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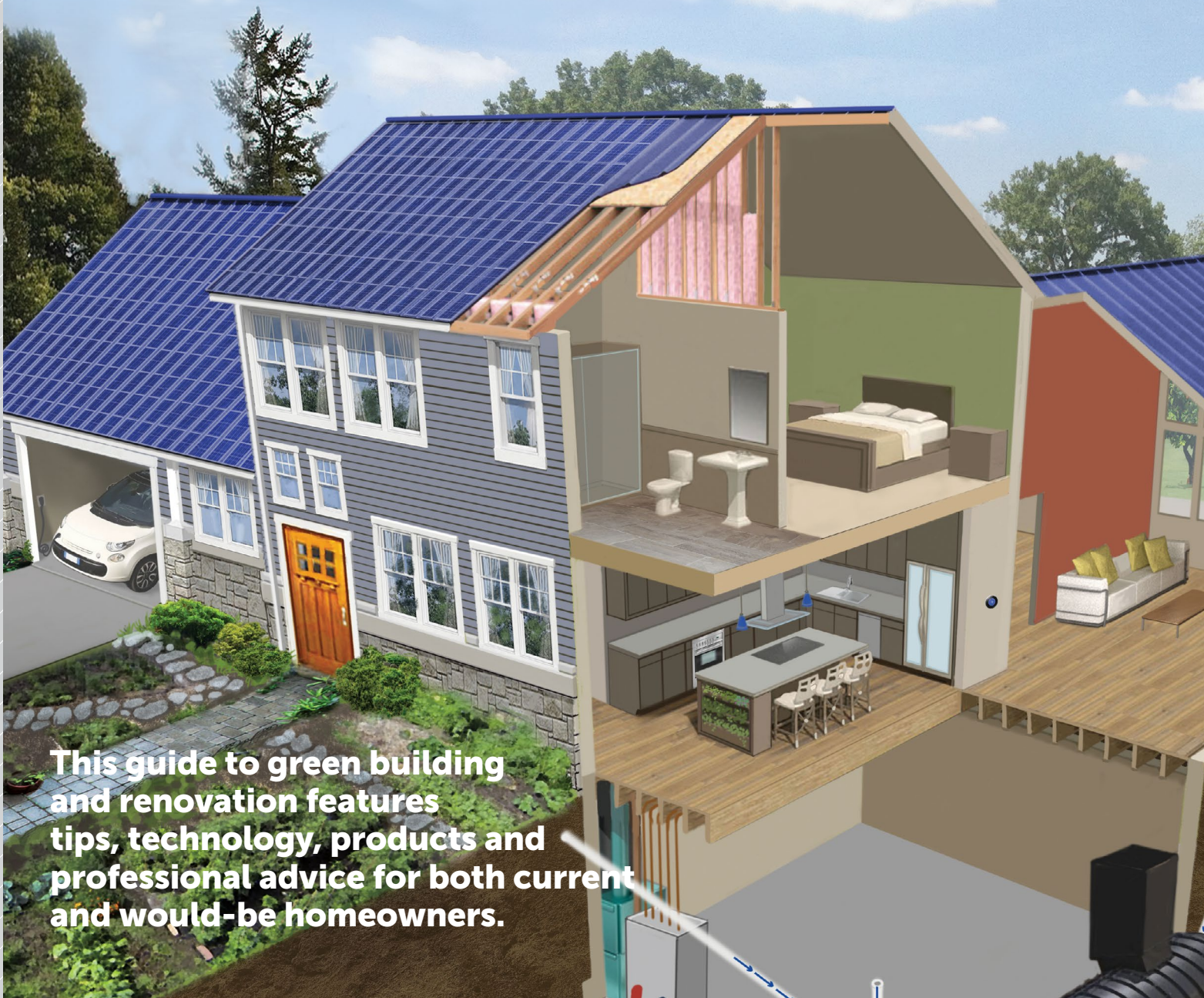
# HOMEOWNER'S GUIDE

## Energy Smart, Healthy Home



**This guide to green building and renovation features tips, technology, products and professional advice for both current and would-be homeowners.**

# The Shift is On with PowerShift by NV Energy

**This homeowner's guide is brought to you by NV Energy.**

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### VISION House® at Mariposa Meadows Showcase

This edition features more than 15 new products that are being used in our demonstration home at Mariposa Meadows. These are tried and true green products from trusted companies. Scan this barcode for a complete roundup—or to learn more about VHMM.

### Activist Profiles

**Real people, real change**

We've included inspiring stories of individuals who have contributed to making their communities more sustainable, healthier places to live.

### Special Wood Stove Section

**Tips for selecting an efficient model**

Wood stoves have come a long way. Learn how to select the right model for your home—and the planet. (**p. 34**)

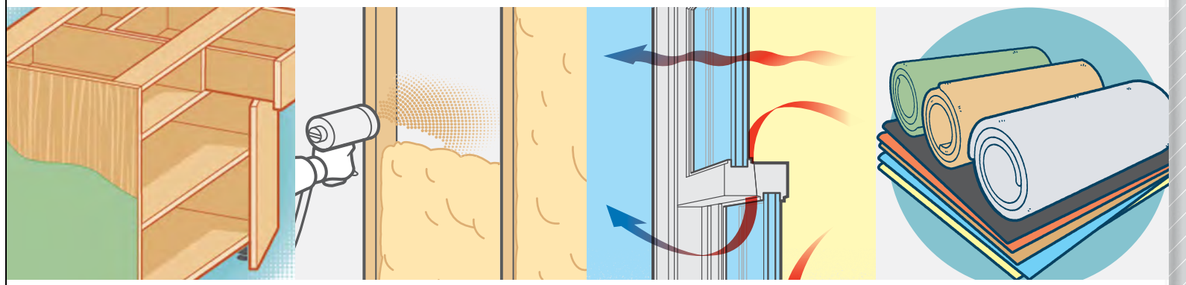
# The Homeowner's GUIDE: Energy Smart, Healthy Home

## Remodeling? Building a new home? This comprehensive guide has you covered.

Understanding the thousands of choices available when constructing or improving a home is daunting. Add in efforts to use "green" products, and the task gets even more complex. That's why we created this Handbook—to help you manage your project, by separating the really important choices from the rest. Here's the essential information you've been looking for.

## CONTENTS





**Harvest the Sun**
The price of rooftop solar PV systems dipped 12 to 15 percent last year, and keeps falling. Now is a great time to take advantage of the 30 percent federal tax credit on renewable energy systems.

**Insulate Well**
Whether fiberglass, cellulose or foam, insulation should fill cavities completely, with no gaps. Insulating foundation walls and slab perimeters can increase a home's energy efficiency by 30 to 50 percent.

**Bring in Fresh Air**
A tight house requires mechanical ventilation to ensure healthy indoor air. Install hood ranges and bathroom fans at minimum; a whole-house Energy Recovery Ventilator (ERV) or Heat Recovery Ventilator (HRV) is appropriate for very tight homes.

**Make Roofing Durable**
Select roofing materials that you will never have to replace. Whether you choose standing-seam metal, tile or another type of durable roofing, make sure the product carries a minimum 50-year warranty.

**Know Your Windows**
Choose glazing appropriate for your climate, and look for durable frames made with renewable and/or recyclable materials.

**Value Water**
Look for the WaterSense label when sourcing faucets, showerheads and toilets. Consider a "no-hands" or dual flush toilet.

**Say No to VOCs**
No-VOC paints are imperative for the health of your home's occupants. Use water-based finishes and adhesives, too.

**Go Natural**
If you must have a pool, make sure it's fed by rainwater, not by treated water from a centralized sewer system.

**Eat Your Landscaping**
Ditch the lawn in favor of drought-tolerant natives or edible food gardens, and use local/regional natural materials for hardscaping.

**Test IQ**
"Learning" thermostats can save energy by adjusting automatically to occupants' schedules, and by providing feedback on energy usage.

**Side with Longevity**
Choose a durable siding, such as fiber cement or brick veneer. If you go with materials that require painting, make sure to keep up on maintenance.

**Avoid Energy Hogs**
Look for the Energy Star label when choosing appliances, but remember to pay attention to overall energy usage, too.

**Minimize Concrete**
To reduce the high environmental cost of cement, choose a simple slab or shallow foundation over a full one.

**Prefinish Flooring**
To keep VOCs from coatings out of the home, install renewable and/or durable floorings that are cured and prefinished in the factory.

**Save the Rain**
An underground cistern can store and distribute rainwater, either for landscape irrigation or household use.

**Go Geothermal**
Geothermal heating and cooling systems draw on the constant temperature of the earth to heat and cool the home; units with a "desuperheater" also heat water. Though a sizeable initial investment, the energy saved can mean a payback of just two to 10 years.

# What Makes It Green?

Turn your existing or new home into a model of high performance. Start with good design combined with smart siting; then add durable materials, quality workmanship and best practices for energy efficiency.

## Before You Build:

**LOCATE Strategically**
Studies have shown that some families consume as much energy by car as they do in their homes. Build close to where you work, shop and play, and do your part to reduce carbon emissions.

**SITE Smart**
Your home's relation to the sun will influence its performance for its lifespan. Orienting the building to take advantage of solar gain and natural ventilation can significantly reduce heating and cooling energy.


**SIZE Right**
Whether building a new house or adding onto an existing one, efficient design can help keep the home's footprint appropriately sized and its energy demand modest.

# Exteriors 01

## Attractive options for a lifetime.

When it comes to your home's exterior, durability, maintenance and fire resistance are just as important as aesthetics.

SIDING CHOICES ABOUND for today's homes. Aesthetics are important when choosing one option over another, and when you take the environment into account, some choices just look a whole lot better than others. According to research from the Freedonia Group (**www.freedoniagroup.com**), fiber cement, stucco and brick siding will see rapid advances through 2014. Vinyl siding will remain the largest segment. Although long lasting, it's a controversial material made with polyvinyl chloride (PVC), a plastic that until recently has had a poor recycling record. At least one company (CertainTeed) has now begun to recycle vinyl, and the industry is beginning to look more closely at vinyl's life-cycle impacts. We haven't included it here as a "green" option, but we will continue to monitor the industry's efforts to move in that direction.

### BRICK

**A Durability Leader**

Made of clay and shale, brick is very durable. It is a solid barrier against weather, and the installation of brick creates a 1" air space between the brick and the interior housewrap. This provides insulation against temperature transfer and the transfer of sound, and it also prevents moisture from seeping into the home. Because of its thickness, brick provides thermal mass, making it slow to heat in the summer and slow to cool in the winter, which helps regulate a home's temperature.

Manufacturers such as Boral Bricks are making brick manufacturing less environmentally caustic. The company recycles waste and uses air scrubbers to make sure emissions from plants are clean and particulate-free.

**Virtues**
- Recyclable
- Durable
- Resists termites, fire, mold and rot
- Made from abundant natural materials
- Low maintenance

**Caveats**
- Resources must be mined
- Not all brick manufacturers have taken steps to reduce emissions from their manufacturing plants
- Expensive
- Heavy weight

### Why Pay More for Brick?

**Because they last almost forever.** Bricks come in many colors, textures and other variations. Approximately 3" thick, brick veneer (Boral Bricks are shown) creates an armored shell for your home. The durability of brick is one of its greatest assets. Boral, for example, offers a "two lifetimes" warranty. More info: **www.boralamerica.com/Bricks**

**LP *SmartSide***

*SmartSide* products deliver the warmth and beauty of traditional wood, plus the durability and workability of engineered wood. The manufacturing process creates products that are engineered for strength, performance and protection against fungal decay and termites. Four product collections are offered, with a 5/50-year transferable limited warranty. **www.lpcorp.com/smartside**

**Cultured Stone**
***Southern Ledgestone***

Available in many shades and variations, this line of stone masonry veneer from Cultured Stone is easy to install and offers a durable, timeless finish for exteriors. Made with 54 percent recycled content, it comes with a limited 50-year warranty. **www.boralamerica.com**

### WOOD

**Green to the Core**

Wood siding is an excellent green choice (not to mention beautiful). Although people think of wood as a valuable natural resource we shouldn't use, it is a renewable product that can be recycled, and, if it goes into the waste stream, biodegrades quickly. If you use wood siding, look for certification by either the Sustainable Forest Initiative (SFI) or the Forest Stewardship Council (FSC).

Wood products don't require a lot of energy to produce—when compared with brick or fiber cement siding. In fact, although wood makes up nearly half of all raw materials manufactured in the United States, its share of energy consumption is a small 4%.

In addition to new wood siding, you can buy reclaimed wood, though more people opt for pre-primed pine or weather-resistant cedar.

**Virtues**
- Renewable
- Recyclable
- Little energy used in its "production"
- Biodegrades quickly in a landfill

**Caveats**
- Not perfectly straight, which can cause install problems
- Attracts pests like carpenter ants and termites
- Doesn't offer insulative benefits (R-1)
- Requires maintenance and can shrink and expand
- Can be twice as expensive as engineered wood or fiber cement

### ENGINEERED WOOD

**Most Improved**

For people who like the look of wood, engineered wood products are a good green option. They are made from wood strands that are coated with a resin binder and compressed to create a strong board. The products look like wood. They are free of knots, resist warping and cupping, and are factory pre-primed to take paint well, which reduces field and labor time once installed.

LP *SmartSide Trim & Siding*, as one example, offers a special manufacturing process that helps protect against termite damage and fungal decay. The product also comes with a self-aligning edge design to make installation faster and easier. Another engineered product, KlipTech's *EcoClad* is made from bamboo fibers, recycled paper and recycled wood fiber. According to its manufacturer, it is as durable as brick or stucco and resists bacteria and fungus growth. Look for engineered wood products that are certified.

**Virtues**
- Lighter weight than fiber cement or brick
- No special cutting tools or fasteners are required—takes nails and screws
- Factory pre-primed
- Less costly than real wood

**Caveats**
- Moisture problems can result from installation errors

**Glossary of Terms**

### Know the Lingo

- **Exterior Insulation Finish System (EIFS):** A building product that provides exterior walls with an insulated finished surface and waterproofing in an integrated composite material system.
- **Embodied Energy:** The energy consumed by all of the processes associated with the production of a building, from the acquisition of natural resources to product delivery.
- **Engineered Wood:** Cladding made from wood strands that are coated with a resin binder and compressed to create a strong board.
- **Fiber Cement Siding:** Cladding made from a mixture of Portland cement, cellulose or wood fiber material, sand and other components.
- **Lap Siding:** Siding that looks like individual boards, typically 8'–12' long. Each piece of siding is lapped over the piece below it to provide a waterproof covering for the house.
- **Portland Cement:** Found in stucco and fiber cement siding, it requires intense heat (and thus energy) to produce.

### FIBER CEMENT

**Tough Stuff**

Fiber cement siding is a low-maintenance product made from sand, Portland cement, clay and wood pulp fibers. It's very strong, long-lasting, termite-proof, fire-resistant and rot-proof. The product has the look of wood siding, and comes in either a smooth or wood-look finish.

The rub against fiber cement is its high embodied energy, though manufacturers are moving toward using more recycled content in their products. At least one brand contains fly ash.

For extra R-value, fiber cement siding can be installed over foam insulation board, as on an ICF house, but caution must be taken to ensure proper installation. If you decide to go this route, follow manufacturers' recommendations closely. **GB**

**Virtues**
- Product is straighter than wood siding
- Superior stability keeps the building envelope crack-free
- Lower cost than wood
- Low-maintenance product; may hold stain or paint for for several years longer than wood (7–15 years)
- Won't rot, buckle or warp

**Caveats**
- Heavier than most sidings and can crack
- Negligible R-value
- High embodied energy because of manufacturing process
- Moisture problems can result from installation errors
- Requires special safety training and special gear to protect against airborne silica—and specific cutting tools

# What makes an EXTERIOR green?

## PRO TIP:

Check out the National Fire Protection Association (NFPA) website to learn about its Firewise Communities program, and for tips on protecting your home from wildfires. **www.firewise.org**

**Vision House® at Mariposa Meadows Sponsor**

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**Fireproofing**
Using fire-resistant exterior materials, such as metal or tile roofing and stucco or stone veneer siding, can go long way to minimizing a home's vulnerability to fire, as can reducing brush and kindling around structures.

**Solar Window Orientation**
In cold climates, south-facing windows capture the sun's heat during the day. Be sure to specify high-performance windows with special glazings and gas-filled cavities. Otherwise. you may lose more heat at night than you gain during the day.

**Solar-Readiness**
Even if you don't plan to install water or solar electricity now, pre-wiring for these systems while building or remodeling can save thousands down the road.

**Outdoor Living**
Areas such as covered patios can save energy. How? By encouraging outdoor activities that reduce demand for lighting, heating and cooling inside the home.

**Durable Materials**
Spend a little more on long-lasting siding materials such as cement stucco, stone or brick veneer or fiber cement, and you can reduce your long-term environmental footprint. Most paints and finishes are extremely resource intensive (not to mention labor). If you do use wood for trim or siding, choose a long-lasting, sustainably harvested species such as cedar. Look for products with at least a 50-year warranty.

**Natural/Edible Landscaping**
Traditional monoculture lawns are not a sustainable choice. Opt for native, drought-resistant plants. Better yet, practice small-scale food production, using permaculture or other gardening techniques.

IMAGE: VISION HOUSE® TUSCON
**LATHAMARCHITECTURAL.COM**

# Roofing 02

## First line of defense.

Your roof should protect your home from the elements for at least 50 years. Make sure your investment counts.

IT WASN'T LONG AGO that roofing wasn't much more than an afterthought—chosen for a house mostly for economic and occasionally for aesthetic reasons, if you could afford it.

But lately, roofing is recognized among the materials that can make a significant difference in a home's energy and resource efficiency, spurring debate (and propaganda) about issues ranging from recycled content and recyclability to reflective values and durability—all of which work into a thoughtful consideration of which roofing material makes the most sense for your house.

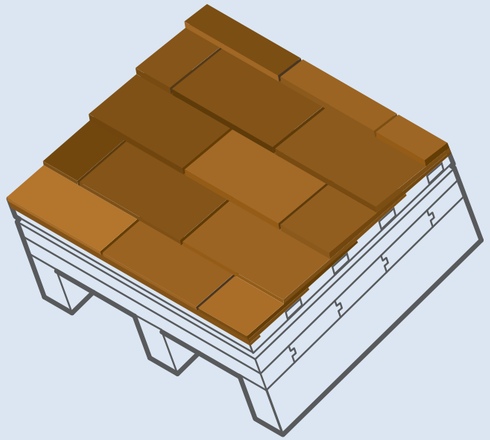
### ASPHALT
**Cool Roof Shingles**

Commanding an 83 percent share of the residential roofing market is no accident. Asphalt composition roofing (right), includes conventional three-tab and newer, thicker fiberglass and laminated types. These products offer affordable options generally designed to last a maximum of about 25 years.

Asphalt's biggest environmental bugaboo is that it's derived from petroleum processing, feeding fossil fuel demand. It's also tough to recycle. But the industry has responded to the call for better eco-performance with colors and granular formations that better reflect the sun's heat, reducing the amount that is absorbed into the roof and attic or living spaces below and lessening demand on the home's heating system—and therefore the energy it consumes.

