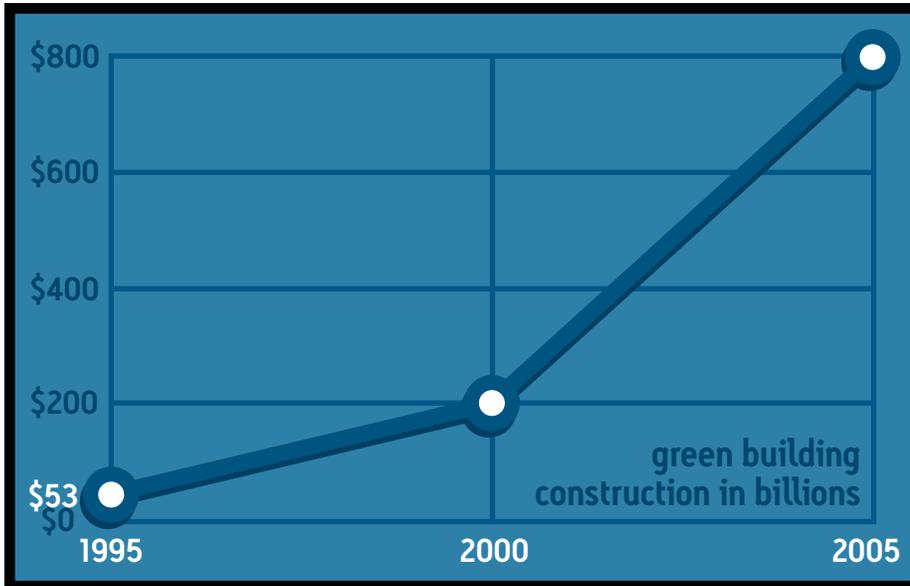
## ARCHITECT MAGAZINE CONTINUING EDUCATION

This course requires supplemental online reading in addition to the following article. For details on accessing the supplemental reading and to learn how to take the test, please see page 6.

## LEARNING OBJECTIVES

The learner will:

- Outline the importance of green building design and sustainability in product choices.
- Identify and outline examples of each of the five pillars of sustainable construction.
- Compare primary types of window and door framing materials and identify how they can help with green building certification.



Between 1995 and 2000, spending on sustainable construction increased by only \$150 billion. Since 2005, spending on sustainable construction has grown to over \$1,200 billion in 2007.

Source: organicARCHITECT

often interchanged with “high-performance” or “healthy” because of the ability of the building to reduce its dependence on natural resources while providing a durable and healthy environment. Ninety percent of what makes a project green is the first 10% — the design.

The term “sustainability” is getting its fair share of attention today. It is defined by the National Council for Interior Design Qualification (NCIDQ) as “a use of materials that is capable of being continued with minimal long-term effect on the environment.” Sustainable construction requires a combined effort between the architect, builder and owner that can result in the greatest performance of a design’s potential. The green-built philosophy is a set of guiding principles that assist in the design and construction of sustainable buildings and communities.

### THE FIVE PILLARS

(credit: Peter Pfeiffer, Barley & Pfeiffer Architects, Austin, TX)

There are five guidelines or pillars that direct the intent of green building: energy efficiency, materials use, water conservation, indoor environmental

quality, and durability. Each pillar helps guide the green building process to help produce an environmentally responsible building.

#### 1. INCREASING ENERGY EFFICIENCY

Buildings consume 48% of all energy in the United States (76% of all electricity) and are responsible for almost half of all greenhouse gas emissions. Homes are responsible for more than one-fifth of all energy consumed annually in the United States. Green building guidelines aim to incorporate energy efficiency into building plans, to reduce the burden of homes on the environment. Improving energy efficiency, by definition, is to provide the same energy output while reducing the amount of energy, resources, and materials used.

By increasing energy efficiency, building owners and homeowners save on utility costs. Programs such as ENERGY STAR help consumers identify energy efficient products. The ENERGY STAR program helped American families save enough energy in 2006 to shave \$14 billion from their utility bills.

