



# THE WORLD AT HOME

## A Household Guide to Building Green



Citizens' Environmental Coalition is a statewide environmental health organization consisting of 110 groups and 14,000 individual members working to eliminate pollution and to protect human and ecosystem health by serving as the nexus for local communities, state policies, and national collaborations.

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# Preface

**A**MERICA IS EXPERIENCING A NEW LEVEL OF ENVIRONMENTAL awareness. Across the nation, state and local governments are setting higher standards for environmental protection. Here in New York, we are taking the lead in energy conservation efforts, including Governor Spitzer's ambitious plan to reduce energy consumption in New York by 15% by the year 2015.

Not since I helped organize the first Earth Day in 1970 have I seen Americans so focused on environmental issues and environmental stewardship. Our challenge—as citizens, consumers, and voters—is to ensure that this heightened environmental awareness is not just a passing fad.

The message of this guide is simple: each of us can begin to save our natural resources by reducing the environmental impact of our homes. A simple compact fluorescent light, for example, saves 150 pounds of carbon dioxide a year and cuts electric use in half. Purchasing renewable energy from your utility nearly eliminates a home's contribution to greenhouse gases. And using sustainable building products preserves natural assets and reduces waste.

By using this guide to “green” our homes, we can help avoid environmental problems and move closer the ultimate goal of sustainability. As Commissioner of the Department of Environmental Conservation, I will do all I can to promote green building and environmental stewardship on the state level. This publication will help you do yours.

Alexander B. “Pete” Grannis  
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## INTRODUCTION

# Why Build Green?



**T**HERE ARE FEW LIFESTYLE CHANGES that impact the environment and our own health and safety as poignantly as the choice to build green. The built environment is, after all, where we live – people spend an estimated 65% to 90% of their time in indoors, yet these surroundings are not seen as greening opportunities for many of us.

That being said, it is important to note early on that “green” isn’t easy to define. Minimizing green house gas emissions, conserving natural resources, reducing workers exposure to toxic chemicals and keeping indoor air quality safe for our families are all reasons to build greener, and measures by which to evaluate building decisions and materials. It’s a difficult job to weigh all these factors against one another – while some building products will save old growth forests, they may be more energy intensive to produce. While tightening up a home saves energy costs, a home with little air flow can have higher levels of indoor air pollution. Sometimes weighing these costs and benefits can be like comparing apples to oranges – comparing the manufacturing impacts of one product with the indoor air quality impacts, energy efficiency, or long-term durability of another.

We can’t always come to clear-cut solutions, but interpreting the confusion and doing the research can be part of the fun. We created this guide to improve your knowledge and decision-making ability, to help you choose building materials that are safer for your family and more environmentally friendly while still being cost-effective.

Perhaps you’re reading this guide because you care about the environmental impact of your latest renovation project or new home construction. Maybe you’ve heard about some of the toxins in certain building supplies, and you’re interested in avoiding these exposures.

As a builder or architect, you may be looking for a brief introduction to a growing market as more and more people make the choice to build greener. Whatever the reason, learning about green building products will inspire you to make choices that can positively affect the health of your family, your state of mind, the environment, and perhaps even your wallet.

The first edition of this guide was released in 2004, and people have been asking us for another one ever since. Over the past few years, the number of people interested in green building has increased, not surprisingly, right along with the number of people who prefer organic food, non-toxic cosmetics, and cars with better gas mileage. As with any of these choices, green building poses a wide range of activities and levels of commitment that one can take, ranging from replacing light bulbs and appliances, to choosing salvaged barn wood rather than vinyl siding for a new home. The creation of *The World at Home: A Household Guide to Building Green* was designed to empower and inspire people looking to build healthy homes, no matter how small or large the project. We at Citizens’ Environmental Coalition strongly believe that so many small changes will end up making a difference.

## ► GREENING THE MARKET

This guide is meant to enable you to compare building materials and make your own educated choices to affordably seek out safer, more sustainable products. It is also meant to help you evaluate the larger life cycle implications of all the products that you buy and use.

The green building market is constantly on the move, changing based on innovations in the market which are also the result of demands from consumers like you. In making better building material purchasing decisions, together

we can cause a transformation in the overall selection, availability, and affordability of safer products. It's important that we support companies that keep a close eye on working conditions, toxic emissions, locality, and quality. As more and more of us make these choices, we send a strong signal to manufacturers and distributors: by demanding this level of craftsmanship from big companies like Lowe's and The Home Depot, we help make such products more affordable and available. By purchasing local materials, we work to reduce emissions and energy from transporting goods long distances, and we also improve our local economy.