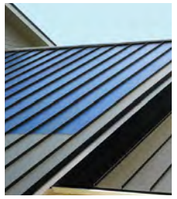
Recent "cool roof" asphalt composition shingle offerings, in fact, have achieved federal Energy Star status for their reflective values, helping reduce peak cooling demand by up to 15 percent. At the same time, cooler shingles last longer, so they've increased their likely service life.

### Asphalt Composition Roofing



**Virtues**
- Affordable and widely available
- Familiar to installers
- New finishes increase heat reflection

**Caveats**
- Petroleum by-product
- Low recycling potential
- Relatively short lifespan
- May leach chemicals into runoff



**Custom-Bilt Metals Roofing**
The *FusionSolar* series from Custom-Bilt Metals combines a durable standing-seam metal roof panel system with factory-applied thin-film solar laminate collectors for integrated renewable energy generation. Solar collectors require no fasteners or additional structure; several compatible heavy-gauge roof profiles are available.
**www.custombiltmetals.com**

**GAF *Timberline* Cool Roof**
*Timberline* series fiberglass-asphalt shingles from GAF feature reflective surface granules to reduce attic heat gain and cooling energy use. The Energy Star-qualified shingles also contain patented algae protection with a 10-year warranty.
**www.gaf.com**

### METAL
**Decades of Performance**

Set aside any visions of cheap tin roofs. Today's metal roofing—most of it made from recycled steel—is a lot tougher and aesthetically appealing than the corrugated sections that shelter shacks and barns.

That said, metal roofing (right) still makes a distinct fashion statement. Long rows of sleek metal, separated by slight ridges (called standing seam) are a departure from tiles and shingles. Metal's market share in single-family housing has more than tripled (to 7 percent) since 2004.

That's partly because metal roofing has a strong environmental story, when you consider the amount of recycled steel it contains, its durability (usually 50 years or longer), and the fact that the material can be 100 percent recycled at end of life.

More recently, the metal roofing industry has introduced cool roof finishes that reflect the sun's infrared light to reduce heat absorption into the structure by as much as 36 percent; some manufacturers have also partnered with thin-film solar electric suppliers to create integrated solar arrays within the panel channels, to generate renewable energy.

The industry has also expanded its styling, forming and coloring panels to simulate curved clay tiles or individual shingle shapes, for a broader range of housing styles.

### WOOD
**Natural, to a Point**

Wood shingles and shakes are the only roofing material that can claim to come from a renewable resource (trees), although it's important to find out how and where that timber is harvested. A wood roof can easily last 50 years if installed and maintained properly. Wood shingles applied over a vented roof deck will remain cooler, dry out faster and generally last longer.

Wood's only serious drawback is its inherent flammability and susceptibility to moisture-related damage over the years. Because of these qualities, fire- and rot-resistant chemical finishes are often applied—and may need to be re-applied in later years.

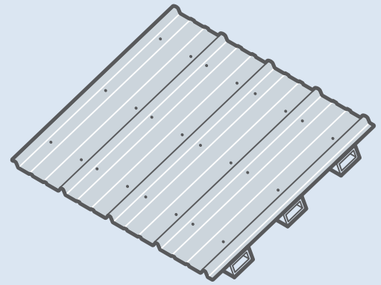
### CLAY/CONCRETE
**Almost Forever**

Clay or concrete roof tiles (p. 23) would appear to have it all: good looks, fire resistance and extreme durability. Recent innovations

*continued on page 13*

**Boral *Madera 900* Concrete Tile Roofing**
This energy-efficient, lightweight cool roof system keeps a home cooler than a typical tile roof. The tile not only reflects the sun, but also helps hot air rise and vent out. The tiles also last longer than a traditional roof. The style shown is *Autumnwood*.
**www.boralna.com/rooftiles/rooftiles.asp**

### Metal Roofing



**Virtues**
- High durability
- Infrared finishes reflect heat
- High recycled content
- 100 percent recyclable
- Fireproof

**Caveats**
- Higher initial cost
- Susceptible to impact or walking damage
- Colors may fade
- Recyclable does not always mean "recycled."

**Glossary of Terms**
### Know the Lingo

- **Deck:** The substrate over which roofing is applied—usually plywood, wood boards or planks.
- **Drip Edge:** An installed lip that keeps shingles up off the deck at edges and extends shingles out over eaves and gutters to prevent water from wicking up and under the shingles.
- **Exposure:** The area on any roofing material that is left exposed to the elements.
- **Flashing:** Materials used to waterproof a roof around any projections.
- **Granules:** Crushed rock that is coated with a ceramic coating and fired, used as top surface on shingles.
- **Ice Dam:** Formed when snow melts on a roof and re-freezes at the eave areas. Ice dams force water to "back up" under shingles and cause leakage.
- **Laminated Shingles:** Asphalt-based shingles made from two separate pieces that are laminated together. Also called dimensional shingles or architectural shingles.
- **Soffit Ventilation:** Intake ventilation installed under the eaves or at the roof edge.
- **Steep-Slope Roofing:** Refers to slopes steeper than a 4" rise for every 12" of length (expressed as 4:12).
- **Tear-Off:** Removal of existing roofing materials down to the roof deck.
- **Valleys:** Areas where two adjoining sloped roof planes intersect on a roof, creating a "V"-shaped depression.

SOURCE: GAF MATERIALS CORP.




Brought to you by NV Energy

# What's a GREEN roof?

You've probably heard of green roofs. In the past couple of years these multi-layered systems have begun to be taken seriously, particularly in urban settings. Especially suited for buildings with flat roofs, such as multifamily apartments, they create welcoming spaces far above the street, reduce heating and cooling costs in a building and can be used to grow edibles, as well. If you're interested in a green roof, consult a local company that specializes in their construction. They can assess your building's structural suitability and make recommendations. For general Information, try **www.greenroofs.org.**

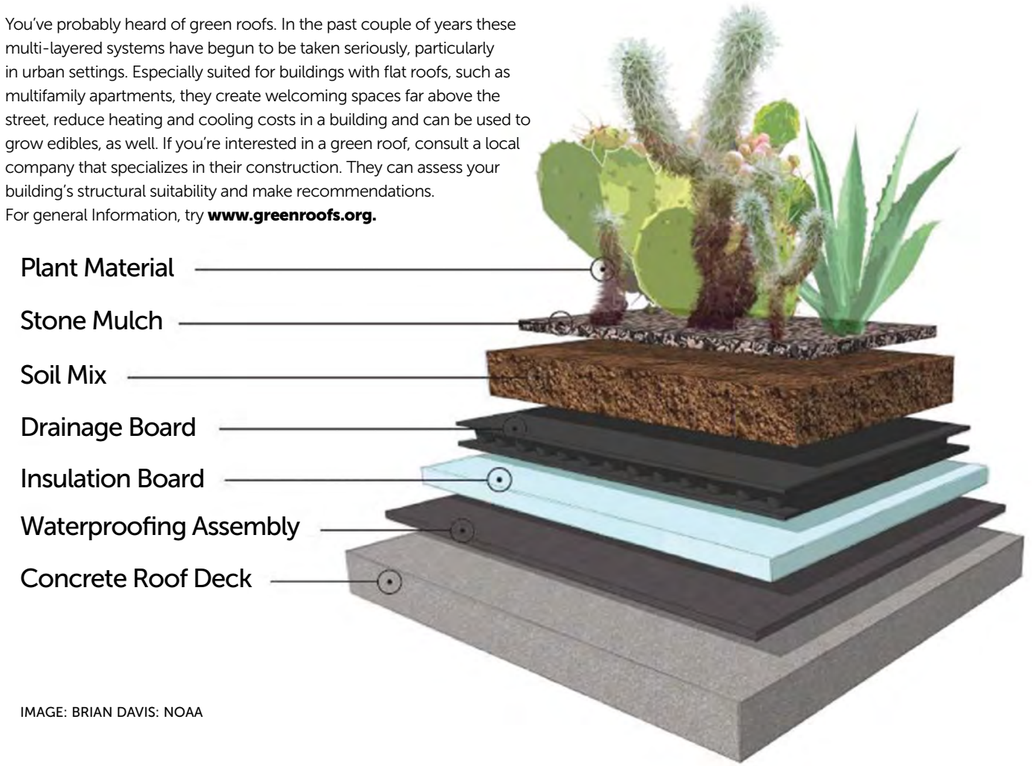



IMAGE: BRIAN DAVIS: NOAA

also address issues of stormwater management, and enable cool roof capability. But the high cost of buying and installing masonry tile roofing has relegated its use to regional styles and high-end housing. Since 2004, its share of the residential roofing market has plummeted by more than half, to about 7 percent.

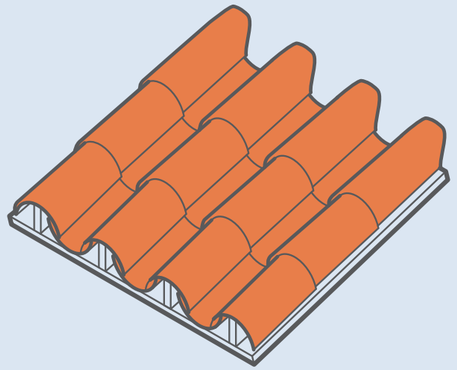
Nonetheless, a quality tile roof that is installed over a heavy-duty underlayment and screwed to the roof deck (not just mortared) should last for decades—if not a century or two—before it's time to remove them, replace the underlayment and put the tiles back on. **GB**

## Wood Roofing

**Virtues**
- Renewable
- Some natural rot resistance
- High natural insulating value
- 100% recyclable and biodegradable

**Caveats**
- High cost (materials and installation)
- Flammable
- Requires chemical treatment for fire safety and durability

## Clay or Concrete Tile



**Virtues**
- Durable
- Abundant resource and low embodied energy
- Natural insulating qualities
- Class A fire rating

**Caveats**
- High cost (materials and installation
- Heavy
- Some types may be susceptible to freeze-thaw damage

If you're planning on rainwater harvesting, a smooth, non-leaching surface may be best.

## COMMUNITY ACTIVIST PROFILE

### Food Garden Sensei

To **Len Trevino**, an unused plot of green grass at a new building site is a canvas...for food.

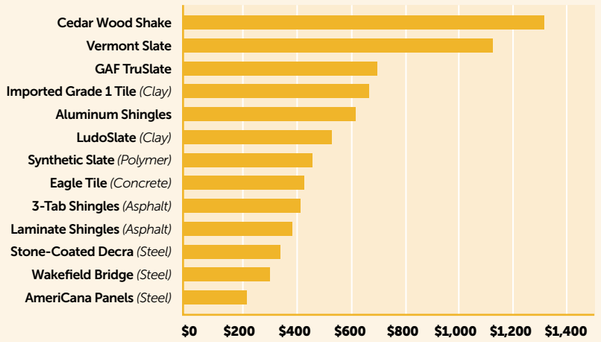
"It's a good way to incorporate art into a community," says the San Antonio, Texas martial arts instructor and food activist. "Food is colorful and artistic and can make a landscape much prettier."

Trevino planted beds of kale, spinach and other vegetables in front of his dojang's strip mall, and has been encouraging other business owners to follow suit. In addition, he is founder and president of the Food Policy Council of San Antonio, which supports a healthy, sustainable, and just local food system, gathers and disseminates information and advocates for policy improvements.

Trevino credits his 30 years of martial arts training for his activism. "It's my ideology that martial arts is supposed to give life, not take it away," he says. "That's what I'm doing."

*By Lisa Iannucci*

**Cost per Year of 100 sq. ft. (Over 35 years)**




GRAPHIC: WWW.ABSROOF.COM

## Roofing Durability

While numbers vary somewhat by brand and installation quality, the chart at left offers a broad overview of the long-term cost of different roofing types, based on expected lifespan and maintenance. Created by a roofing reseller, the chart shows only a few brands, but as a general rule, you get what you pay for. An early initial investment in metal or high-end laminate shingles pays back nicely over time.

*– Editor*




Brought to you by NV Energy

# Structure 03

## The bones of the home.

Wood framing, concrete blocks and SIPs each have pros and cons. Make sure you understand your options before you start building.

WHILE WOOD FRAMING is the most common and familiar type of home structure, you have other options, including insulating concrete forms (ICFs), structural insulated panels (SIPs) and lightweight concrete blocks. Of course, if you're adventurous, many other systems have been around for decades, including log homes, straw bale, cordwood and even Earthships. Not every method of construction may be right for your geography, but most technologies can be modified to accommodate your taste and your region. For the purposes of this primer, however, let's stick to the structural systems your builder is most likely to know and understand.

### WOOD FRAMING

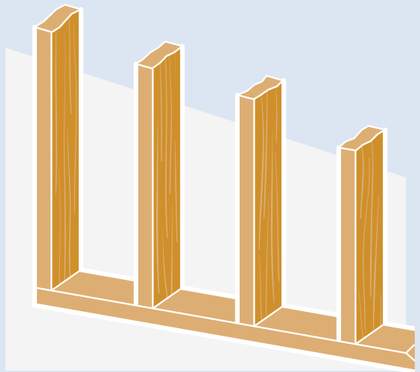
**Old and New**

Wood, by its very nature, is a green product. If forests are managed properly, trees grow back. How do you know if forests are being treated with respect? Look for lumber that is certified by the Forest Stewardship Council (**www.fsc.org**) or the Sustainable Forestry Initiative (**www.sfiprogram.org**). Typically, energy-efficient builders prefer 2" x 6" lumber for vertical studs in wall cavities, because the wider space allows for more insulation.

Another more recent wood framing technology is called engineered wood products (EWP). Products such as studs and joists are created in a factory with special water-resistant glues and fibers from leftover mill lumber or fast-growing tree species. They are pressed and glued into lightweight floor joists, rafters or other structural pieces. The green advantages? First, engineered products use more of the tree—there's virtually no waste. Second, they tend to be more stable and straight than dimensional lumber. The downside? Certain products need to be stored carefully and installed exactly as intended, or they can lose their structural integrity.

*continued on page 26*

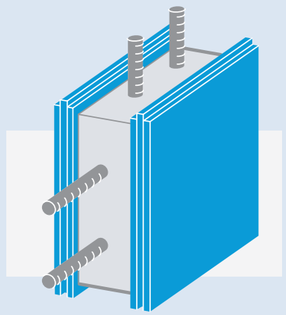
### Dimensional Lumber



**Virtues**
- Renewable (if forest is well managed)
- Familiar to contractors
- Excellent durability

**Caveats**
- May create unwanted thermal bridging
- Requires skilled labor

### Insulating Concrete Forms



**Virtues**
- Very little air infiltration
- Lightweight forms assemble easily
- Thermal mass of concrete slows temperature swings

**Caveats**
- Exposed foam may need protection
- Some brands require additional furring strips to attach drywall and siding

# What makes FRAMING green?

## PRO TIP:

**Advanced Framing:**
The method of framing shown here is called optimum value engineering, or OVE. It saves lumber and allows for better insulating of the home–a win-win for the homeowner and the environment.





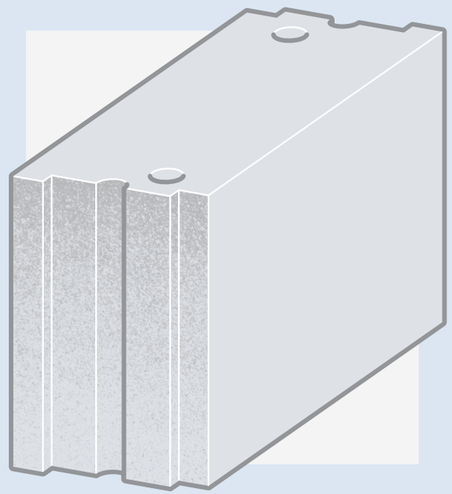
**VISION HOUSE® AT MARIPOSA MEADOWS PRODUCT**

***AinsworthEngineered* Canada LP *SteadiTred* Stair Treads**

These sturdy stair treads are available square-edged or bullnosed, and come pre-sized in popular lengths and widths for faster construction. Moisture and wear resistant, *SteadiTred* stair treads are made from OSB from rapidly renewable aspen trees.
**www.ainsworthengineered.com**

IMAGE: BUILDING SCIENCE CORPORATION AND **YOUTHBUILDUSA.ORG**

## Lightweight Concrete Blocks



**Virtues**
- Easy to handle
- Less energy intensive than concrete
- Durable and termite proof

**Caveats**
- May not be locally manufactured
- Contractors/masons may need training
- Waste components should be tested/verified

### INSULATING CONCRETE FORMS
**Light and Tight**

Poured concrete walls alone have very little insulating value. Yet concrete can last forever, or nearly so, if it's protected from erratic moisture changes and freeze-thaw cycles. That's what makes ICFs an excellent structural system. They enclose both sides of a poured cement wall within a water-resistant cocoon of rigid foam. Another advantage to ICFs is that their assembly is quite simple, and the completed walls have an average insulating value of about R-22.

**VISION HOUSE® AT MARIPOSA MEADOWS PRODUCT**

**R-Control SIPS from AFM (SIPA Member)**

Made with OSB laminated to a termite-resistant EPS insulation core, R-Control SIPs are state-of-the-art. The core is also treated with EPA-approved mold resistance. A 6 1/2" panel is a respectable R-23. **www.r-control.com**

## Glossary of Terms
## Know the Lingo

- **Dimensional Lumber:** Wood that has been cut and shaped from a single tree, typically used for framing.
- **Load-Bearing Wall:** A wall that helps hold up the house. Interior walls may not be load bearing, but external ones almost always are.
- **Engineered Wood Products (EWP):** Structural products made in the factory from industrial wood scrap or fast-growing species, assembled with resins under extreme pressure.
- **Oriented Strand Board (OSB):** A type of engineered wood panel. The thickness of OSB used in most SIPs is 7/16".
- **Fly Ash:** Controversial waste by-product from coal-fired power plants. Used as a filler in some—but not all—brands of lightweight concrete blocks.
- **Sound Transmission Class (STC):** Refers to how well a wall partition attenuates sound. Products such as ICFs have high STC ratings and greatly reduce noise levels inside the home.

### LIGHTWEIGHT CONCRETE BLOCKS
**Lasting Value**

Lightweight concrete is a structural material that's been around since at least the 1920s. To create these blocks, the manufacturer replaces a portion of the concrete with something lighter and better insulating, such as an industrial waste product like fly ash or petroleum-based polystyrene. Some companies such as Cresco Concrete, creator of *Liteblok* (**www.crescoconcrete.com**) use a temporary agent that leaves nothing but air gaps behind. If a product does include fly ash, make sure the manufacturer provides data showing that they have carefully tested and screened the material to keep heavy metals and other toxins out of the end product.