Sustainably built homes often include

improved insulation, radiant barrier sheathing, improved duct sealing, efficient HVAC units, and advanced window glazing, which all help improve thermal efficiency and effectiveness. When considering energy efficiency, it is necessary to consider which materials or products you use or specify. That is why the second pillar of green building is Appropriate Materials Use.

90% of what makes a project green is the first 10%, the design.

#### 2. APPROPRIATE MATERIALS USE

**Products do not qualify for green-building certification.** Rather, they help contribute points towards building certification. For example, windows and doors can earn points for energy efficiency if they are ENERGY STAR certified. Products that have low volatile organic compound (VOC) emissions may contribute towards indoor air quality. Recycled products can contribute towards the materials and resources category.



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Materials that are recycled, reused, renewable, locally produced, or third-party certified are preferred. Common examples of these include composite decking (recycled plastic and wood fiber), engineered lumber, and certified wood products. Certified wood products are those which have a third-party chain of custody certification from a sustainable forestry organization such as SFI, FSC, or SCS.

### 3. WATER CONSERVATION

Even though 70% of the Earth's surface is water, it is still a finite resource; only about 1% of water is available for human use. Further, according to the U.S. Environmental Protection Agency, at least 36 states in the United States are predicting water shortages by 2013. We need to take advantage of current technologies that allow us to consume water more efficiently.

To help reduce consumption and conserve water, we can utilize on-demand tankless water heaters, waterless urinals, low-flow plumbing fixtures, foot-peddle faucets, and region-appropriate landscaping with drought resistant plants, among other strategies. Not only do such measures reduce the risk

of water shortages, they also reduce the amount of energy required to supply water to American homes. Running a faucet for five minutes uses about as much energy as a 60 watt light bulb that is on for 14 hours. The U.S. EPA has developed WaterSense, a program similar to ENERGY STAR that will help consumers become aware of the importance of water conservation as well as help them identify efficient products.

### 4. INDOOR ENVIRONMENTAL QUALITY

As we are spending more time indoors than ever before, we need to be aware of the quality of the air we breathe indoors, as well as out. VOC content is up to 10 times more concentrated indoors than out. VOCs can cause health issues such as upper respiratory and sinus problems, eye and skin irritations and asthma. Asthma rates among children have more than doubled between 1980 and 2001. This may be a result of deteriorating indoor air quality.

Green building guidelines incorporate the use of building materials that help reduce off-gassing of VOCs during manufacturing and application. VOCs are commonly found

In 2007, for the first time ever, industry estimates revealed that over 50% of all new projects designed and constructed contained at least some element of sustainability.

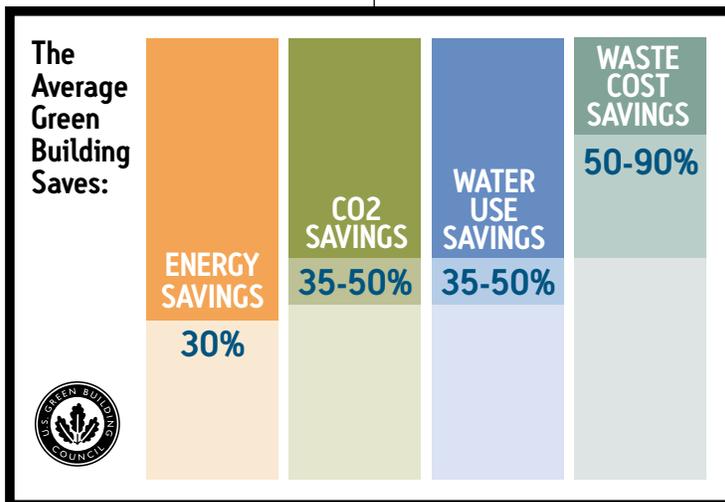
in paints, stains, carpeting, sealants, cleaners, adhesives, and caulks. HVAC equipment can help reduce VOC content indoors.