Currently there are many reputable manufacturers and distributors of green building supplies, but be on the lookout for "green washing" – when companies advertise in a way to make

them look more environmentally friendly than they really are to reap the benefits of green consumer demand. Use common sense and demand more than just a savvy ad campaign before you invest your time and money.

### ► HOW TO USE THIS GUIDE

When we choose to build green, we not only protect ourselves and our families, we also protect the environment as a whole, since many toxic building materials threaten the environment and our health at several points from manufacture to use to disposal – what is called their life cycle. As you read about toxic building supplies and choose from the possible alternatives, it is important to consider that the entire life cycle includes resource extraction, manufacturing, construction, occupancy, demolition, re-

## Major Players in the Green Building Movement

- The U.S. federal government has several programs in place, including guidance for environmentally preferable purchasing (EPP); recycled-content rules in the Comprehensive Procurement Guidelines; the ENERGY STAR program for products and buildings; and an initiative in the Department of Agriculture promoting the use of bio-based products. <http://www.ofee.gov/sb/policies.html>, <http://www.energystar.gov/>
- State governments have programs to promote energy efficiency to and provide incentives for alternative energy systems. In New York, New York State Energy Research and Development Authority (NYSERDA) provides services through the Energy Smart Program, and New York State Executive Order No. 111 provides green building guidelines for all State Executive Branch agencies, departments, public benefit corporations, and authorities. [www.nyserda.org](http://www.nyserda.org)
- The U.S. Green Building Council's LEED Rating System encourages the use of products and materials with a wide range of eco-friendly characteristics. For more on LEED certification, see page 29. [www.usgbc.org](http://www.usgbc.org)
- Non-profit organizations create and certify products that comply with certain environmental standards. Examples include Green Seal (for overall environmental performance) Green Guard (for safe indoor air emissions), and Forest Stewardship Council (FSC) for sustainably harvested wood from certified forests. [www.greenseal.org](http://www.greenseal.org), [www.greenguard.org](http://www.greenguard.org), [www.fsc.org](http://www.fsc.org)
- For-profit certifiers, such as Scientific Certification Systems, can provide third-party certification for environmental claims. [www.scs-certified.com](http://www.scs-certified.com)
- Various publishers and online guides offer comprehensive green product directories. Examples include the GreenSpec Directory from BuildingGreen, Inc., and Oikos Green Building Source. [www.buildinggreen.com](http://www.buildinggreen.com), [www.oikos.com](http://www.oikos.com)

Source: Adapted from Green Biz: Backgrounders [www.greenbiz.com/sites/greenerbuildings/backgrounders](http://www.greenbiz.com/sites/greenerbuildings/backgrounders)

## General Guidelines for Going Green

The suggestions found in this guide center around a few simple principles. Understanding these will allow you to make commonsense decisions not only with home building, but throughout your entire life!

- **Reduce, reuse, and recycle.** Yup, the 3 R's will always apply – and they apply in that order. Cut down on landfill and incineration waste by planning carefully to minimize waste, getting more than just one use from a product and always recycling waste that can't be reused in a reasonable way. Using salvaged lumber is an example of reusing what may otherwise be sent to a landfill.
- **Save energy.** Building an energy and water-efficient home will allow you to reduce carbon emissions while also cutting down on utility expenses.
- **Choose “simple” products.** Reduce green-house gas emissions by choosing products that demand less energy to process and transport; those that have low “embodied energy.” For example, the cement used in making concrete is extremely energy intensive to produce. Locally procured, natural building materials like cob or straw bales have much less embodied energy than other manufactured building supplies.
- **Buy socially responsible products.** Fair trade and sustainably harvested materials help the environment and the people who depend on it. By giving local people the means by which to make a living, as through sustainable farming, they have an incentive to take care of the environment, and consumers have access to products that encourage that cycle. For example, FSC certified lumber comes only from forests where the rights of indigenous people are protected.
- **Avoid toxic materials.** Polyvinyl Chloride, or Vinyl, is energy intensive and highly polluting through production, and extremely dangerous to humans through use and disposal. There are many alternatives to this toxic plastic, but it is still found in many consumer products. Products that off-gas toxic VOCs – Volatile Organic Compounds – are harmful not only to the environment, but to your family. VOCs include a wide variety of chemicals and are linked to range health effects including asthma and cancer. If it's toxic, don't bring it into your home!
- **Buy local.** Buying from local sources often means you're supporting small-scale, sustainable operations with management that is able to closely monitor working conditions, energy use, and pollution. Green builders generally agree that if you can buy your construction supplies from within 500 miles of your home, you're greatly reducing the carbon emissions that result from materials transportation. Sometimes builders will have “green” supplies shipped from across the world – greatly reducing the environmental benefits.

cycling, reuse and disposal. Examining the total environmental impact of a material or product through every step of its life, also known as a life cycle assessment (LCA), is a difficult task. Think of this guide as a starting point.