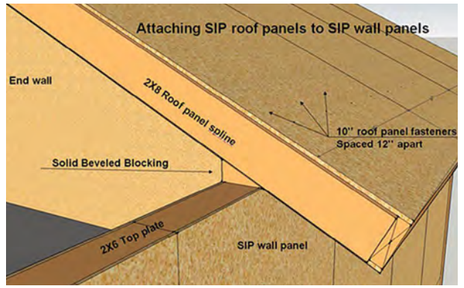
### STRUCTURAL INSULATED PANELS
**Many Strengths**

The concept here is simple. Two sturdy panels—typically oriented strand board (OSB)—are glued under pressure to a super insulating layer of plastic-based rigid foam (either polystyrene or polyisocyanurate). SIPs address air infiltration, R-value and vapor permeability, while at the same time creating the home's structure and providing a nailing surface for siding and drywall. So why aren't they seen everywhere? Because they tend to cost more up front than stick framing, and aren't widely understood by contractors. But if you figure in the benefits in labor savings (up to 60 percent in some cases), plus the ongoing energy payback to homeowners, you can argue that SIPs come out on par with or lower in cost than wood framing. **GB**

**Simpson Strong-Tie *Strong Frame* Special Moment Frame**

This cutting-edge lateral system solution is designed to help prevent structural damage in earthquakes. During a seismic event, the beam-to-column links are engineered to bear the brunt of lateral forces, keeping the structural integrity of the beams and columns intact. The new patented *Yield-Link* fuses are fully replaceable if damaged by seismic activity. **www.strongtie.com**

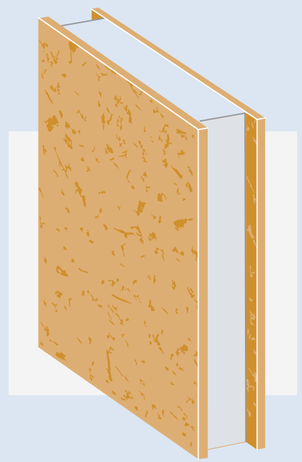
## SIPs on the Roof?




**The point where wall panels connect to an SIP roof** is one of the trickier details when building a complete home shell with these pre-made panels. Get it right, and you'll have a super-strong, super-insulated structure.

IMAGE: WWW.THERMALSHELLHOMES.COM

## Structural Insulated Panels



**Virtues**
- Reduces labor time/cost up to 60 percent
- Excellent insulating and air infiltration barrier

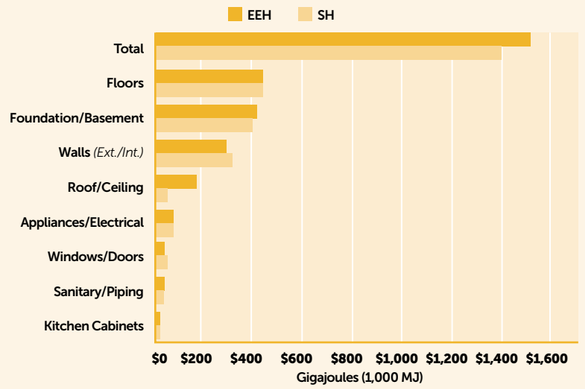
**Caveats**
- Storage on site must be dry and flat
- More expensive material costs than stick framing
- Skilled installation recommended (for the wall to roof transition especially)

**VISION HOUSE® AT MARIPOSA MEADOWS SPONSOR**

**Structural Insulated Panel Association (SIPA)**

Since 1990, SIPA has worked to advance energy-efficient construction through the use of structural insulated panels (SIPs). A replacement for wood-frame construction, SIPs are made of foam core sandwiched between two structural facings. SIPs provide builders shorter construction time and less jobsite waste. Homeowners benefit because smaller heating and cooling systems are required with SIP construction. **www.sips.com**

**Study: Embodied Energy in the Home**




**Materials with higher embodied energy need to last longer** to justify their cost to the environment. This study from the University of Michigan compared an energy-efficient house (EEH) with a standard house (SH)—and measured the energy costs for construction, maintenance and improvement of a home within a 50-year lifespan. The EEH does slightly better on these measurements, but greater savings (not shown) will come from energy savings in the more efficient structure.

*– Editor*

SOURCE: WWW.UMICH.EDU




Brought to you by NV Energy

# Insulation 04

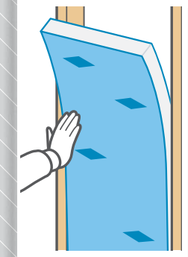
## Don't leave your home without it.

Insulating your roof, walls and foundation will also insulate your wallet from the high energy cost of heating and cooling your home. This one-time investment will save you money for decades.

IF YOU'VE EVER opened up the wall of a home built before about 1950, you've probably been shocked to find little or no insulation—or at best some crumpled newspapers. And even the earliest serious attempts at insulation with fiberglass look quaint now. Cavities were often only partially filled. Water from outside often leaked in around windows and doors and damaged the insulation. Of course, homes were so leaky prior to the 1960s that walls dried out quickly, so mold wasn't a big problem. The rules of the game are very different today. Homes are built tight—with no tolerance for sloppy insulating.

Building scientists (a new breed of experts) now have a deep understanding of how insulation works. They've learned that factors such as air infiltration, dampness and age can dramatically affect performance.

But they also recognize that insulation is part of an energy saving system, not a standalone solution. Good results can be achieved with any insulating material, if it's combined with the right housewraps, tapes and construction details. Here's an overview of the latest advances in insulation technology.



**Fiberglass Insulation**

**Virtues**
- Renewable and recyclable
- Familiar to contractors
- Field-proven for decades

**Caveats**
- Requires careful installation
- May need an additional air infiltration barrier

### Glossary of Terms
### Know the Lingo

- **R-Value:** A measure of how effectively a material resists heat flow. Thus, higher numbers are better. For a full list comparing various types of insulation, visit **www.coloradoenergy.org**.
- **Batt:** A length of insulation that is precut to fit certain wall cavity dimensions. Typically sold in a pre-cut roll.
- **Unfaced/Faced Insulation:** Faced insulation (typically a fiberglass batt) includes a vapor retarder on the interior face that restricts movement of moist air into wall cavities. Unfaced is simply a batt without a vapor retarder.
- **Ridge Vent:** An opening covered by a rainproof vent that follows the peak of the roof, typically required by code. Some insulating methods, however, negate the need for a ridge vent. Clear it with your local code official first.
- **Blow-In:** Method of introducing loose fiberglass, cellulose or mineral wool to framing cavities or attic space, typically using a machine with an attached hose.
- **Blower Door:** Equipment used to test the effectiveness of a home's insulation and air sealing systems.
- **Stud Cavity:** The space between the vertical members of a conventionally framed wood or lightweight steel home. Common stud spacings include 16" and 24" on center (of stud).

### FIBERGLASS
**Installer Friendly**

Fiberglass insulation in batt form is probably the most familiar insulating product. Changes in recent years have affected the composition of chemical binders that hold the product together, along with the size of the glass fibers. Many brands have removed or reduced toxins such as formaldehyde from their products. Some of the largest manufacturers of fiberglass products now offer hybrid systems that include an air-sealing component. They have improved the performance and handling of blown-in fiberglass, and added to the percentage of recycled content in all product lines (up to 40 percent).

### SPRAY FOAM
**Filling Every Void**

Insulating walls and ceilings with spray foam is relatively expensive, typically more than twice the cost of fiberglass batts, and most often it's a job best handled by pros. Why is foam green? Not because of what's in it. Even the most eco-friendly brands replace only a small percentage of their petroleum-based chemical mix with biological products such as soy. But the energy performance of foam is hard to beat. Some brands offer insulating value of more than R-6 per inch, at the same time sealing against air infiltration. This makes spray foam a dual-duty system, ideal for both new and retrofit construction.

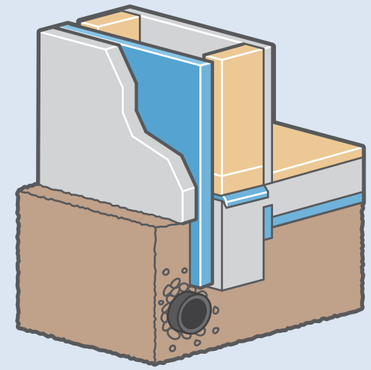
### CELLULOSE
**Paper Trail**

Cellulose has a good green story to tell, especially from the manufacturing side. It's made primarily with recycled paper, typically newspapers, and most brands are treated with boric acid as a fire retardant. Research on the health effects of boric acid suggest that it is a minor irritant in small doses. Cellulose

*continued on page 21*

**VISION HOUSE® AT MARIPOSA MEADOWS PRODUCT**
**AFM *Foam-Control MAX Rigid Insulation***
The closed cell structure of AFM's *Foam-Control MAX* rigid insulation contains air instead of blowing agents that deplete over time, helping to keep the R-value constant. The materials are unaffected by moisture and don't support the growth of mold or mildew. *Foam-Control* is also resistant to termite infestation. **www.foam-control.com**

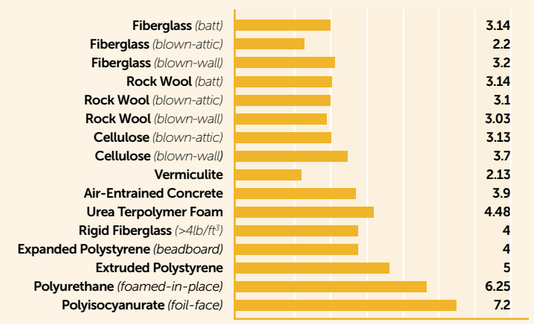
### Rigid Foam Insulation



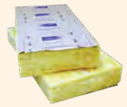
**Virtues**
- High R-value per inch
- Seals against air infiltration
- Good solution for basement walls

**Caveats**
- Some brands may shrink over time
- Producing synthetic foam is a resource-intensive process

## Insulation R-Values (per inch)




**3.14** Fiberglass Batt



**3.13** Cellulose Blown (attic)

**6.25** Polyurethane (foamed-in-place)

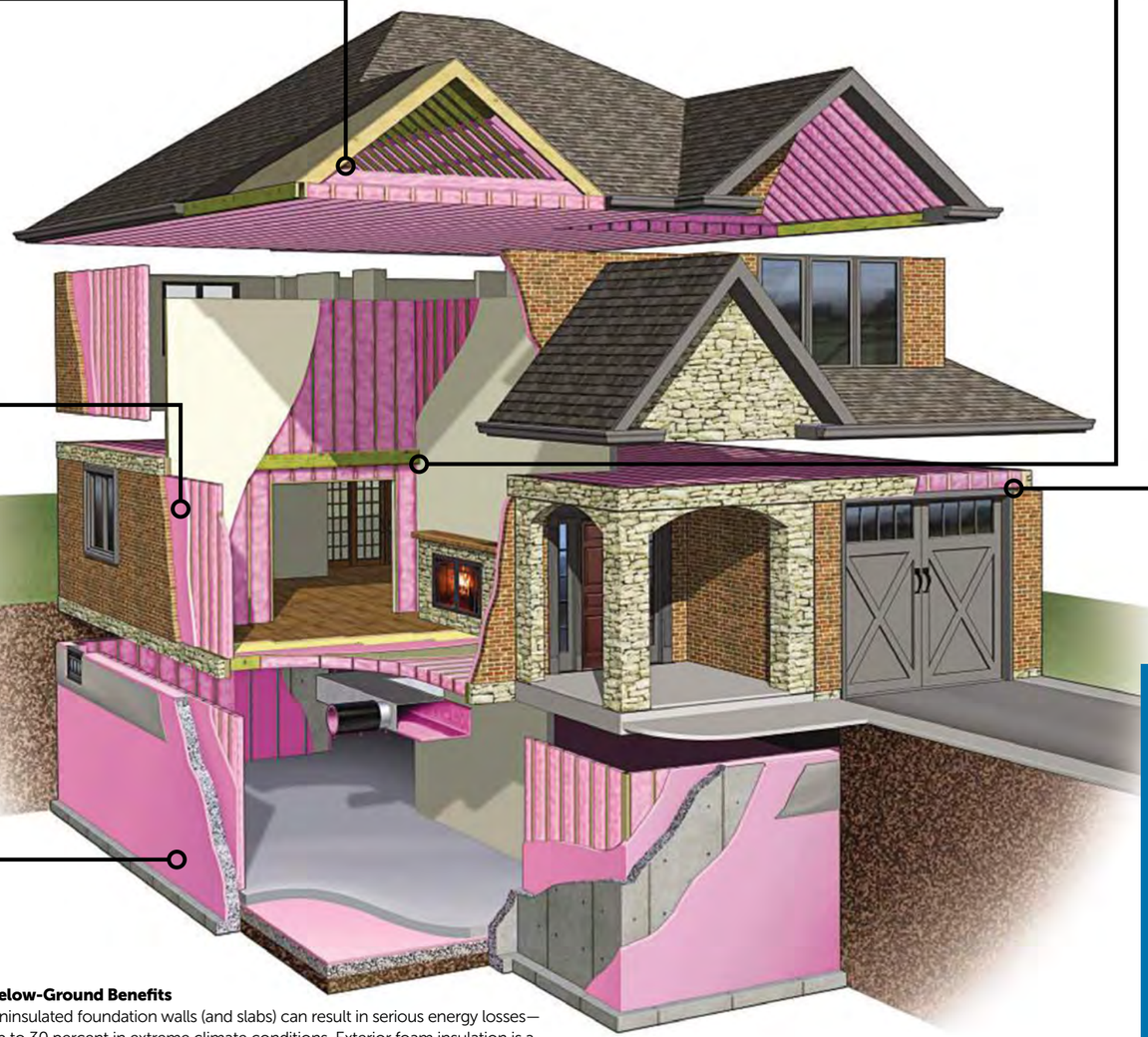
**7.2** Polyisocyanurate (foil-faced)

SOURCE: HTTP://CHEMISTRY.NEED.ORG

**This chart shows the approximate R-value per inch of various products.** Note, however, that not all product brands have exactly the same performance. More importantly, however, many methods of insulating lean heavily on what goes into the rest of the wall system to achieve good results. For example, blown-in fiberglass or cellulose can provide great results at a very reasonable cost, as long as plumbing and other penetrations are properly sealed, windows are caulked and sealed, and overall air infiltration is minimized with building wrap or (in the case of some types of rigid foam) carefully taped seams.

# What makes INSULATION green?

**Hats and Batts**
Insulating attic space is relatively easy and offers immediate payoff in both the home's comfort and reduced energy bills. Think of attic (or rafter) insulation as a thermal "hat" for your home, keeping warm (or cool) air from escaping out the top. Also, not every roof needs venting, although some building codes require it. New research shows that unvented attics can be highly efficient, if designed and insulated properly.



**Double Defense**
To maximize the R-value of walls, consider using a "hybrid" insulation system, combining two or more types of insulation. Think of walls as a "system." You might combine foam board and insulating batts, or incorporate products such as *EnergyComplete* sealant (**www.ocenergycomplete.com**), which is part of a whole-home insulation and air sealing system from Owens Corning, designed to help increase a home's overall comfort and energy efficiency.

**Below-Ground Benefits**
Uninsulated foundation walls (and slabs) can result in serious energy losses—up to 30 percent in extreme climate conditions. Exterior foam insulation is a good choice in new construction. It not only insulates, but reduces moisture transfer from outside to inside the home. For retrofiting, foam or fiberglass batts can be placed on interior walls.

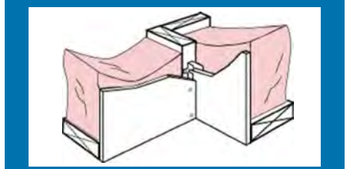
**Interior Control**
Many new homes include interior wall insulation—in part because it makes walls more soundproof. But it also has energy advantages. It allows you to "zone" different parts of the home so that only the areas of the home being used are fully heated or cooled.

**Rim Armor**
The point were the first floor of a home meets the second has historically been tough to insulate. New products and systems include this part of the house in the insulated envelope, greatly reducing energy loss.

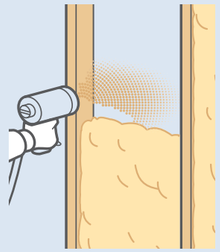
IMAGE COURTESY OF OWENS CORNING (**WWW.OWENSCORNING.COM**). THE COLOR PINK IS A REGISTERED TRADEMARK OF OWENS CORNING: TEXT BY *GREEN BUILDER* STAFF

## PRO TIP:

**Clip It.** Corners are one of the toughest parts of a structure to insulate. You can allow for more insulating at corners by using drywall clips on the inside walls. These effectively remove an unnecessary piece of lumber. Image: Oikos.com



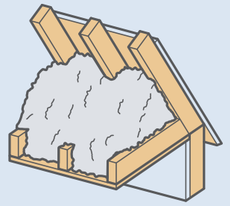
## Spray Foam Insulation



**Virtues**
- Fills gaps and cavities completely
- Provides its own air barrier
- High R-value per inch

**Caveats**
- More expensive than competing products
- Requires special equipment/skills to install

## Cellulose Insulation



**Virtues**
- High percent of recycled content
- Little or no toxic offgassing
- Relatively easy to install

**Caveats**
- Must be installed carefully to fill all gaps
- Wet products can be problematic if not allowed to dry properly

can be installed wet or dry. If installed wet, it should be allowed to dry properly before covering with drywall (typically less than 48 hours). The insulating value of cellulose is about the same as blown fiber glass (roughly R-3.7 per inch).

### MINERAL WOOL
**Nothing to Burn**

Although mineral wool looks like fiberglass, it's made from basalt rock and slag, not glass. The resulting product, either batts or loose fill, is non-flammable, requiring no chemical flame retardants. As a result, offgassing emissions tend to be low. Mineral wool includes high levels of post-industrial recycled content waste (up to 90 percent), reducing the environmental impact of its production.

### RIGID FOAM
**Water Resistive**

You may have seen contractors in your area putting green or blue insulation right over the wood siding of an old house. Chances are, they're applying extruded expanded polystyrene (XEPS) or polyisocyanurate closed-cell foam. Both products are dense and durable. Some building experts suggest that foam used this way can an act as water resistive barriers (WRBs), negating the need for housewrap, but we recommend playing it safe and using housewrap as well. Rigid foam also is a good choice for insulating basement walls. **GB**

# Air Quality 05

## Manage air flow—and materials.

Controlling the flow of air in and out of the home has a huge impact on indoor air quality, but monitoring potential toxins in materials and products is equally important.

ONE OF THE confusing characteristics of green building certification programs is the way they lump together two different aspects of building science: saving energy and keeping indoor air safe and clean. Is a green home one that saves energy, or one that has healthier indoor air than a conventional home? The answer is both. How did the two concepts get mashed together this way? Blame tight houses. As windows, walls and basements have become less leaky, the stuff that pollutes air inside the home—glues, carpets, paints, pressed board cabinets—has suddenly become a lot more dangerous. So, here's the deal. If you want to build or retrofit your home to be greener, you'll have to control the air quality at the same time. There are three ways to do this: first, by eliminating pollutants at the point source; second, by keeping moisture levels healthy indoors; and third, by mechanically "cleaning" the air.

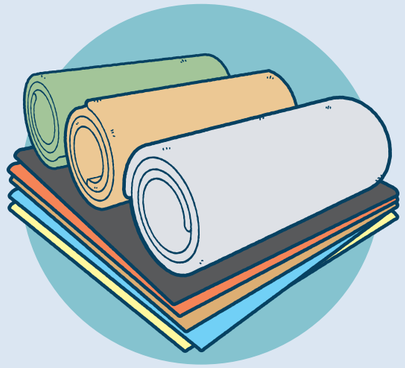
**Here are some key products whose attributes help provide healthier indoor air:**

### HOUSEWRAP

**Passive Resistance**

Some modern building products operate passively. Housewraps fall under this description. These weather-resistant barriers allow water vapor to escape living spaces and wall cavities (where it might condense and encourage mold or mildew), at the same time preventing unwanted outdoor air from creeping into the home. Housewrap is only as good as its installation, however. The Department of Energy says that housewrap must be taped at every seam. Otherwise, it may be 20 percent less efficient. It's also important that housewrap not be left exposed to sun and wind for too long, factors that can degrade its effectiveness over time.