Indoor environmental quality is not just about the air we breathe. Studies have shown that people are healthier and more productive under natural light than artificial light. Daylighting is a simple way to improve indoor environmental health and is an important component of green building.

### 5. DURABILITY

Products or processes that will not require significant remanufacturing or reharvesting of materials should be incorporated into green building designs. Life-Cycle Assessments (LCAs) are used to analyze a product's environmental impact throughout its cradle-to-grave life span. LCAs include materials used, energy consumed, environmental impact at various stages of its manufacture, usage, and disposal.

Sustainable designs should incorporate durable, environmentally friendly products and processes. Specification of products that are resistant to rot, water absorption, and termite damage is one way to incorporate sustainability into project designs. Products that outlast their application and can be recycled or reused are considered preferable in green built projects.



Green building is an integrated approach that requires cooperation of the owner, builder and architect to achieve the maximum potential of a building's design.

Source: United States Green Building Council



JELD-WEN Windows & Doors Presents

## GREEN BUILDING: AN INTEGRATED APPROACH TO CONSTRUCTION

Efficient Windows and Doors



SUPPLEMENTAL  
ONLINE READING

### WINDOW PERFORMANCE

Windows can be the Achilles heel of a wall system if they are not properly specified and installed. Energy-efficient residential glazings can improve the U-value of a window by more than 30% compared to clear insulated glass. The glass is not the only component to consider when specifying a window or door. The framing material can be just as important to ensure thermal efficiency and performance. Window frames may be crafted entirely of aluminum, wood, vinyl, and fiberglass, or may be a combination of these materials. The frame accounts for approximately one-quarter of the total window area, and should be made of a non-thermally conductive material.



### COMPARISON OF FRAMING OPTIONS

#### ALUMINUM

Aluminum frames are common in commercial applications. The material is strong, durable, recyclable, and will provide years of reliable operation. Aluminum is a good conductor of heat, so frames allow heat to pass freely from the warm interior to the cooler exterior side and may not be suitable for all climates. Thermally improved, insulated frames are available that can help reduce heat loss through the frame.



#### VINYL

Vinyl windows are becoming more common in residential applications. Vinyl is durable, recyclable, economical, and requires minimal maintenance. Vinyl has a high insulating value, is flame-resistant and has sound-deadening qualities. Vinyl is not as strong as some other materials and requires additional metal reinforcement for large frames. It is available in a variety of colors and works well in a variety of climates. Vinyl is not organic and thus is



not susceptible to decay, fungus, or termite infestation. For these reasons, vinyl windows are recognized by the USGBC for their energy-efficient contributions in sustainable projects, longevity, and performance over time.

#### FIBERGLASS/COMPOSITE FRAMES

Fiberglass frames are relatively new to the market. They are strong, durable, and good thermal insulators and do not expand and contract significantly with temperature changes. Some manufacturers may couple fiberglass frames for specific use inside, with another material for use outside, or vice versa.

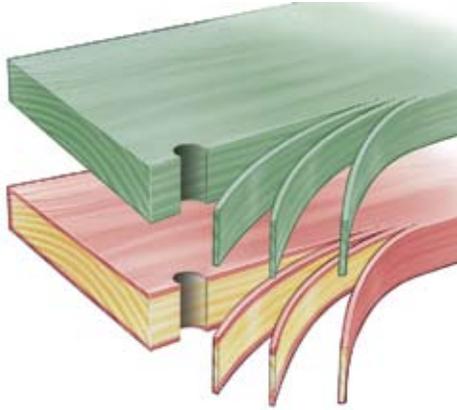
#### WOOD

Wood windows and frames are most common in residential applications. Wood has a high insulation value, nearly unlimited finishing options, and is renewable. Most wood is protected by a dip-treated process that only protects its outer layers. This standard process typically uses a petroleum or mineral-based solution and is followed by most frame manufacturers. With this process, if the surface of the wood is damaged, the core of the wood will be in jeopardy because it has not absorbed the protective treatment. These traditional methods require paints, stains, and other weather-proofing compounds that off-gas high levels of VOCs and may offer only



With a water-based vacuum/pressure process, virtually 100% penetration of active ingredients can protect wood from decay, water saturation, and termites. Standard dip-treated wood only protects 20–40% of the wood.