#### Keep Walls Under Wraps



Housewrap is only as effective as its installation. For example, metal flashing above doors or windows should be installed before the housewrap, not on top of it.

**Virtues**
- Reduces air infiltration
- Repels windborne rain
- Long service life

**Caveats**
- Can't be left exposed indefinitely
- Requires careful installation

**VISION HOUSE® AT MARIPOSA MEADOWS PRODUCT**

**Panasonic *WhisperRecessed LED* Ventilation Fan**

The easy-to-install *WhisperRecessed LED* from Panasonic is a quiet and energy-efficient ventilation fan for bathrooms. The Energy Star fan and light fixture complies with ventilation standards required by LEED and uses an LED bulb, which produces little heat, contains no mercury and uses less energy than CFL bulbs. **www.panasonic.com**

**VISION HOUSE® AT MARIPOSA MEADOWS PRODUCT**

**BEAM *Alliance* Central Vacuum**

The BEAM *Alliance* Power Unit and Cleaning Set by Electrolux boasts advanced technology. A high-efficiency motor uses 30 percent less energy than other central vacuums. The system comes with the BEAM *Alliance* HEPA filter and a collection receptacle that snaps into place to assure a perfect seal, preventing dirt and allergens from re-entering your home.
**www.beamvac.com**

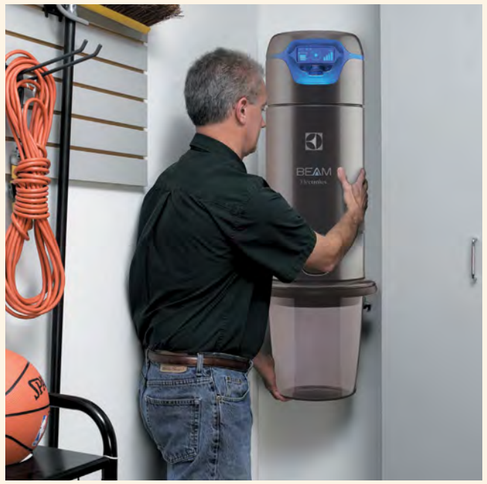


## Central Vacuum Systems: Not Just for New Homes

Many homeowners shy away from installing central vacuum systems in their existing homes, because they fear that the installation process must be part of a full-scale renovation. However, almost one-third of all central vacuums sold in the U.S. are installed in existing homes without tearing out sections of walls or ceilings. In fact, the entire installation process usually takes less than a day.

Central vacuum systems are built into the home. They include three basic components. A power unit that includes the system motor, filtration and a collection bucket is typically installed in a garage, basement or utility room and provides three to five times more cleaning power than a traditional vacuum. PVC tubing and wires are installed inside interior walls and between floor joists that connect the power unit to strategically located inlet valves. A powered 30- or 35-foot hose and attachments plug into the inlet valves and activate the system.

The added cleaning power and the location of the motor outside the living area allow a central vacuum system to completely remove captured dust and allergens without blowing air into the living space during cleaning. As a result, installing a central vacuum system earns certification points under both the National Green Building Standards and LEED for Homes.




### Planning Is Key to Retrofit Installation

"An existing home installation should look like the house was built with a central vacuum system," says Jim Carmichael, central vacuum category manager for Electrolux and a former BEAM central vacuum system dealer. "You'll want the dealer to visually inspect the home before the installation to determine where to place the inlet valves in interior walls, where to place the power unit and the best route to install the tubing and wiring that connect the system."

Homes with unfinished basement ceilings, crawl spaces or attics allow for simple installation, Carmichael says.

When installed, the inlet valves cover approximately 600 to 700 square feet of the home; the average home of 2,400 square feet will only need four inlets, at the most. The inlets are installed in interior walls at the same height as standard electric plugs. Small holes no larger than a standard electrical outlet are cut into the drywall to accommodate each valve; the valves are then connected to the system by vacuum tubing inside the walls from below or above. The vertical tubing then is fitted to a main trunk line that is installed between floor and/or ceiling joists from a basement, crawl space or attic that connects to the power unit. All the inlets in the home are tied into the one main line to assure the best suction possible and the least amount of tubing. Cover plates attached to each valve conceal all of the tubing and wire.

A thin, lightweight electrified hose is inserted in the inlet valves and activates the vacuum from a touch of the switch on the hose. One advantage of a central vacuum is that the homeowner can clean a room from top to bottom—floors, furniture, crown molding, ceiling fan and baseboards—without having to change inlet locations. When finished, simply turn off the vacuum at the hose handle and hang the hose in the closet. The only maintenance for the central vacuum system involves emptying the system's collection canister every three to four months.

SOURCE: BEAM/ELECTROLUX

### CARPET

**Look Below the Surface**

Carpets have only in the last decade or so come under close scrutiny for their environmental impacts—both in and out of the home. Most commercial carpets are made from some variation of synthetic, petroleum-based material. This material is often treated with other chemicals to improve stain resistance, wear or color retention. To make matters worse, many carpets are installed over highly toxic rubberized pads. They may also be glued to the floor with pungent adhesives. That new carpet smell you recognize is not something you want in your home. It's a sign that your floor is releasing unknown chemicals into your living space. A few of the larger carpet makers—notably Mohawk (below), Interface and Shaw Industries (**www.shawfloors.com**) have begun to

*continued on page 25*

**VISION HOUSE® AT MARIPOSA MEADOWS SPONSOR**

**DuPont *Tyvek ThermaWrap R5.0***

This insulated housewrap is made with 20 percent pre-consumer recycled polymers, including polyolefin. It adds R-5 to the building's insulation envelope and reduces thermal bridging. Non-insulated six-inch flaps at the start and bottom of each roll allow vertical and horizontal seams to be installed shingle-style. **www.dupont.com**

**VISION HOUSE® AT MARIPOSA MEADOWS PRODUCT**

**Mohawk *SmartStrand* Carpet**


One of the few large carpet companies to make major steps toward sustainability, Mohawk developed *SmartStrand* in a joint effort with DuPont to add renewably sourced polymers (from corn sugar and other sources) to a synthetic weave. The product has integral stain resistance, eliminating the need for toxic chemical treatments. **www.mohawkflooring.com**



Brought to you by NV Energy

# Indoor Air Quality Testing

**Indoor air quality has been identified as a public health risk, and UL Environment, a division of the independent safety science company UL, tests products to determine their environmental impact, providing homeowners with valuable information on how to make their surroundings safer.**

For example, UL's GREENGUARD program certifies products, which include everything from computers to televisions to paint and flooring, offer low chemical emissions and contribute to healthier indoor environments. UL's ECOLOGO certification rates multiple attributes, including impact to indoor air quality, throughout the life cycle of products. From building materials to cleaning supplies, ECOLOGO and GREENGUARD certifications enable purchasers to identify holistically greener products that meet their sustainability goals.

UL Environment also offers a free app on its Facebook page that gives homeowners tips on improving environmental safety. UL Environment also maintains the Sustainable Product Guide, a free searchable database of more than 14,000 currently certified products.

GREENGUARD

PRODUCT CERTIFIED FOR LOW CHEMICAL EMISSIONS
UL.COM/GG
UL 2818

**Vision House® at Mariposa Meadows Sponsor**

MARIPOSA MEADOWS

**www.ul.com/environment**

Some of the most common pollutants include:

**Biologicals**
These include molds, bacteria, viruses, pollen, animal dander and particles from dust mites and cockroaches. These may cause infections, provoke allergic symptoms or trigger asthma attacks. Means of control include washing bedding to kill dust mites, keeping animals out of areas affected persons frequent and practicing careful cleaning.

**Secondhand Tobacco Smoke**
A major indoor air pollutant, it contains some 200 known poisons, such as formaldehyde and carbon monoxide, and at least 60 chemicals known to cause cancer. It causes an estimated 3,000 lung cancer deaths and up to 50,000 heart disease deaths among U.S. non-smokers each year.

**Combustion Pollutants**
These come from sources such as fuel burning stoves, furnaces, fireplaces, heaters and water heaters, equipment that uses gas, oil, coal, wood or other fuel. The most dangerous pollutants are both colorless and odorless gases: carbon monoxide (CO) and nitrogen dioxide ($NO_2$). CO interferes with the delivery of oxygen to the body. It can produce fatigue, headache, confusion, nausea and dizziness. Make sure combustion appliances are installed and maintained by reliable professionals and properly used. A UL-listed CO monitor should also be installed.

**Formaldehyde**
This common chemical is found primarily in adhesive or bonding agents and is used in carpets, upholstery, particle board and plywood paneling. The release of formaldehyde into the air may cause health problems, such as coughing; eye, nose and throat irritation; skin rashes, headaches and dizziness. The best control is to avoid using products that emit formaldehyde. As a second line of defense, allow new, potential sources of formaldehyde to air out thoroughly before bringing them indoors.

**ALSO:** Hundreds of potentially harmful chemicals are emitted by household cleaning agents, personal care products, pesticides, paints, hobby products and solvents. Such chemicals can cause dizziness, nausea, allergic reactions, eye/skin/respiratory tract irritation and cancer. Minimize your use of such sources of dangerous chemicals.

SOURCE: AMERICAN LUNG ASSOCIATION: REPRINTED FROM **WWW.LUNG.ORG**

approach carpets from a more eco-friendly perspective, not only recycling old carpets—but offering less toxic installation systems and products that have lower levels of offgassing.

## CENTRAL VACUUM SYSTEMS

### Dust Deniers

The carpet industry suggests that the average American family uses a vacuum cleaner at least once weekly, while about 10 percent of us vacuum our homes once or more per day. But the typical upright household vacuum cleaner may not be the solution to clearing the air in a home. These upright units are not created equal. Most lack an effective HEPA filtering system—the only reliable way to capture the fine particles that have been shown to be harmful to human health. On the contrary, a vacuum with a non-HEPA filter may simply toss tiny particles back into the air. A whole-house vacuum solves this problem by actually taking unwanted particles outside the living space—into a garage or unfinished basement.

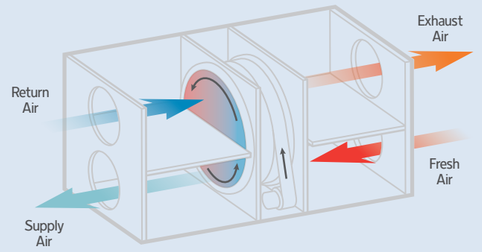
## What Makes One Carpet Greener than Another?

**The EPA offers a few guidelines:**

- Low or no volatile organic compounds (VOCs)
- No toxic dyes
- Recyclable
- Recycled content
- Reduced energy use (during manufacturing)
- Reduced or improved air emissions (during manufacturing)
- Minimum 10-year warranty

Recent EPA research found that carpet tiles can be a more sustainable alternative than wall-to-wall products. If you stain a section, for example, you can remove and replace it. Also, you can "rotate" tiles from heavy use areas to light use areas. The EPA's test building used Milliken 36" x 36" tile carpet and low-VOC adhesives to test these principles.

## ERV Transfers




An ERV transfers heat and moisture in hot climates. It dries incoming moist outdoor air and transfers some of that unwanted heat into the exhaust air stream that's leaving the home.

## ENERGY AND HEAT RECOVERY VENTILATORS

### Key Component

You may have heard of energy recovery ventilator (ERVs) and their northern cousins, heat recovery ventilators (HRVs). This heat transfer technology is a key component of any modern "tight" house. Without them, modern houses would probably not be worth the foam, tape and caulking with which they're sealed. These mechanical wonders take hot, unconditioned fresh air from outside, pass it over a heat collecting medium, where it gets a partial cool-down before entering the home. A study by John Bower (visit **www.healthyhouseinstitute.com**) found that using a heat recovery ventilator with continuous ventilation cost a Minnesota homeowner just $86 a year. It cost $188 to do the same ventilation without an HRV. GB

**Ventilation Air Requirements (CFM)**

| | Bedrooms | | | | |
|---|---|---|---|---|---|
| **Floor Area (ft²)** | **0-1** | **2-3** | **4-5** | **6-7** | **>7** |
| **Less than 1,500** | 30 | 45 | 60 | 75 | 90 |
| **1,501-3,000** | 45 | 60 | 75 | 90 | 105 |
| **3,001-4,500** | 60 | 75 | 90 | 105 | 120 |
| **4,501-6,000** | 75 | 90 | 105 | 120 | 135 |
| **6,001-7,500** | 90 | 105 | 120 | 135 | 150 |
| **Greater than 7,500** | 105 | 120 | 135 | 150 | 165 |

## Fresh Air Formula

Indoor air tends to concentrate pollutants quickly. As a result, building codes typically have certain requirements for the amount of fresh air that must be exchanged with stale indoor air over a given period. Typically, this is expressed as cubic feet per minute, or CFM. An organization called ASHRAE provides guidelines for how much ventilation is needed, although the best means for achieving that ventilation are often debated. When in doubt, more ventilation is better than less, but you have to balance the resulting energy loss with improved indoor air quality.

SOURCE: ASHRAE 62-2-2003

# Windows 06

## Choices for every climate.

Window manufacturers are not only creating more durable and energy-efficient products, they're tailoring glazing options for specific climates.

WINDOW TECHNOLOGY HAS improved by leaps and bounds over the past few years. Today, you can get a high-performance window that looks good and performs well at any price point.

The windows you select for your house—whether retrofit or new—must meet your local energy code requirements at a minimum and ideally should be Energy Star-qualified for your home's climate.

### ENERGY COSTS

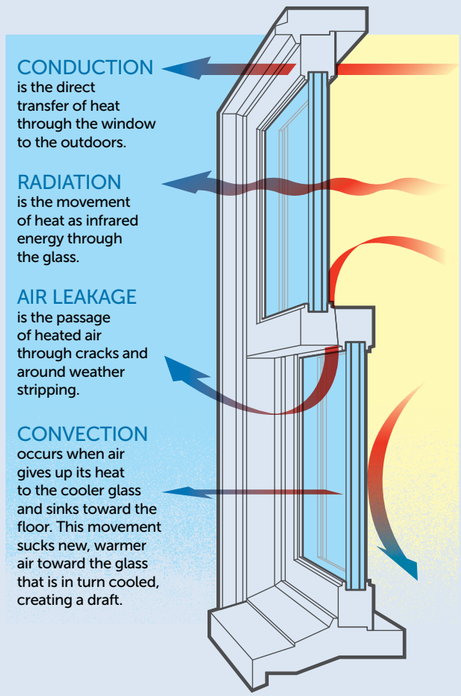
**The Right Window**

If you want to reduce utility bills, you need to consider the impact of windows. In climates with a significant heating season, windows have represented a major source of unwanted heat loss, discomfort and condensation problems. But today it is possible to have lower heat loss, less air leakage and warmer window surfaces that improve comfort and minimize condensation.

Similarly, in climates that mainly require cooling, windows typically represent a major source of unwanted heat gain—but low-E finishes that reject solar heat without darkening the glass have changed the rules. These glazings significantly reduce solar heat gain and improve comfort, at the same time providing clear views and daylight.

As an example, a study by the Efficient Windows Collaborative (**www.efficientwindows.org**) shows that the annual heating cost of a typical house in Boston drops from about $750 a year to $550 (24 percent) by switching from double-pane windows to triple-pane with high solar gain, low-E glass. Keep this in mind when you are assessing the "first cost" of new windows.

### How Windows Handle Energy




GRAPHIC INSPIRED BY FINE HOMEBUILDING

### COMFORT

**Know the Science**

For homeowners, how comfortable a house feels can be just as important as its energy efficiency. An older window with a lower glass temperature feels colder because more heat is radiated from a person's body to the window.

Cold glass can also create uncomfortable drafts as air next to the window is cooled and drops to the floor. This sets up an air movement pattern that feels drafty and accelerates heat loss.

High-performance windows with lower U-values will result in a higher interior window temperature in winter and thus greater comfort. Proper installation along with weatherstripping designed to seal tightly will also improve comfort by reducing cold air leakage.

During the summer, direct sunlight strikes people and surfaces, creating overheating and discomfort. Windows with low solar heat gain coefficients will reduce the solar radiation coming through the glass. That's where low-emissivity (low-E) glass comes in—reducing heat gain while still providing sufficient light and view.

### LESS FADING AND CONDENSATION

**Block the Rays**

High-performance windows with new glazing technologies make homes more comfortable. They create warmer interior glass surfaces, reducing frost and condensation. High-performance windows with warm edge technology and insulating frames have such a warm interior surface that condensation on interior surfaces is significantly reduced under all conditions.

Another concern for homeowners is the effect of sunlight on the home and its contents. Many organic materials, such as carpet, fabrics, paper, artwork, paints and wood may fade upon exposure to sunlight. Window selection can influence the type and intensity of transmitted radiation.

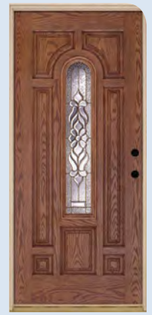
Ultraviolet (UV) rays are the most harmful radiation in sunlight. They are the most energetic and thus most likely to break chemical bonds, leading to fading and degradation.

Finishes on glass can reduce the UV transmitted by up to 75

*continued on page 29*

### EXTERIOR DOORS

Both the type of "skin" and the core of an exterior door affects its energy performance, as does the type of glazing. Strike a balance between looks and efficiency.



Feather River Doors Fiberglass Door

| DOOR TYPE | R-VALUE |
|---|---|
| **Wood Hollow Core Flush** | 2.17 |
| **Wood Solid Core Flush 1 3/4"** | 3.03 |
| **Wood Solid Core Flush 2 1/4"** | 3.70 |
| **Wood Panel Door 1 3/4"** | 1.85 |
| **Wood Storm Door 50% Glass** | 1.25 |
| **Metal Storm Door** | 1.00 |
| **Metal Insulated Door – Average** | 7.00 |
| **Metal Insulated Door – 2" Urethane** | 15.00 |

SOURCE:
**WWW.GREEN3DHOME.COM**

**Glossary of Terms**

### Know the Lingo

- **Air Infiltration:** The amount of air that passes between a window sash and frame, measured in cubic feet per minute per square foot of frame area.
- **Argon Gas:** A colorless, odorless, inert gas that fills the otherwise empty space within an insulating glass unit.
- **Efficient Windows Collaborative:** Organization that provides detailed reports and studies on the value of using high-performance windows. Visit the Web site at **www.efficientwindows.org** for more information on the studies cited in this article.
- **Insulating Glass (IG):** Glass units constructed of two or more glass panes separated by a hermetically sealed space.
- **Low-Emissivity Coating (low-E):** Low-E finishes reduce energy transfer through insulating glass units, and thereby achieve one of the highest levels of energy performance possible for glass.
- **Solar Heat Gain Coefficient (SHGC):** Measures the fraction of solar energy admitted, and indicates how well the product blocks heat caused by sunlight.
- **U-Value:** The escape of BTUs per square foot per hour, per degree Fahrenheit.
- **Warm Edge Technology:** The use of low-conductance spacers to reduce heat transfer near the edge of insulated glazing.

# What makes WINDOW GLAZINGS green?

**EXAMPLE A**
- double glazing
- clear glass
- aluminum frame w/ thermal break

**EXAMPLE B**
- double glazing
- low-E coating (low solar gain) argon gas fill
- aluminum frame w/ thermal break

**EXAMPLE C**
- double glazing
- clear glass
- vinyl/wood frame

**EXAMPLE D**
- double glazing
- low-E coating (high solar gain) argon gas fill
- vinyl/wood frame

**EXAMPLE E**
- double glazing
- low-E coating (low solar gain) argon gas fill
- vinyl/wood frame

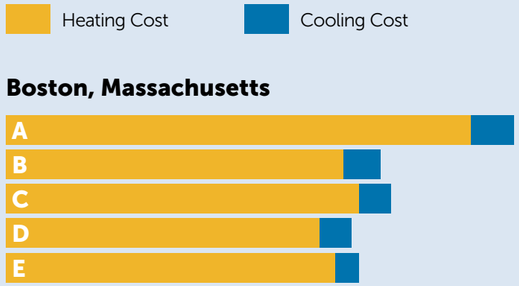
**Climate Affects Performance**

The annual energy performance figures shown here were generated using RESFEN for a typical (new construction) 2000-sq.-ft. house. The costs shown here are annual costs for space heating and space cooling only, and thus will be less than total utility bills. The mechanical system uses a gas furnace for heating and air conditioning for cooling. Energy prices were projected for the period of 2006-2030, the typical effective lifetime of a window installed in 2005.

*Note: The graphs at right are intended to show how regional variations in climate affect the relative advantages of window types, not as specific cost comparisons.*—Editor

SOURCE: **EFFICIENTWINDOWS.ORG** AND *BEST PRACTICE GUIDE TO RESIDENTIAL CONSTRUCTION*

## Annual Energy Performance of Glazing Types by Climate




percent. UV absorbers can be incorporated into thin plastic films in multilayer windows or as an interlayer in laminated glass. In both cases, the UV transmission can be reduced to less than 1 percent. However, it is important to note that the remaining visible light that is transmitted can still cause fading in some materials. Using low-E coated glass or windows incorporating plastic layers rather than clear uncoated glass will reduce fading.

### ANOTHER WINDOW PERK

**Smaller HVAC Equipment**

High-performance windows can reduce utility bills, and they also reduce peak heating and cooling loads. The peak load for a building is the maximum requirement for heating or cooling at a given time. This load is important, because it determines the size of the furnace, heat pump, air conditioner and/or ventilating fans that must be installed. Reducing the peak load may allow homeowners to install a smaller HVAC system, which costs less up front—and less to operate.

Properly sized HVAC systems offer a number of advantages to homeowners. First, by running more constantly, smaller equipment provides the best air quality and comfort. Second, HVAC systems that are more closely matched to peak cooling loads achieve better dehumidification, which prevents mold. Several calculating procedure can be found to help with proper sizing of HVAC equipment. That's really the HVAC installer's job, but if you want to do your own calculations, there's a simple piece of software out there called the *HVAC-Calc Residential 4.0*, which costs $49 (available at **www.hvaccomputer.com**). You enter in some information about your home (or proposed new home), and it helps you figure out the optimal size and type of equipment you need for best performance and energy efficiency. **GB**

## COMMUNITY ACTIVIST PROFILE

PHOTO CREDIT: GOLDMAN ENVIRONMENTAL PRIZE

**Fracking Fighter**

**Helen Holden Slottje's** message is clear: fracking—drilling for natural gas by using water and chemicals to break up shale deposits underground—locks the country into a continued dependence on fossil fuels and must be stopped.

"It's a 180 (degree) turn from where we should be going," says Slottje, the managing attorney of Community Environmental Defense Council, Inc. in Ithaca, New York. She and her husband David established a grassroots effort and convinced more than 170 New York communities to ban fracking. It hasn't been easy. When Dryden's town board unanimously passed a law banning fracking in 2011, the gas industry sued the town. The industry lost the battle in trial court, and following an unsuccessful appeal, the case is now before the state's highest court.

Slottje has been harassed and intimidated, but she hasn't stopped; this year she was honored by the Goldman Environmental Foundation for her work.

"Awards provide a platform for us to speak to other states," she says. The couple now encourages other states to lobby, and is meeting with people in Oklahoma, Virginia, West Virginia and Montana.

*By Lisa Iannucci*

## Tilt-and-Turn Advantages

European-style tilt-and-turn windows are gaining popularity in the U.S., in part because of their performance in Passive House projects. Tilt-and-turn windows are designed to swing in like a casement window or tilt in at the top. The design offers several advantages:

**Cleaning and Egress**. The windows swing in, allowing for quick air exchange, easy cleaning and optimal egress in case of emergencies.

**Ventilation**. The tilt-at-the-top function provides draft-free air exchange between rooms.

**Energy Efficiency**. The complete seal on tilt-and-turn windows keeps air from leaking through. Their design also allows for double and triple glazing that is often thicker than in other window types.

**Security**. One handle moves the multi-point locking hardware into place, locking the window on all sides for higher security and a tighter seal.

**Customization**. Walls facing the south and west can be fitted with a glass combination that captures heat from the sun during winter, while providing a good thermal performance. On the north and east, a glass combination designed to minimize heat loss through the windows can be installed.

**Clear Advantages.** ***ThermoPlus*** **Windows from EuroLine Windows Inc. are made in North America. The triple-pane glass can be customized depending on the window location.**

# Heating & Cooling 07

## The most demanding systems in a home.

The energy savings and increased comfort far outweigh the upfront cost of an energy-efficient HVAC system.

AT THE HEART of most home heating systems is a furnace, a boiler or a heat pump. A furnace burns fossil fuel to heat air that's forced by a blower fan through a series of ducts to the living spaces; a boiler heats water that's then pumped to a hydronic, or water-based, distribution system. Most heat pumps run on electricity. They don't create heat, but rather extract it from the air or the ground. Heat pumps are available for use with forced-air and hydronic distribution systems. If you want to minimize your fuel bill, an Energy Star rating is a minimum standard for these appliances.

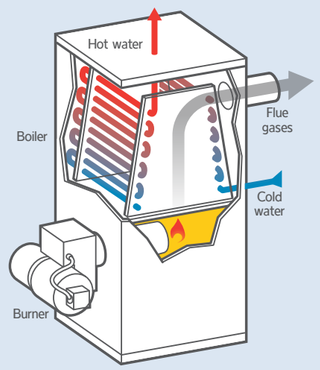
### GAS FURNACE

**Super Efficiency**

A modulating gas furnace is the most technologically advanced fossil fuel-burning furnace you can get, with efficiencies as high as 97percent (that's the percentage of the fuel's potential energy delivered as heat). It achieves this feat with a series of technical innovations. Gas is not as clean as we once believed, however, now that dirty methods of "fracking" are used in some extraction. The pollution may simply be happening at the front end of the process. No fossil fuel gets an environmental free ride. It's a finite resource, not a renewable one.

One way that new technology squeezes more heating power from gas is with an exhaust heat exchanger. This exchanger steals back heat from the furnace's waste byproducts. Another feature, flame modulation, adjusts the flame size, based on demand. These furnaces include variable-speed blower fans with high-efficiency electric motors. The ability to vary airflow and flame intensity also allows for nearly constant room temperatures and better air circulation.

### High-Efficiency Boiler




**Virtues**

- Quiet operation—no air blowing
- Relatively easy to zone
- Lack of fan means lower electric use than a forced-air system
- Distribution system takes up much less space than ductwork

**Caveats**

- Up to 50% more expensive than a conventional boiler
- There are fewer high-efficiency boilers to choose from than there are high-efficiency furnaces

### HIGH-EFFICIENCY BOILER

**Hot Water Wiz**

A boiler burns oil, natural gas or propane to heat water. That heated water is then pumped through a system of pipes to radiators, baseboard heaters or a radiant floor.

A good boiler will offer efficiencies of 90 to 95 percent and will include many of the same technologies as a high-efficiency furnace. These include a modulating burner that matches the heat output to whatever the thermostat is calling for at the moment, advanced heat exchangers to extract more heat from the same amount of fuel, and the ability to recover heat from the exhaust gas by condensing it. The resulting exhaust is cool enough to be vented out of a plastic pipe. In the best cases, this condensing process can squeeze 10 to 12 percent more usable energy out of the fuel.

### AIR-SOURCE HEAT PUMP

**Reverse Motion**

A heat pump is basically an air conditioner that works in reverse to provide heat. The heat pump captures and concentrates heat from one area, then releases it to another.

In heating mode the heat pump takes heat from the outdoor air and delivers it to the home's distribution system. In cooling mode, it reverses direction to work like an air conditioner, extracting heat from inside the house and blowing it outside. In cooling mode, this waste heat can also be used for water heating. The most common type is the split system, which uses separate indoor and outdoor units, but you can also get packaged systems that place everything in a self-contained outdoor unit. While air-source heat pumps can offer efficiencies of 200 to 300 percent, they're most efficient in the southern part of the country. A backup electric or gas heater may be needed when the outside air drops below a certain temperature. Although different versions are made for forced-air and hydronic distribution, the forced-air type is the most common. Heat pumps don't get air as hot as a furnace or boiler, so may require more airflow to maintain the same temperature.

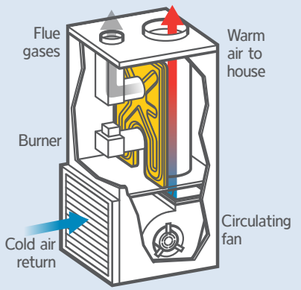
### Air-Source Heat Pump

**Virtues**

- Can provide heating and cooling
- No need for a chimney or exhaust flue
- More fuel efficient than a fossil fuel furnace or boiler

**Caveats**

- Not practical in very cold climates
- Does not get air as hot as a furnace




### GEOTHERMAL

**Earth Energy**

A geothermal heat pump (GHP) uses refrigerant-filled underground piping loops, installed horizontally or vertically, to exchange heat with the earth. These systems work well in both warm and cold climates. A good GHP is able to move three to five times more energy than it consumes. Models are available for use with forced-air or hydronic distribution systems. While the hydronic models don't get water as hot as a conventional boiler (122 °F, compared to 150 °F or more) their low temperature output is a perfect match for radiant floor heat. **GB**

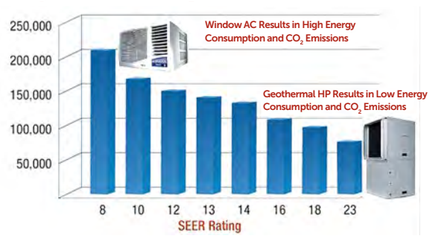
## Window ACs Cost More Than You Think

A through-the-wall air conditioner is typically chosen in response to the following question: "What is the largest number of BTUs I can get for the least expense?" But don't let the initial low cost of an off-the-shelf window unit fool you. Before long, you'll be paying far more for that cool air than you would with an alternative such as geothermal. Here are some of the drawbacks of window ACs:

- The unit is likely either oversized or undersized for the space, each of which wastes energy.
- A through-the-wall air conditioner is likely rated for an EER (energy efficiency rating) of 10—falling short of the minimum 13 SEER standards for home air conditioners.
- Installation rarely works out the way instructions promise; this results in increased thermal gains due to infiltration of air, solar gains and other losses in efficiency. The install may even be a safety hazard.
- High energy consumption (and proportionally high $CO_2$ emissions).
- Increased noise pollution proportional to the number of window ACs in a building.
- Increased safety risks and equipment hazards on ground level (and even upper level) installations.
- Greater security risk (often because of poor installation).

Many homes could be cooled much more efficiently by choosing a geothermal cooling system over window air conditioners. This chart shows the energy cost of cooling a typical 1,500-square-foot house with window air conditioners (10 SEER) vs. using a geothermal HVAC system (20 to 40 EER).

**Life Cycle Pounds of $CO_2$ Emitted**




Based on performance of one 3 ton air conditioning unit operating for 2100 cooling hours, SO.11/kWh, a life cycle of 13 years, and 1.6 lbs of CO2 emissions/kWh. Actual results may vary depending on climate conditions, energy rates, patterns of usage and life span of system.

To be fair, it's not uncommon for a home that uses only through-the-wall air conditioning to use less energy per square foot than a home that uses central air conditioning. We've all been in homes where the occupants only air condition the living room during the day and then just the bedroom at night. This is a good energy habit, and can also be effectively applied with HVAC (ducted) systems using zoning: a well-installed duct system with automatic dampers to cool and heat only the rooms occupied.

SOURCE: JAY EGG/EGG GEOTHERMAL, **WWW.EGGGEO.COM**

# What makes Heating and Cooling green?

IMAGE: UPONOR (WWW.UPONOR-USA.COM)
PHOTO BY JOEL SILVERMAN

**Heat Pumps**
A heat pump is a device that uses a small amount of energy to transfer heat and store it. This technology has become increasingly available in both water- and space-heating equipment. Heat pumps are typically selected based on which source of heat will be most efficient. Some household systems (such as the one shown) include both air- and water-source pumps that condition air, before distributing it through ducts to the home. The water-to-air unit, for example, might be better for heating in the winter months, while the water-to-water unit will efficiently provide cooling in the summer.

**Recirculating Pump**
In large or multi-family homes, if the heating unit is far from the point of use, you can waste a lot of water waiting for the hot water to reach your faucet—as much as 40 gallons a day or 14,000 gallons a year for the average U.S. household. Recirculating pumps move hot water from the source and back again, creating a hot water "loop." This allows you to have instant hot water access from any faucet. The pump can be activated by a motion sensor, then automatically shut off after a few minutes. No water is wasted, and the cost to run the pump is minimal. The Uponor *D'Mand* Hot Water Delivery System is shown here.

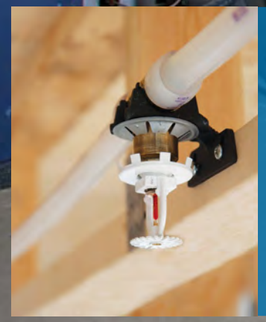
**Duct Diligence**
An often overlooked factor in heating and cooling performance in homes with forced-air systems (vents and registers) is heat loss through ducts. By some estimates, duct leakage accounts for up to 70 percent of a home's air leakage when the furnace blower is operating. To prevent this, all duct seams and joints should be carefully sealed. Ducts that pass through unconditioned or partially conditioned spaces such as attics and basements should be insulated.

**Modulating Boiler**
The boiler shown here is for a very specific purpose—to keep two hot water tanks at the ready for a radiant floor heating system in the home. As such, the water produced is not intended for drinking. It's part of the heating loop. This type of boiler has been around a long time, but the science of "modulation" keeps improving. Modern, high-efficiency boilers have computerized controls that adjust performance based on demand—to produce the most hot water at the lowest energy cost.

**Water-to-Water Ground Source Heat Pump**

**Water-to-Air Ground Source Heat Pump**

**Insulated Water Tank**
The best hot water storage tanks lose only about half a degree of water temperature every hour. That amounts to big savings, because water that's not used immediately doesn't have to reheated all day. Standard boilers used with insulated tanks are sometimes called "indirect" water heating systems—and are sometimes a good retrofit option or a more affordable choice than on-demand boilers.



**VISION HOUSE® AT MARIPOSA MEADOWS PRODUCT**

**Uponor *AquaSAFE* Fire Sprinklers**
Uponor ***AquaSAFE*** fire sprinkler systems give homeowners peace of mind in the case of a fire. Tapping into the home's cold-water plumbing system, it uses just 10 to 15 gallons of water per minute to extinguish a fire—compared to the 250 gallons per minute that are expelled from a fire hose.
**www.uponor-usa.com**


**Noritz *NRCP* Condensing Tankless Water Heaters**
The new *NRCP* line of residential tankless water heaters from Noritz America combines the high efficiency of condensing technology with the comfort and savings of hot-water recirculation. A circulating pump inside the water heater keeps hot water close to the outlet, minimizing the waste of unused potable water down the drain. Both models have an energy factor of 0.95 for both natural gas and LP gas.
**www.noritz.com**

Glossary of Terms

## Know the Lingo

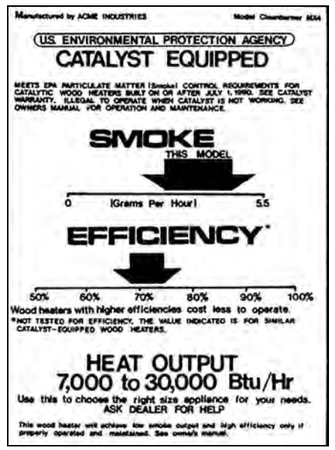
- **Annual Fuel Utilization Efficiency (AFUE):** The percentage of a fuel's potential energy that a furnace or boiler converts to usable heat. Government standards that take effect in 2015 require AFUE levels of 82% for gas boilers, 83% for oil boilers, 80% for gas furnaces and 82% for oil furnaces.
- **Air Handler:** In a forced-air heating or cooling system, the air handler unit moves heated or cooled air through the home's ductwork.
- **British Thermal Unit (BTU):** The unit of measurement for heat, whether it's the heat given off by burning fuel or extracted from a home for cooling. Technically, one BTU is the energy required to raise one pound of water one degree Fahrenheit.
- **Combustion Chamber:** The part of a furnace or boiler where the fuel is burned.
- **Compressor:** That part of the air conditioner or heat pump that compresses and pumps refrigerant.
- **Condenser Coil:** The part of an air conditioner or heat pump that releases heat from the surrounding air in cooling mode and collects it in heating mode.
- **Distribution System:** The network of air ducts or hot water pipes that delivers heat from a furnace, boiler or heat pump to the home's rooms.
- **Evaporator Coil:** The part of an air conditioner or heat pump that exchanges heat with the air in the home.
- **Heat Exchanger:** Located in the furnace or boiler, it transfers heat from the combustion chamber to the air or water in the heat distribution system.
- **Heating Seasonal Performance Factor (HSPF):** The heating efficiency of a heat pump. It's a ratio of the heat it generates over the heating season, in BTUs, to the watt-hours of electricity it consumes. Heat pumps manufactured after 2006 have to have an HSPF of at least 7.7, but the best units have ratings as high as 10.
- **Seasonal Energy Efficiency Ratio (SEER):** The cooling efficiency of an air conditioner or heat pump. It's the ratio of cooling output to electricity used. The minimum SEER requirement for units manufactured beginning in 2006 is 13.
- **Zoning:** A method of partitioning a home's hydronic or forced-air distribution system into independently controlled comfort zones.

# CHOOSING A WOOD STOVE

OLDER, UNCERTIFIED wood stoves produce 30 to 50 grams of particulate per hour, contributing to asthma and a host of other health issues. The internal design of wood stoves has changed entirely since the EPA issued standards of performance for new wood stoves in 1988. Today's wood stove models feature improved safety and efficiency; they produce almost no smoke, minimal ash and require less firewood.