# GREEN BUILDING: AN INTEGRATED APPROACH TO CONSTRUCTION



**A water-based vacuum/pressure process (shown in green) provides virtually 100% penetration of the protective ingredients from the surface to the core. This means that nail and screw holes or trimming and sanding cannot compromise the integrity of the wood.**

**Compare the water-based treatment to dip-treated wood (shown in red) which has only surface protection. This means the treatment's effectiveness will be compromised when the surface is broken during manufacturing or installation.**

**Note that the colors are used for illustration purposes only; actual treated wood is visually identical to non-treated wood.**

minimal warranties. If not treated properly, wood can be extremely susceptible to weather penetration and damage.

The primary enemy of wood is excessive moisture, which is why traditional dipping methods are not sufficient for treating wood. When wood is exposed to moisture it can decay very quickly and may fail in five years or less. Decay is caused by organisms called fungi, and commonly referred to as mold. These microscopic organisms are visible only in large colonies; some varieties discolor the wood they grow on, while others digest the wood fiber, destroying the wood. In addition to increasing the rate of decay, moist wood provides an ideal environment for termites, carpenter ants, beetles, and other boring insects that eat or nest in wood.

When specifying wood frames you can specify a water-based vacuum/pressure process that protects the wood to the core and is virtually VOC-free. Water absorption,

fungus decay, and termite resistance are only some of the added benefits of a water-based finishing process. The Environmental Protection Agency (EPA) Method 24 is a test used to measure the VOC content of coatings and inks. In October of 2007, EPA Method 24 results indicated that the water-based finishing process was virtually VOC free. "The ponderosa pine used in wood window products gives off no additional VOCs due to the water-based protection process than it would in its natural state." This new process has not only improved the safety of wood treatment, it has significantly improved the performance of wood frames compared to the standard "dip" treating process. With the water-based process, virtually 100% of the wood is protected, compared to approximately only 20–40 % with a petroleum or mineral-based dip process.

A recent case study compared a standard dip-treated wood frame to a wood frame that was protected with a low-VOC water-based process. The test house was in a very harsh, humid environment and after several years of constant exposure to the elements, the house had been completely destroyed by termites and water/rot damage — except for the window frame that had been treated with the water-based process. It was left undamaged.

Subterranean termites are the most destructive insects to wood in the United States; they cause more than \$2 billion in damage each year. While these insects are both necessary and beneficial in nature, they can attack homes, businesses, and warehouses, destroying foundations and putting buildings at risk of failure. Their presence is not easily detected, nor are they easy to eliminate. The best way to protect a building from termites is prevention.

## THE FUTURE OF WINDOWS AND GREEN BUILDING

Windows play an important role in the quality of a structure and the quality of life. Windows let in much needed natural light. As you have seen, energy efficient windows can help contribute to green building project certification due to their efficiency, ability to improve air quality and, in some cases, their durability.

A window's framing material is as important as the efficiency of the glass. If the frame fails, then the window-wall interface is in jeopardy. When considering framing options remember to carefully consider the advantages and disadvantages of each material. Consider the geographic location of your project and how the local weather will affect the

**The window frame on this test house was built with a water-based treatment. The house was completely destroyed by water penetration, wood rot and termite infestation; all except for the window frame. This shows the level of protection that a water-based treatment provides.**



frame. Consider how the treatment and finishing processes will affect the environment. A treatment process is available for wood frames that virtually eliminates the amount of VOCs emitted into the environment and significantly improves the durability of the wood.