**Emission Limits for Wood Stoves.** EPA's mandatory smoke emission limit for wood stoves is 7.5 grams of smoke per hour (g/h) for non-catalytic stoves and 4.1 g/h for catalytic stoves. Some newer stoves have certified emissions in the 1 to 4 g/h range;.

When comparing models, look for the EPA white label on the stove. A lower g/h rating means a cleaner, more efficient stove. Also check for safety labeling by the Underwriters' Laboratories of Canada (ULC) or another testing and certification body.





CREDIT: WWW.USSCHOTT.COM

## TYPES OF WOOD STOVES

The two general approaches to meeting the EPA smoke emission limits are non-catalytic and catalytic combustion. Although most of the stoves on the market are non-catalytic, some of the more popular high-end stoves use catalytic combustion. Because they are slightly more complicated to operate, catalytic stoves are suited to people who like technology and are prepared to maintain the stove properly, so it continues to operate at peak performance.

**Non-Catalytic Stoves.** Three components make these stoves efficient: firebox insulation, a large baffle to produce a longer, hotter gas flow path and pre-heated combustion air introduced through small holes above the fuel in the firebox. The baffle and some other internal parts of a non-catalytic stove will need replacement from time to time, as they deteriorate with the high heat of efficient combustion.

**Catalytic Stoves.** These stoves produce a long, even heat output—thanks to catalytic combustion—in which the smoky exhaust is passed through a coated ceramic honeycomb inside the stove where the smoke gases and particles ignite and burn. All catalytic stoves have a lever-operated catalyst bypass damper, which is opened for starting and reloading. The catalytic honeycomb degrades over time and must be replaced; it can last more than six seasons if the stove is used properly. If the stove is over-fired, if inappropriate fuel is burned, or if regular cleaning and maintenance are not done, the catalyst may break down in as little as two years.

**Sizing.** Small stoves are suitable for heating a family room or a seasonal cottage. In larger homes with older central furnaces, you can use a small stove for "zone heating" a specific area of your home (family or living room). Medium stoves are suitable for heating small houses, medium-sized energy-efficient houses and cottages used in winter. Large stoves are suitable for larger, open-plan houses or older, leakier houses in colder climate zones.

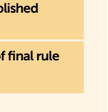
**Wood Matters**. Dense or "hard" wood contains the most energy per cord and is the best choice for peak winter conditions. Burning softer woods during swing seasons keeps rooms from overheating. Regardless, wood should be dried and stored for at least two years before burning. **GB**

SOURCE: EPA

## Winning Wood Stove Designs

In 2013, the Alliance for Green Heat hosted the first Wood Stove Decathlon, a competition created to encourage more efficient designs. A panel of judges evaluated several different stoves on a range of factors: overall performance, affordability, innovation, particulate matter emissions, efficiency, market appeal and carbon monoxide emissions. Two of the top three were catalytic hybrid stoves; masonry stoves scored the highest on efficiency and cleanliness. Here are the six top overall stoves, though there were several others that scored high marks in individual cateogories:

**Woodstock *Union Hybrid* Soapstone Stove**
This stove combines steel, cast iron and soapstone to create a durable stove with thermal mass for holding heat. It utilizes secondary combustion and a catalytic combustor, along with a self-regulating air-to-fuel ratio, to maximize efficiency.
www.woodstove.com

**Wittus *xeoos TwinFire***

This clean-burning, double-chambered wood stove achieves high efficiencies through gasification, which converts wood into carbon monoxide dioxide and hydrogen at extreme temperatures. http://tinyurl.com/k9edjtz

**Lopi (Travis Industries) *Cape Cod Hybrid-Fyre* Stove**
Boasting 80 percent efficiency, this cast-iron stove features a large firebox surrounded by a convection heat exchanger.
http://tinyurl.com/lud7bkk

**Intercontinental *2B4W***
Made from recycled steel oil barrels and fire brick, this masonry stove utilizes computerized combustion control system to maximize efficiency.
www.rodzander.com

**EcoLabel Tile Stove by Ofenbau and Feuerstellen**

This Austrian tile stove achieves low emissions by using a baffle and series of slots to control air entering the inner combustion chamber.
http://tinyurl.com/n85p6bc

**HWAM**
Made in Denmark, this cylindrical wood stove uses *Autopilot HIS* to control combustion; a remote control sensor "tells" the user when to add more fuel. www.hwam.com

### Stepping It Up: New EPA Rule Strengthens Standards for Wood Stoves

The EPA first established limits for particulate matter from wood stoves in 1988. In early 2014, the EPA proposed updated standards for new wood heaters, including pellet stoves. The rule, which should be finalized in early 2015, proposes a tiered schedule for implementing the new standards:

| | Particulate Matter Limit | Compliance Deadline |
|---|---|---|
| Step 1: All stoves without current EPA certification | 4.5 g/h | 60 days after final rule is published |
| Step 2: All wood stoves and pellet stoves | 1.3 g/h | 5 years after effective date of final rule |

## Pellet Stoves

Pellet stoves use compressed pellets (made from wood or other biomass) for fuel and can be used in either fireplace inserts or free-standing stoves. They are categorized into two types, based on the pellet delivery system.

**Top-fed pellet stoves** direct pellets into the combustion chamber from the hopper at the top of the stove. The combustion chamber is more likely to be filled with ash and other debris.

**Bottom-fed pellet stoves** feed pellets into the combustion chamber from the bottom and automatically push the ash into the ash pan. Cleanup is typically easier because of the larger capacity of the ash pan.

Pellet stoves are easy to operate and maintain. Unlike wood stoves, pellet-burning involves no cutting, less hauling, no splitting, stacking or waiting for wood to dry. If used correctly, pellet stoves produce very little smoke or creosote, which can cause chimney fires.

# Appliances 08

## Technology you can trust.

Proper sizing and use can make these labor-saving machines more energy efficient.

HOME APPLIANCES SAVE time, make our homes more comfortable, and increase our quality of life. However, there is more to choosing an appliance than simply selecting the finish, features and price.

Finding a washer, dryer or refrigerator that gets the job done while using less energy and water has become much easier, thanks to programs such as Energy Star and the EnergyGuide label. These labels help you select an appliance that performs well, yet conserves natural resources.

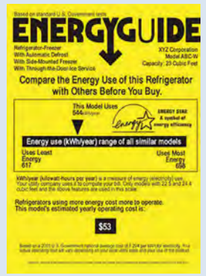
### REFRIGERATORS

#### The Big Energy Hogs

Of all the appliances in the home, the refrigerator can be the most wasteful of electricity. Unlike other appliances that you can turn off, the refrigerator is always on. Fortunately, modern refrigerators are more than 75 percent more energy efficient than ones built just 15 years ago.

Upgrading your 1970s-era fridge to a modern Energy Star option can save you over $200 annually in energy bills. Rebates from local utility companies, manufacturers, federal, state and local governments are often available. Visit **www.dsireusa.org** to see what's available in your area.

Besides saving energy, some manufacturers are producing refrigerators that simply do a better job of storing food. Smart refrigerators are able to moderate the humidity of different bins within the unit, which reduces food spoilage and waste. Fruit and vegetables, for instance, require higher levels of humidity and a constant circulation of air to retain their freshness, color, flavor and vitamins. Meats, on the other hand, should be kept in dryer, more air-tight compartments. While this technology can help you preserve your food, it does come at a higher price.




**Don't overlook the familiar yellow EnergyGuide sticker.** It holds a host of information that can help you find the most efficient appliances available.

#### What to Know

- If you have a refrigerator that's more than 15 years old, replace it!
- Energy Star–rated refrigerators can save you hundreds of dollars over the life of the appliance.
- Size matters: One big refrigerator in the kitchen is better than two small ones (i.e., one in the kitchen, one in the garage).

### WASHERS AND DRYERS

#### Advances in Conservation

The average American family does more than 400 loads of laundry a year, so even modest energy and water savings can greatly impact overall natural resource conservation. Reducing water while doing the laundry has gotten easier in the past decade, thanks in large part to the advancement (and acceptance) of front-loading washing machines.

While top-loading machines still have their place in the market, front-loading units use up to one-third less water, reduce the wear

*continued on page 38*



# What makes a DISHWASHER green?


**Full Loads**
A dishwasher works most efficiently when completely full. Newer models such as this one from Bosch include a third rack that allows you to wash more utensils and dishes using the same energy.

**Tough Interiors**
Better units have stainless steel interiors that will not stain or catch food. Durable interiors greatly extend the lifespan of a dishwasher.

**Flexible Cycles**
Smart dishwashers include several modes that can save even more water, electricity—or both. For example, this unit has a "Half Load" setting that reduces water waste.

**Quiet Operation**
Excessive noise isn't just irritating. It's been shown to raise stress levels in humans—adversely affecting health. Quieter machines make better living companions.

## PRO TIP:

**Air Drying.** Some green experts advocate letting your dishes dry naturally as a way to save additional energy. Assuming your home can handle the moisture, just open the door and let your dishes cool and dry after washing.

PHOTO: BOSCH *800 SERIES* DISHWASHER

on clothes, and require less detergent. By using gravity to move the clothes inside the drum instead of a spindle, front loading washers also conserve electricity while providing more effective spin cycles.

Two terms to be familiar with when evaluating washing machines are modified energy factor (MEF) and water factor (WF). The higher the MEF, the more energy efficient the model. This rating takes into account not only the energy used during the course of cleaning the clothes, but also the energy used to heat the water and run the dryer. The WF rates the water efficiency of the unit based on its size. The lower the WF, the more water efficient the washer.

Using the MEF and WF, along with an Energy Star label and the EnergyGuide label can help you determine which washer set will conserve resources yet still perform well.

### What to Know

- Dryers with moisture sensors can greatly reduce energy use.
- Most HE (high efficiency) washers use special low-sudsing detergent.
- Energy Star specifications for clothes dryers go into effect in 2015.

## COMMUNITY ACTIVIST PROFILE

### Electric Car Crusader

Colorado native **Linda Campbell** has been an environmentalist all her life. But when her Homeowner's Association (HOA) told her she had to stop using a common outlet in front of her townhome to charge her electric vehicle, she saw an opportunity to fight for real change. Campbell proposed alternatives: drawing power from an outlet inside her townhome, or from one in the garage, but the HOA rejected these solutions, citing the potential fire danger posed by her Chevy Volt.

Campbell called a meeting with the development's management and her lawyer. She was prepared to go to the press, if necessary—particularly since the development promotes itself as "sustainable." In the end, they agreed to let Campbell use the original outlet, in exchange for $1.50 per day for the electricity. They have since written an entire set of regulations around electric vehicles; best of all, says Campbell, their newest building will include charging stations.

Campbell has since worked with Colorado state legislators to introduce a bill (modeled on a similar one in Hawaii) that directs HOAs to accommodate electric vehicles.

*By Juliet Grable*

Glossary of Terms

## Know the Lingo

- **Modified Energy Factor (MEF):** MEF is the official energy efficiency metric used to compare relative efficiencies of different clothes washers. MEF considers the energy used to run the washer, heat the water and run the dryer. The higher the MEF, the more efficient the clothes washer.
- **Water Factor (WF):** WF is a measurement of water efficiency that is calculated as gallons of water used per cubic foot of capacity. The lower the number the more water efficient the clothes washer.
- **High Efficiency (HE):** HE is used to describe clothes washers that typically use 50 percent less water than traditional units. Special low-sudsing detergent is used with these models.
- **EnergyGuide Label:** This yellow label created by the U.S. Federal Trade Commission is on most home appliances, and will help you compare the energy use (and cost) of operating one appliance relative to another.
- **Induction Cooking:** Induction heating elements heat only the pan and its contents, and offer energy efficiency by reducing wasted heat when compared to radiant and gas cooktops. The actual induction element stays cool, while the metal pot or pan up rapidly making induction heating safer and more energy efficient than traditional cooking methods.
- **Consortium for Energy Efficiency (CEE):** CEE, a consortium of efficiency program administrators from across the United States and Canada, periodically compiles lists of products that meet the organization's tiers of efficiency, based on manufacturer data. **www.cee1.org**
- **Hydrochlorofluorocarbon (HCFC):** HCFC-based refrigerants are the most common type of refrigerant used in the United States today and are considered significant contributors to greenhouse gas emissions and global warming.

## DISHWASHERS

### Quiet and Efficient

Energy savings and water savings are closely linked; the more hot water you use in your appliances, the higher your energy bills. Dishwashers produced before 1994 typically use 10 gallons per load more water than modern units. Considering that the average home washes over 300 loads per year, reducing the amount of water used can quickly lower utility bills. Dishwashers that offer cycle selections and energy-saving options can help reduce the amount of water you use.

To dissolve detergent and remove grease, dishwashers require extremely hot water. Many dishwashers now come with a "booster" or internal heating element that raises the incoming water temperature to the required 140 degrees.

This can allow you to lower the temperature on your water heater and still allow your dishwasher to operate at optimum levels. Some dishwashers offer the booster cycle, but only if you select "heavy duty."

Along with energy and water savings, noise is a factor in choosing a dishwasher. Measured in decibels (dB), the amount of sound produced can vary dramatically by make and model.

Normal conversation levels range around 60 dB, so choosing a unit that is quieter than that is important. Because of advances in insulation and sound proofing, some dishwashers can be "whisper quiet," creating as little as 41 dB during operation. That is the just slightly louder than the hum of your refrigerator.

### What to Know

- Dishwashers have two EnergyGuide cost labels: one for consumers who use electric water heaters and one for natural gas users.
- Boost heaters generally increase the cost of the unit, but the energy savings can pay for the upgrade in about one year.
- Dishwashers fall into two categories—compact and standard.

## RANGES AND OVENS

### Smart Cooking Saves Energy

Refrigerators, dishwashers and laundry units may be considered "major" appliances, but they aren't the only units you may have to purchase or replace. Thoughtful selection of ranges, ovens, cooktops, microwaves and range hoods can help reduce energy use while improving the quality of life around your home.

**Ranges.** The kitchen range is a dual oven/cooktop, and is available in electric, natural gas and dual-fuel. The benefit of a dual-fuel range is that it has the benefits of gas burners on the cooktop, but offers the stable temperatures of oven cooking with electricity. Cooktops are also available using electrical induction, which creates a magnetic field that heats pans directly, unlike traditional electric resistance coils, which use conduction to transfer heat.

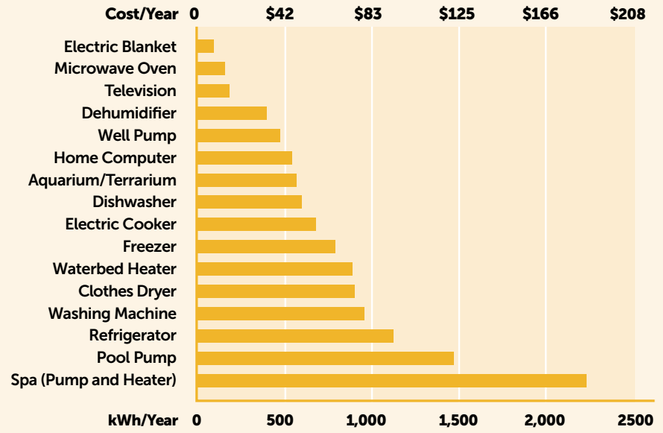
**Microwaves.** Often an afterthought when finishing a kitchen, microwaves can create a more energy-efficient and comfortable kitchen when used properly. Energy consumption can be reduced by up to 80 percent when smaller portions are heated up in the microwave instead of the oven. Also, using a microwave instead of the oven will reduce the amount of heat generated in the kitchen.

**Range Hoods.** These are important in the kitchen for several reasons. First, the ventilation removes unwanted moisture, which could lead to mold issues in the home. It also exhausts heat, smoke and cooking odors from the home. A quality hood also offers task lighting above the range, which will increase safety around hot burners.

### What to Know

- Induction ranges are more energy efficient than traditional ranges, but can only be used with ferrous (steel or iron) cookware.
- Flat cooktops are not necessarily induction ranges.
- Most flat-surfaced cooktops simply use electric resistance heaters under a ceramic cover.
- There is no Energy Star label for residential ovens, ranges or microwave ovens at this time. **GB**

### How Much Electricity Do Appliances Use?




**This chart shows how much energy a typical appliance uses per year and its corresponding cost, based on national averages.**

For example, a refrigerator uses almost five times the electricity the average television uses. Not surprisingly, pools and spas are energy hogs.

Visit **www.energysavers.gov** for instructions on calculating the electrical use of your appliances.

SOURCE: DOE




Brought to you by NV Energy

# Faucets & Fixtures 09

## Save water without sacrificing performance.

Faucets and fixtures are more miserly than ever before, but your behavior plays an important role, too.

THE FAUCET AND fixture industry has consistently delivered the eco-friendly goods. Their products get more efficient and more durable almost every year, yet remain remarkably affordable. Every year, bath, kitchen and laundry gadgets help us reduce water usage by about 5 percent. But as a nation, we're still slipping—using about the same volume of fresh water every year. Why? Because the U.S. population grows at about 5 percent per year.

The problem, says author and water expert Robert Glennon, is that the total amount of fresh water available is getting smaller. Some sources have become polluted. Groundwater that takes decades to replenish is being drained like there's no tomorrow. Dry times lie ahead, unless we all change our habits along with our fixtures. It's time to treat fresh water like blue gold.

It's important to make sure all the faucets, fixtures and showerheads in your home are on their best behavior. That means installing the most durable, water-stingy, appropriately priced models available. If you're not sure how to recognize these parameters, here's a quick overview.

### FAUCET FUNCTION

**Better Technology**

In modern faucets, ceramic washers have largely replaced rubber ones. These diamond-hard discs should last forever. But in our experience, that's not always the case. We've seen less expensive faucets and shower handles, even ones with ceramic discs, develop leaks within a year or two of installation, possibly because other parts of the assembly are not as tough. Fortunately, many faucets—even low-cost ones—now come with limited lifetime warranties that cover all part failures for the original owner. Still, who wants to chase down warranties? The easiest solution: Spend a little more up front for a brand that cares about its reputation, and chances are you'll get a better made, more durable product.

### FAUCET FINISHES

**New Durability**

Ever heard of physical vapor deposition finish? It's just one of the high-tech finishes being used on faucets. With these advanced surface treatments, alternatives to chrome (one of the longest lasting finishes) make more sense. In some cases, metals such as bronze and brushed nickel are simply protected with a polymer coating. In others—Delta's "Brilliance" finish comes to mind—the coating emulates a metal such as brass.

The green angle? Durability. When faucets corrode, people throw them away, whether or not the mechanics still perform properly. Tossing functional hardware in the landfill is not a green choice.

### PLUMBING

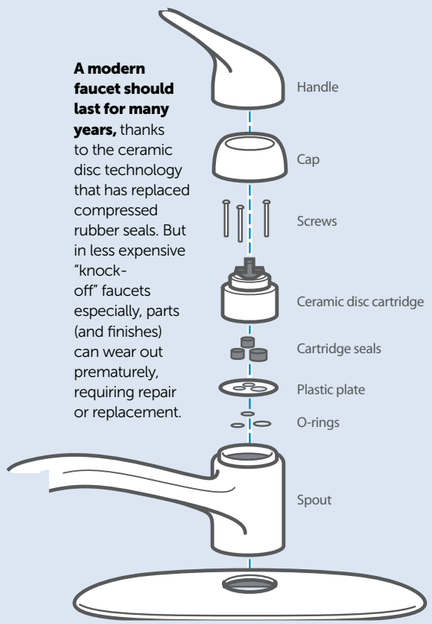
**Think Flexible**

Flexible PEX (crosslinked polyethylene) plumbing has become

*continued on page 42*

### Faucet Anatomy

**A modern faucet should last for many years,** thanks to the ceramic disc technology that has replaced compressed rubber seals. But in less expensive "knock-off" faucets especially, parts (and finishes) can wear out prematurely, requiring repair or replacement.