"Green" building should not be considered a movement; it is a process that is here to stay, and we will all be better off as a result. Green building philosophy and principles were designed to lead us to a better quality of living. Architects, designers, builders, and consumers are all becoming more aware of how to make green choices in design, planning and purchasing. As awareness grows, so too will adoption of the green building process.

**TO ACCESS SUPPLEMENTAL READING:** Go to [www.architectmagazine.com](http://www.architectmagazine.com) and select "Resources" then select "Continuing Education Center." There you can download PDF files of this course and the required supplemental information.

**TAKE THE TEST ONLINE FOR FREE:** New users must create a new account. Returning users may log in. After logging in, click on "My Courses." Then select this course title to launch your test. A score of 80% or higher earns 1 AIA/CES HSW LU credit hour. Valid for credit through May 2010.

**TEST QUESTIONS**

1. Sustainability can be defined as:
  - a. The use of "green certified" products that will have minimal environmental impact
  - b. The use of "high performance" materials that will provide a healthy environment
  - c. The use of materials capable of being continued with minimal long-term environmental impact
  - d. A set of guiding principles that assist in the design and construction of green buildings
2. Which of the following is not one of the five pillars of green building?
  - a. Water conservation
  - b. Appropriate materials use
  - c. Indoor environmental quality
  - d. Rapidly completed
  - e. Durability
3. The U.S. Government has developed programs such as \_\_\_\_\_ and \_\_\_\_\_ to help consumers identify eco-friendly products.
  - a. The Environmental Protection Agency and the National Council for Interior Design Qualification
  - b. ENERGY STAR and WaterSense
  - c. LEED and the USGBC
  - d. Life-cycle assessments and product labeling
4. Aluminum is commonly used as a window framing material in commercial projects because of its \_\_\_\_\_.
  - a. ability to conduct heat
  - b. strength and durability
  - c. ability to let heat transfer between the interior and exterior
  - d. all of the above
5. On average, a window's frame accounts for \_\_\_\_\_ of the total window area.
  - a. one quarter
  - b. one fifth
  - c. one eighth
  - d. one third
6. Vinyl frames are durable and resistant to rot and decay, but in large sizes may require \_\_\_\_\_.
  - a. lots of maintenance
  - b. special coating for exterior use
  - c. metal reinforcement
  - d. extra insulation
7. Wood window frames are the most common frames in residential projects because wood \_\_\_\_\_.
  - a. has a high insulation value
  - b. is renewable and has virtually unlimited finishing options
  - c. is generally not vulnerable to fungal decay.
  - d. A and B only
  - e. All of the above
8. Wood is typically treated with a \_\_\_\_\_ treatment process, but a new process provides improved protection.
  - a. Water-based, oil-based
  - b. Petroleum/mineral, water-based
  - c. "dipped," petroleum/mineral
  - d. oil-based, "dipped"
9. In addition to better protection of the wood from surface to core, the water-based treatment process virtually eliminates \_\_\_\_\_.
  - a. VOCs
  - b. the need for maintenance
  - c. the risk of termite and/or water damage
  - d. A and C only
  - e. All of the above
10. EPA Method 24 measures which of the following?
  - a. The penetration of a finishing coat into the wood
  - b. The termite resistance of a wood frame material
  - c. The weather resistance of a window frame material
  - d. The VOC content in coatings and inks



**Green Building: An Integrated Approach to Construction**

You have the option of taking the test online free of charge or you may mail your test along with a check in the amount of \$10. A score of 80% or higher earns 1 AIA/CES LU credit hour. Certificates of completion are available upon request and delivered by email.

test	1.	a	b	c	d		6.	a	b	c	d	
	2.	a	b	c	d	e	7.	a	b	c	d	e
	3.	a	b	c	d		8.	a	b	c	d	
	4.	a	b	c	d		9.	a	b	c	d	e
	5.	a	b	c	d		10.	a	b	c	d	



**MAIL-IN TEST:** Photocopy this page. Clearly circle the letter of the correct answers. Mail this test with the completed form and check for \$10, payable to ArchitectCES, to:

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