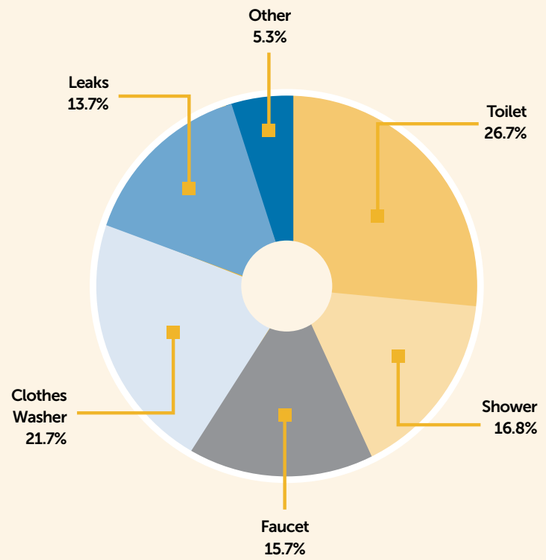



### Glossary of Terms
### Know the Lingo

- **Low-Flow Toilet:** Also known as a low-consumption toilets, these fixtures typically using a maximum of 1.6 gallons per flush.
- **Ultra-Low Flush:** Another term to describe low-flow fixtures, this may also refer to a single- or dual-flush model that uses as little as .8 gpf.
- **Aerator:** Small screened device that fits inside a faucet nozzle, mixing air into water so less is required to do the same chore.
- **Widespread Lavatory Faucet:** Refers to the style of faucet, typically one with two separate handles, 8" apart.
- **Physical Vapor Deposition (PVD):** High-tech finishing technique that allows for faucets with many different looks, including "metal on metal" surfaces that are extremely corrosion and wear resistant.
- **PEX Tubing:** Crosslinked polyethylene plastic pipe. Increasingly popular as a replacement for PVC or copper plumbing.
- **Cartridge Faucet:** Most modern faucets contain ceramic cartridges that allow water to flow, whereas older faucets used compression—squeezing a rubber o-ring that would eventually wear out.



**Daily Residential Indoor Water Use** (Before Conservation Measures)




**If all U.S. households** installed water-saving features, water use would decrease by 30 percent. This would save an estimated 5.4 billion gallons of water per day, resulting in daily dollar-volume savings of $11.3 million, or more than $4 billion per year.

**The largest daily user** of water in the home is the toilet. By replacing this one product with a high-efficiency toilet (HET) you can greatly reduce a home's total water use.

**The next step** would be to install a bidet, which would cut overall residential water use by hundreds of gallons a day (what it takes to make toilet paper).

SOURCE: AMERICAN WATER WORKS ASSOCIATION RESEARCH FOUNDATION, "RESIDENTIAL END USES OF WATER"

widely accepted as a substitute for other standards of household plumbing. Fittings have improved, problems are rare, and most plumbers have come to embrace the technology.

From a green perspective, tubing made from high-grade plastic is a welcome alternative to vinyl-based PVC pipe. And from a practical perspective, PEX is ideal for tricky retrofit jobs, because the flexible tubing can snake around obstacles, so you can avoid unnecessary demolition.

## SUPER TOILETS

### Water Misers

The toilet efficiency race has been a big win for the environment. We've seen models with water usage of less than .8 gpf in dual-flush models, and a 1-gpf single-flush model. Flush technology is probably approaching its bottom limit.

But other approaches may squeeze water savings. For example, graywater-fed toilet tanks are now on the market (ones that use lavatory water to fill the toilet tank), along with hand-washing faucets built right into the top of the tank.

Manufacturers will continue to tweak toilet efficiency, no doubt, but the biggest gains could probably be made by simply adjusting our behavior: "If it's yellow, let it mellow." **GB**

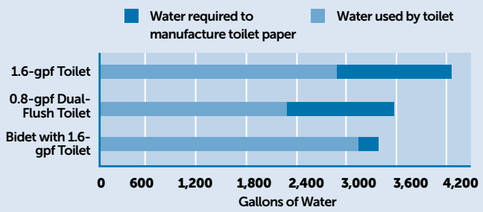
## The Benefits of Bidets

Bidet toilets work by using water, rather than toilet paper, to clean the nether regions. Bidets save more water indirectly by eliminating the need for toilet paper, the manufacture of which is a water-intensive process. But is a bidet really a better choice than, say, a water-efficient dual-flush toilet?

Annual toilet paper use in the U.S. tops out at 36.5 billion rolls. This equals 473,587,500,000 gallons of water and 15 million trees—and that doesn't account for the additional water required to treat and dispose of toilet paper waste. As the chart shows, a bidet attachment in combination with an efficient toilet saves about 200 gallons of water annually, compared to a dual-flush toilet. Other advantages? Water cleans better and is less abrasive than toilet paper, and bidets keep hands free—and clean.

If you're ready for a hands-free toilet, you don't have to purchase a new one; instead, you can opt for a bidet seat attachment. Depending on the model you choose, the money saved by crossing toilet paper off the grocery list will potentially pay for the bidet seat in a matter of months.

**Annual Water Use in Gallons (Per Person)**




**Water Savings?** For this analysis, we assumed bidet users would still require 20 percent of the toilet paper as "conventional" toilet users, and would require 0.125 gallons of water per use, in addition to the water required for flushing.

# What makes a BATH green?

**Waterproof Tile Installation**
Standard grout is not waterproof! It must be coated every two years or so to keep water—and mold growth—out of walls. Behind the walls and floors, a waterproofing system such as the one shown below from Schluter (**www.schluter.com**) can add many years of leak-proof performance to a shower and/or floor.

**Moisture Removal**
Trapped moisture is the major cause of mold and mildew in bathrooms. Installing a quiet ventilating fan (not shown) is essential. New models have moisture sensors that turn the fan on automatically.


**Water-Saving Faucets**
Well-designed faucets contain ceramic washers that outlast the rubber washers of past decades. They're not as likely to develop leaks and they restrict water flow, without feeling stingy. High-tech finishes prevent corrosion.

**Avoid Toxic Cleaners**
Keeping highly toxic cleaners such as bleach and clog removers under your sink is a good way to pollute your bathroom air. Purchase non-toxic cleaners instead, and make your bathroom a friendly place for kids and pets—as well as adults.

**Low-Flow Toilets**
The best new low-flow toilets, such as the *Archer* toilet from Kohler pictured here, use as little as 1.28 gallons per flush. Some dual-flush toilets require even less.

IMAGE: VISION HOUSE® TUSCON (**LATHAMARCHITECTURAL.COM**)

## PRO TIP:


**Epoxy Grout.** One way to reduce the maintenance requirements for grout in a custom shower or bath floor is to apply epoxy grout. Much more resistant to mold and mildew than standard grout, it costs more and requires more skill to apply, but has major durability advantages. A Laticrete product is shown.

# Finishes 10

## What's on the surface counts.

Make sourcing paints and adhesives with no VOCs top priority, but don't forget about proper application and maintenance of these products.

PAINTS AND ADHESIVES in the United States have come a long away. They no longer contain lead or other heavy metals. Most contain only a fraction of the volatile organic compounds (VOCs) they did ten years ago. Oil-based (alkyd) paints have largely been replaced by water-based latex products. But the conversion hasn't always been smooth, and it's far too early to declare "mission accomplished."

Some of the first brands of ultra low-VOC products got a bad rap a few years ago. These new paints were not as stable, harder to apply and almost impossible to find. They set back the transition to "green" paint, especially among contractors.

But those quality problems have been solved. Most of the latest generation of low-impact paints and adhesives perform almost as well as their solvent counterparts. But beware of exaggerated green claims. Some companies like to hint that their paint brands are eco-friendly, when they're really just doing the bare minimum—meeting regulatory standards. The same consumer caution should apply to adhesives. Remind yourself that the color of a product's container or labeling may have nothing to do with what's inside.

As you consider low-VOC, no-VOC and other emissions claims, here are some points to consider.

### Glossary of Terms
### Know the Lingo

- **Volatile Organic Compounds (VOCs):** Toxic ingredients common in paints, adhesives and many household items that are released into the air.
- **Hazardous Air Pollutants (HAPs):** These substances were listed in the 1990 Clean Air Act Amendments. Here's the EPA list: **http://www.epa.gov/ttnatw01/187polls.html**
- **Alkyd:** Commonly referred to as "oil based," this type of coating is typically higher in VOCs than waterborne paint, containing a petroleum-based solvent and a binder of synthetic resin.
- **Acrylic Latex:** This widely used finish uses water as a solvent, and tends to be lower in VOC content than alkyd products, although it may offgas more slowly.
- **Breathe:** How well a paint allows water vapor to pass through it without blistering or failing.
- **Back Priming:** Coating the back or hidden face of siding or trim prior to installation as an added measure of protection from moisture.

### VOCS
#### They're Not the Only Villains

Just because a paint is low in volatile organic compounds doesn't mean it's safe to apply it in your home without wearing property safety gear—or that it won't release other dangerous pollutants. VOCs are just one category of paint ingredient. Even if a paint contains no VOCs at all, it may contain hazardous airborne pollutants (HAPs). These take the form of both gases and tiny particles that have been shown to cause respiratory trouble,

*continued on page 47*


**Mythic Paint**

Mythic has been a leader in the no-VOC category of paints. The company also offers some information about other toxins such as formaldehyde that are not in its products, although it could go further to identify other ingredients.
**www.mythicpaint.com**

**VISION HOUSE® AT MARIPOSA MEADOWS PRODUCT**

**BEHR *Premium Plus* Interior Paint**

Behr *Premium Plus* interior paint is GREENGUARD Gold certified, and offers homeowners more than 4,000 color choices in semi-gloss, flat, eggshell and base finishes. The zero-VOC formula is a low-odor and self-priming product.
**www.behr.com/consumer/home**

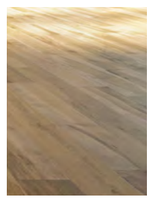
# What makes FINISHES green?

**Clean-Air Paints**
Use only no-VOC or extremely low-VOC paints in the home. Bear in mind, however, that low-VOC products can still contain toxins. Sometimes, VOCs are replaced with something worse. If you want truly toxin-free you'll have to go with something such as a milk-based or organic paint.

**Caulking Considerations**
Certain types of caulking can contribute to indoor air pollution. But in our view, caulking *quality* matters too. If you use a 100% silicone product, it will offgass quickly. Once it dries, you're in the clear.

**Floor Finishes**
Whenever possible, order pre-finished floors, whether hardwood or bamboo. Finishing them at home without creating a lot of air pollution is tough. The Lauzon *Pure Genius* flooring pictured here uses a titanium finish that reacts with sunlight to break down VOCs and other chemicals.

**Formaldehyde-Free Millwork**
It's more challenging than you might think to find cabinetry and shelves that are not loaded with chemicals and other ingredients harmful to human health. Ask for CARB-approved plywood or real-wood shelves and sides. If the only products available are medium-density fiberboard, make sure you choose a brand that has very low formaldehye content. Seal unfinished sides with *Binz* or some similar product to contain the offgassing.



**Lauzon *Pure Genius* Flooring**

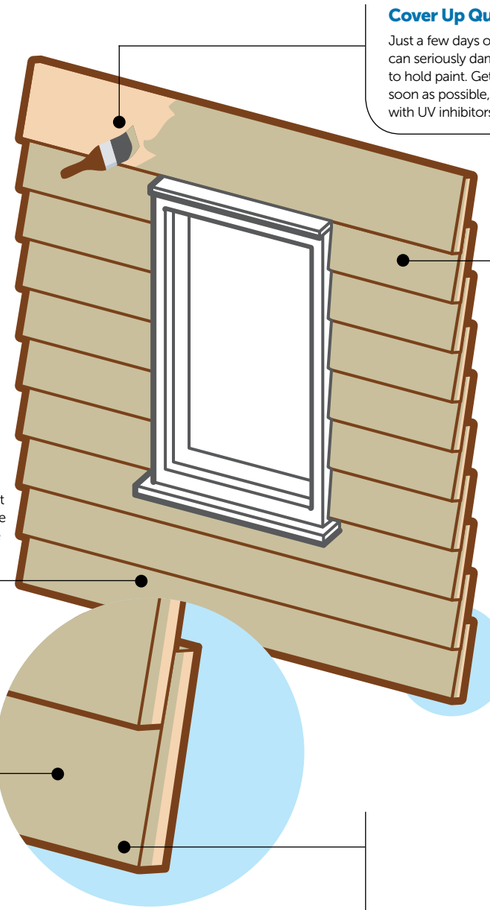
Forget smartphones, Lauzon's *Pure Genius* flooring is a smart floor, cleaning the air in your home by breaking down airborne toxins, such as VOCs. The filtering power of *Pure Genius* flooring is the equivalent of having three mature trees in your home, purifying the air up to 85 percent and reducing potential carcinogens that may lead to allergies and asthma.
**www.lauzonflooring.com**

## PRO TIP:

**Tile Is Always an Option.** Floor tiles, installed carefully produce almost no harmful offgassing. Some brands, such as Crossvile's *Virtue* line, contain 4 percent recycled content and are Green Square certified. The porcelain tile also can be treated with *Hydrotect*, a fired-on coating developed with TOTO Corporation, that's comprised of a triple silver-copper-titanium dioxide mixture. The coating has antimicrobial, dust-repelling, self-cleaning and even air-purifying effects.

# Exterior Paint: Making It Last

UNFORTUNATELY, PAINTING YOUR home is not a green activity. Why? Because products such as acrylic latex have a very high embodied energy—producing them takes a toll on the environment. It's key, therefore, to maximize paint durability. You might think that switching to vinyl siding is a more "permanent" solution, but vinyl products come with a different set of environmental drawbacks. There's no perfect solution. You can, however, take several steps to make sure paint lasts as long as possible on your new siding. Old siding is a bigger challenge, but in general, the same rules apply.



### Cover Up Quickly

Just a few days of exposure to UV rays can seriously damage the ability of wood to hold paint. Get a coat of primer on as soon as possible, preferably a product with UV inhibitors.

### Use Durable Fasteners

It's easy now to find exterior fasteners that will not rust and stain wood. Spend a little extra for the best fasteners you can find. You may add years to the viability of each paint job.

### No Freezes, Please

Water-based paints that have been stored too long may lose their chemical consistency. Worse, if they're allowed to freeze, their performance may suffer. Don't risk painting with a compromised can of paint. The amount of labor versus the price of new paint makes that a bad deal.

### Order Pre-Primed Wood or Fiber Cement

Boards that are pre-primed in a factory tend to hold their paint longer than siding that's painted in place. This is true for several reasons. First, if handled properly, factory-painted wood tends to be coated only when the wood reaches an optimal level of moisture saturation, typically about 15 percent. Also, the primer is usually applied to the front side, back side and ends of each board. Note that it's key to recoat primed ends after cutting.

### Play Rough

Research has shown that boards with a slightly rough texture tend to hold paint much better than smooth sanded surfaces. If ordering cedar, pine or other natural finishes, ask about different texture options.

### Choose Cool Colors

Paints exposed to regular cycles of extreme heat undergo more stress, shortening their useful lifespan. One simple solution is to specify lighter colors on wood exteriors, especially in hot climates on the sides of the home that get several hours of sun each day.

### Seal End Grain

Often, siding and trim boards weather and crack on the ends—for a simple reason: They were not coated properly when the rest of the home was primed and painted. If possible, coat them with a good sealer before installation.



especially for people with asthma. Household cleaners and bath products often contain both VOCs and HAPs as well, so you can't blame paint for all your indoor air quality issues, but when selecting a finish or an adhesive or caulk, make sure the manufacturer gives a full account of all potential pollutants, not just VOCs.

## FACTORY FINISH

### A Green Idea

For certain painting and finishing projects, doing the job at home may not be the best option, if you want to limit the volume of pollutants released inside. For cabinets, shelves and flooring, you often have the option of a "baked-on" factory finish. This may require an extra day or two for delivery, but it's well worth the time and cost for people sensitive to paint fumes. At the factory, high heat speeds the paint or stain's release of VOCs and other toxins. That accelerated pollution happens in a controlled environment, not inside your home.

## ADHESIVES

### The Fine Print

Like paints, adhesives are now marketed as low-VOC and eco-friendly. But as with paint, it's important to get all of the facts—not simply to accept the branding pitch. For example, Gorilla brand last year released *Gorilla PVC*, an adhesive for use in PVC plumbing—a product it markets as "eco-friendly." But if you read the fine print, the glue contains contains N-methylpyrrolidone (NMP), "a chemical known to the State of California to cause birth defects or other reproductive harm."

## CAULKING

### Seal the Deal

For the most part, latex-based caulkings tend to release less toxins during application and initial drying than their solvent-based counterparts.

But the verdict is still out about how latex products impact air quality over the long term. It's important, however, with both paints and caulkings, never to use exterior products indoors. They tend to contain more volatiles.

There's also the question of durability. While 100 percent silicone caulk produces strong initial offgassing (some of which is from vinegar in the mix) it's also likely to perform better than an acrylic-latex based product, particularly in wet areas.

As you can see, choosing a green paint or adhesive is not always as easy as reading a label. You have to shop carefully, understand how and when this product should be applied, and weigh whether the product's air quality benefits are as good as they sound. **GB**

## Standards for Low-Emitting Materials

### Green Seal VOC Content Standards: Paints and Finishes

**Low-Emitting Materials: Paints and Finishes Requirements**

**The Standard sets emission limits (measured as predicted concentration in air) for particulate matter, formaldehyde and other chemicals; GREENGUARD Gold certification also sets emission limits for specific VOCs.**

| | |
|---|---|
| Flat finishes: | 50g/L |
| Non-flat finishes: | 150 g/L |
| For anti-corrosive and anti-rust paints applied to interior ferrous metal substrates, the limit is somewhat higher: | 250 g/L |

**For clear wood finishes, floor finishes, stains, sealers and shellacs applied to interior elements, the VOC content limit is as follows:**

| | |
|---|---|
| Clear wood finishes: | 350 g/L for varnish |
| | 550 g/L for lacquer |
| Floor finishes: | 100 g/L |
| Sealers: | 250 g/L for waterproofing sealers |
| | 275 g/L for sanding sealers |
| | 200 g/L for all other sealers |
| Shellac: | 730 g/L for clear |
| | 550 g/L for pigmented |
| Stains: | 250 g/L |

### GREENGUARD Total VOCs Emission Thresholds: Building Products and Interior Finishes

**The Standard sets emission limits (measured as predicted concentration in air) for particulate matter, formaldehyde and other chemicals; the GREENGUARD Gold certification standard also sets limits for specific VOCs.**

| | |
|---|---|
| GREENGUARD: | 500 µg/m3 |
| GREENGUARD Gold: | 220 µg/m3 |

SOURCES: WWW.LEEDUSER.COM AND INDUSTRIES.UL.COM


Brought to you by NV Energy

# Cabinets & Tops 11

## Make sure they're green, inside and out.

From the incorporation of recycled materials to the use of non-toxic finishes, many makers of cabinets and countertops are finally offering truly green options.

BACK IN THE MID-1990S, it was almost impossible to find off-the-shelf cabinetry that didn't contain particleboard saturated with formaldehyde, with the exception of one or two semi-custom high-end or European manufacturers. It's easier now, but primarily because of the efforts of small-scale cabinet shops. The U.S. cabinet industry at large, like the carpet industry, has been a follower—not a leader—in the arena of environmental responsibility and pollution control.

In 2006, the Kitchen Cabinet Manufacturers Association (KCMA) launched an in-house sustainability benchmark called the Environmental Stewardship Program (ESP). The program has some flaws, but at least it's a move toward the light. Many firms have used ESP guidelines as a baseline for how to improve sustainability. Keep in mind that not every green cabinet line will be KCMA certified, any more than every eco-friendly builder's work is LEED certified. But those that do get the ESP seal have at least taken some steps to clean up their practices and products.

### Glossary of Terms
### Know the Lingo

- **Particleboard:** Wood chips bonded together with resins that frequently contain air pollutants such as formaldehyde.
- **Medium-Density Fiberboard (MDF):** An engineered wood often used in cabinet door construction. MDF may also contain volatile air pollutants.
- **Veneer:** Thin layer of wood typically glued to a less valuable substrate. Both the adhesive and the substrate can contribute to indoor air pollution, depending on the glues used.
- **Substrate:** A panel that's used underneath higher value finish materials. In cabinetry, substrates typically are made of plywood, particleboard or other engineered wood products.
- **Surface Seal Paint:** Some finishes, such as AFM Safecoat *Hard Seal*, have a low enough permeability that they can be used to prevent or slow the release of air pollutants from particleboard and other resin-bonded materials.

ESP offers manufacturers 105 possible points. They have to get 80 to qualify for certification. It should be noted that they *self certify* by sending in documentation (often from other industry-friendly organizations such as the Composite Panel Association) to prove that they have met certain criteria.

A cabinet company looking for the ESP label must achieve a

*continued on page 51*

**VISION HOUSE® AT MARIPOSA MEADOWS PRODUCT**

### CaesarStone Countertops

CaesarStone Quartz Countertops are available in 70 colors and textures. *Chocolate Truffle* is part of the *Recycled Collection*, which includes up to 42 percent recycled content reclaimed from fabrication and from recycled glass and mirrors. CaesarStone countertops are mold and mildew resistant, meaning clean-up requires just soap and water. **www.caesarstoneus.com**

### Eco-Friendly Cabinets from Neil Kelly

These truly green cabinets are made with bio-based Agriboard and FSC-certified wood veneers; all finishes, stains and adhesives are non-toxic, with no added formaldehyde. The company recently released its Declare-labeled *Naturally Northwest* cabinet collection, which is offered in seven wood species, including Western juniper. **www.neilkellycabinets.com**

# What makes CABINETS and TOPS green?

**Recycled Countertops**
Many varieties of durable, partly recycled countertops are now available, such as PaperStone. Other option include quartz-based products such as Vetrazzo, or the Cambria countertops pictured here. These materials require far less environmental impact than imported stone such as granite.

**Solid Wood Construction**
Finding kitchen cabinets and shelves that are made with zero formaldehyde or other offgassing substances can be challenging. Most of the MDF used for shelves and doors (commonly known as particle board) used in cabinets tends to offgass for months—or even years. One workaround is to have a local woodworker make them. The Wellborn cabinets pictured here are from sustainable forests and are formaldehyde-free.

## PRO TIP:

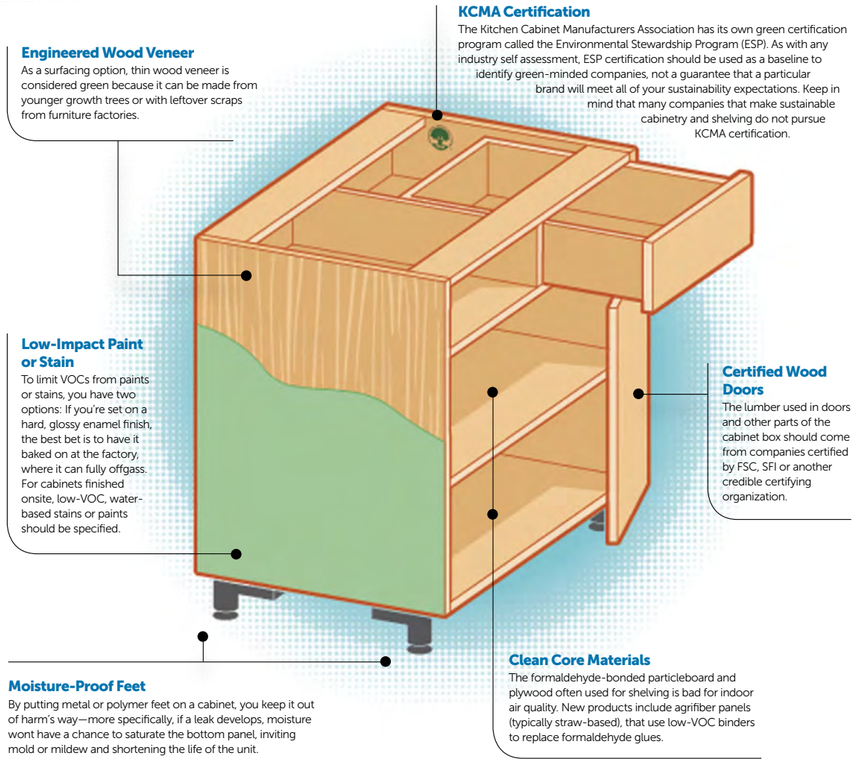
**Remember the Range Hood.**
If you go to all this trouble to keep the air clean in your kitchen, then fail to install an vent fan on your range, you will be disappointed in the overall air quality in your home.

**Safe Finish**
Try to use water-based final coatings for your cabinet and floors. Spend extra to buy the most durable finish you can find. Every time you have to re-coat surfaces, you introduce toxins back into your living space—and extract more resources from the natural world. Pictured are Wellborn Hanover-style cabinets in Cherry.

PHOTO: GREENHAVEN KITCHEN IN ATLANTA, GEORGIA FEATURING WELLBORN CABINETS
**WWW.WELLBORN.COM**

## What Makes a Cabinet Green?

INSPIRATION FOR THIS IMAGE:
**CRYSTALCABINETS.COM**



**Engineered Wood Veneer**
As a surfacing option, thin wood veneer is considered green because it can be made from younger growth trees or with leftover scraps from furniture factories.

**KCMA Certification**
The Kitchen Cabinet Manufacturers Association has its own green certification program called the Environmental Stewardship Program (ESP). As with any industry self assessment, ESP certification should be used as a baseline to identify green-minded companies, not a guarantee that a particular brand will meet all of your sustainability expectations. Keep in mind that many companies that make sustainable cabinetry and shelving do not pursue KCMA certification.

**Low-Impact Paint or Stain**
To limit VOCs from paints or stains, you have two options: If you're set on a hard, glossy enamel finish, the best bet is to have it baked on at the factory, where it can fully offgass. For cabinets finished onsite, low-VOC, water-based stains or paints should be specified.

**Certified Wood Doors**
The lumber used in doors and other parts of the cabinet box should come from companies certified by FSC, SFI or another credible certifying organization.

**Clean Core Materials**
The formaldehyde-bonded particleboard and plywood often used for shelving is bad for indoor air quality. New products include agrifiber panels (typically straw-based), that use low-VOC binders to replace formaldehyde glues.

**Moisture-Proof Feet**
By putting metal or polymer feet on a cabinet, you keep it out of harm's way—more specifically, if a leak develops, moisture wont have a chance to saturate the bottom panel, inviting mold or mildew and shortening the life of the unit.

## COMMUNITY ACTIVIST PROFILE

### Sustainability Strategists

While **Maria** and **Bob Kingery** work with individuals and developers on energy efficiency and renewable energy strategies, they make sure they are also "walking the walk."

"The same quantifiable measurements we give other companies we give to ourselves," says Maria, co-founder of Southern Energy Management in Morrisville, North Carolina. The company has grown from their living room to a team of more than 50 professionals dedicated to sustainable home energy, efficient building practices and smart energy solutions for businesses.

The couple's work has helped transform their state into a leader in both the solar PV and home certification markets. More recently, SEM developed an "entry-level" green building program called ecoSelect.

As president of the North Carolina League of Conservation Voters, Maria also leads the charge on measuring the efficacy of legislators and their participation on environmentally-related legislation. She contributed to a number of statewide initiatives, including the State Energy Sector Partnership, a "green grant" program that funds training and education in the clean energy sector.

*By Lisa Iannucci*



minimum number of points in each of the following categories:

| | |
|---|---|
| Air Quality | 30 |
| Product Resource Management | 30 |
| Process Resource Management | 20 |
| Environmental Stewardship | 15 |
| Community Relations | 10 |

Some points are sound—such as the 5 points awarded under ESP for "reviewing the environmental practices and policies of its key vendors and contractors," although *reviewing* it should be noted, does not guarantee any changes. Unfortunately, other point criteria act as loopholes that weaken the program. For example, a company can earn 10 points in Air Quality if "75 percent of finished products are finished domestically, and finishes used emit no greater HAPs (hazardous air pollutants) than allowed by local plant operating permits." We'd call that simply playing by the rules. They also can earn 5 Community Relations points for not getting any citations "from any federal, state or local environmental regulatory agency in the previous 12 months." Again, they can rack up points simply for staying on the right side of regulations. Our point is not to bash the KCMA, but to urge its many members to think much bigger about what it means to be green. We often write about ESP-certified cabinet brands that are being used in our demonstration homes and other projects. We know these companies, and they've indicated that they want to get real about sustainability. We believe they're sincere, and we expect exciting new cabinet products soon.

Homeowners and builders have been frustrated too long by the lack of readily available green cabinetry and shelving. It's time to give them more options. For people with asthma, chemical sensitivity, or infants in the house, the only alternative in the past has been to take matters into their own hands, to have their cabinets custom built and finished with low-VOC paints, or to seal in VOCs and formaldehyde with surface sealing paints. They shouldn't have to work so hard.

A few brands are pointing the way by offering low-VOC waterborne finishes and safer adhesives, along with straw core shelves and wood for both door faces and veneers that is certified by the Forest Stewardship Council. Change is coming. **GB**

## Countertops: What's the Difference?

● Excellent ◓ Very good ● Good ◒ Fair ○ Poor

| Material | Price per sq.ft. | Overall score | Test results: Stains | Heat | Abrasion | Impact |
|---|---|---|---|---|---|---|
| **Quartz** (engineered stone) | $50-100 | 79 | ◓ | ● | ● | ◒ |
| **Granite** | 45-200 | 78 | ◒ | ● | ● | ◒ |
| **Laminate** | 10-30 | 78 | ● | ● | ● | ◓ |
| **Solid surfacing** | 35-100 | 62 | ◒ | ◒ | ◒ | ◓ |
| **Tile** (ceramic and porcelain) | 10-30 | 58 | ● | ● | ◓ | ● |
| **Concrete** (topical sealer) | 80-120 | 53 | ◒ | ◒ | ● | ○ |
| **Stainless steel** | 100-150 | 52 | ◓ | ● | ◒ | ○ |
| **Concrete** (penetrating sealer) | 80-120 | 38 | ◒ | ● | ◒ | ○ |
| **Limestone** | 60-100 | 36 | ◒ | ● | ◒ | ○ |
| **Marble** | 50-140 | 26 | ● | ◒ | ○ | ○ |

SOURCE: CONSUMER REPORTS

*Consumer Reports* analyzed various attributes of common countertop materials, including how it handles staining, heat, abrasions and impact. Quartz (engineered stone) got the highest marks, with marble coming in last, primarily because it doesn't hold up well against abrasions and impact. While both quartz and granite garner high scores, it's important to remember that large amounts of energy are required to transport these stones, so it's best to look for a local fabricator. Stainless steel has become quite popular in contemporary kitchens, but it is susceptible to scratching. – *Editor*


Brought to you by NV Energy

# Alternative Energy 12

## Weaning homes off fossil fuels.

Renewable energy systems can take a well-designed, energy-efficient home to net-zero energy status.

PRODUCTION OF ELECTRICITY and hot water at home using natural energy from the sun is nothing new. But technologies have greatly improved over the past few years. Not only do they cost less to install, but they're more reliable, more efficient—and simply a better deal. In addition, the supporting hardware is vastly superior to the old stuff. The politics of alternative energy is changing too, albeit more slowly than many would like. In many states, utilities are now required to buy back any "extra" electricity you produce. And both wind turbines and solar installations are eligible for 30 percent tax credits with no upper limit from the federal government, plus certain state and utility incentives. If you're looking at alternative systems, here's some essential information.

### WIND TURBINES

#### Lighter Wind Demands

Small-scale wind turbines that create electricity have always been a fairly specialized form of power generation—most valuable in mountainous and coastal regions. The challenge has been to build a turbine that produces adequate electricity, even in low wind, to make it worth the cost. We're getting much closer. For example, both the Swift (**www.swiftwindturbine.com**) and the Skystream (**www.skystreamenergy.com**) turbines begin producing power in winds of just 8 miles per hour.

The advantage of wind power over PV? The wind often blows when it's dark outside. But before you buy, take a look at the *continued on page 64*

**Glossary of Terms**

### Know the Lingo

- **Inverter:** Device that converts direct current (DC) electricity into alternating current (AC), the type of power most commonly used by U.S. appliances and light fixtures.
- **Grid-Tied:** Electricity produced on site (from photovoltaic panels, wind turbines, etc.) is fed directly into local power lines, rather than being stored in batteries.
- **Cogeneration:** Production of electricity from heat that would otherwise be wasted, such as hot flue gases produced by a gas-powered furnace or boiler.
- **Wind Maps:** Useful for siting (and evaluating the viability of) wind turbines, wind maps show how much wind can be expected in a geographic region or specific site.
- **Building Integrated Photovoltaics (BIPV):** Electricity generating solar panels that have been designed to resemble various familiar types of roofing.
- **Standby Heat Loss:** Heat lost by hot water that is sitting passively in a storage tank or pipes. Super-insulated hot water tanks greatly reduce this loss.

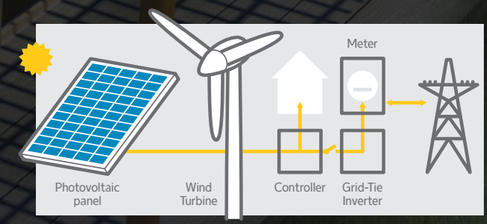


# Will you go "OFF THE GRID?"

**Solar Living**
The Tidewater Virginia house was part of the 2013 Solar Decathlon, which exhibits self-sufficient and elegant demonstration houses in a solar village setting.

**PRO TIP:**

**Make Ready.** Even if you don't plan to install solar electric panels or solar hot water now, if you pre-wire and pre-plumb, you can save thousands on a later installation.




**Different Approaches to Solar at Home**
Creating electricity with either photovoltaic panels or wind turbines typically begins with production of direct current (DC) electricity. That current then passes through a transformer to become the typical alternating current (AC) used in almost all homes (aside from some RVs and boats). Most modern systems do not include battery storage, simply because battery technology has not matured enough to warrant the expense and environmental impacts. That may change in the next few years, but for now, the best bet is a grid-connected system that can later be reconfigured for advanced batteries.

TIDEWATER VIRGINIA HOUSE RENDERING
HAMPTON UNIVERSITY AND OLD DOMINION UNIVERSITY
COURTESY U.S. DEPARTMENT OF ENERGY SOLAR DECATHLON

national wind map published by the National Renewable Energy Laboratory (NREL). You'll see that not every area of the United States is well suited for wind-powered living. In fact, if you live in any of the Southeast states—and you don't have a place right on the water—wind is a long shot. You will make a lot more power with a good solar PV setup.

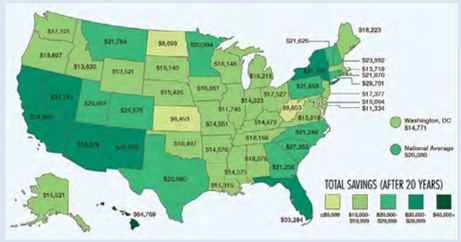
## PHOTOVOLTAICS

### Looking Sharp

The race is on to build better PV cells that convert sunlight to electricity. New solar films and panels are being tested that are more efficient, less expensive and lighter than ever. The current challenge is to find a more affordable alternative to the polycrystalline silicon based panels that dominate the market. But while that R&D is going on, existing solar products are becoming more practical. For example, Sanyo recently came out with double-sided solar panels that can simultaneously provide shade (in the form of an awning), and take in sunlight on both the top and bottom surfaces.

At the same time, the range of building integrated photovoltaics (BIPV) has exploded. That's good news for homeowners. It means you can now have a solar generating system built right into your roof that looks like asphalt shingles or architectural metal or even clay tiles. And, as we mentioned earlier, many states require utilities to buy any leftover electricity you generate. One of the key improvements in BIPV in recent years has been the way they connect to each other and your home's power system. The early products were co-dependent. In other words, when the connection broke on a solar shingle, the whole roof stopped producing. Newer systems have built-in redundancy in their wiring, and most are more modular, making replacement of a single faulty tile or panel less of a hassle.

## SOLAR SAVINGS




### What You Could Save Over Time

What would you do with an extra $20K? That's how much the average solar system will save you over 20 years. Residents in states with high electricity rates, such as Hawaii, can expect to save even more.

SOURCE: ONE BLOCK OFF THE GRID

## SMALL-SCALE COGENERATION

**The freewatt *Plus* warm air system** captures waste energy from a furnace component and converts it into electricity, producing 1.2 kW whenever the furnace is running. It also provides backup power during an outage. **http://tinyurl.com/qjrtmvw**

## SOLAR HOT WATER

### Smart Storage

The availability of extremely durable hot water storage tanks—which in some cases also serve as water heaters—has made solar hot water collection even more viable. Many tanks now include a separate closed loop of a freeze-resistant liquid. That extra loop is specifically for solar hot water—so that when the sun is shining, the solar panels on the roof heat the clean water in the tank. But when the sun is not sufficient (or you have teenagers using up the "free" hot water) an external boiler or heating system built into the tank kicks on to make up the difference.

One of the great advantages of a solar hot water system is the relatively rapid payback. In other words, if you install this year, it may pay for itself in less than three years, especially once you figure in the tax credits and rebates available.

## COGENERATION

### Waste Not

Cogeneration has been common at large factories for decades. It's basically a way of squeezing more work out of fossil fuels. Also known as combined heat and power (CHP) generation systems, these mechanical wonders put the waste heat generated by a home furnace or boiler to work making electricity. By some estimates, they achieve 90 percent efficiency, compared with 30 to 40 percent from your local power station. If you're already replacing or installing a new boiler or furnace, why not take it to another level and try cogeneration? **GB**