Generally, the most sustainable building materials are those that use the fewest natural resources to produce, are manufactured locally, and are energy efficient and long lasting. While it is unlikely that you can meet all these criteria with every product you use, consider your per-

sonal needs and how you can match them to as many of these factors as you can while you plan and build. These are the considerations that we hope you take away from this guide – so that you not only build greener, but live greener too.

Building in a way that makes sense for our different climates is an important part of building green, since it allows us to work with what nature offers rather than against it. Because Citizens Environmental Coalition is based in New York State, this guide often lists local goods

and services, or strategies that pertain mainly to a northeastern climate. If you live in another area, take our suggestions as examples of what's out there – and be sure to look for local sources for materials and services you want.

The guide is set up to first give you an overview of the problems with conventional building materials and highlight some of the solutions to eliminating health problems in existing homes, such as lead, asbestos and mold. The next portion gives an overview of some important decisions that will influence planning – including alternative materials and techniques, renewable energy, and how to talk to your designer and contractor about what you want. The third major segment of the guide breaks

down the building process by evaluating healthier, greener options for each part of the house from the foundation to the roof. We've included profiles that introduce you to people and organizations with green building projects around NY State, as well as inset sections with green building tips and current events in the green building movement.

Whether you're planning a home for your family, you're in the midst of home improvement projects, or you just want to know about this stuff when those needs arise, we hope this resource inspires the creative builder within you to construct the healthy, safe, and comfortable home of your dreams!

## SECTION ONE

# What We're Up Against



**This section highlights some of the environmental health and safety concerns with some of the most common building supplies. We also discuss how to deal with other home problems, including mold, arsenic treated lumber, lead paint, radon and asbestos.**

## WHAT'S WRONG WITH CONVENTIONAL PRODUCTS?

**M**ANY CONVENTIONAL BUILDING products have been developed to produce homes quickly and cheaply. While such materials can allow us to build with ease, they also encourage home building that can be harmful to our families and to the environment. “Sick building syndrome” is a term used to de-

scribe a number of symptoms that result from exposure to indoor air toxins like phthalates, arsenic and formaldehyde. In fact, recent studies by the EPA cite indoor air quality issues as a growing concern, with indoor air pollution often exceeding outdoor pollution by up to 25 times. Chemicals in indoor air are often irritating to the mucous membranes and lungs, lead-

### Indoor Air Quality

U. S. Environmental Protection Agency (EPA) studies of human exposure to air pollutants indicate that indoor air pollution is four to five times more polluted than outdoor air and some pollutants may be 25 times – and occasionally more than 100 times – higher than outdoor levels. This is particularly important because it is estimated that many people spend as much as 90% of their time indoors. Building or remodeling a home provides the opportunity for preventing indoor air problems. However, it can result in exposure to higher levels of indoor air contaminants if careful attention is not given to potential pollution sources and the air exchange rate. New building products often contain volatile organic compounds – or VOCs – which include a variety of chemicals that may have short and long term adverse health effects. Also, even small remodeling jobs can create a lot of dust, so seal off areas that are under construction, as well as AC vents and air grills.

Poor indoor air quality can come from building materials and furnishings as diverse as deteriorated, asbestos-containing insulation, smelly new paint and carpet adhesives off-gassing VOCs, and cabinetry or furniture made of certain pressed wood products that emit formaldehyde. Other sources of indoor air pollution can include combustion sources like oil, gas, kerosene, coal, and wood. Some building materials release pollutants more or less continuously, and high pollutant concentrations can remain in the air for long periods after installation. Mold is also a threat to indoor air, and can grow easily in moist areas. Finally, the cleaning and maintenance products you use may also contain toxic chemicals linked with asthma and other health effects.

The choices you make when you build or redecorate can make a big difference. It's important to express your concerns about indoor air quality to your architect or builder to enlist his or her cooperation in taking measures to avoid these problems.

ing to asthma in some people. In fact, rates of asthma have risen sharply over the past thirty years, particularly among young children.

Many building products can release what are known as PBTs, or persistent bioaccumulative toxins. These substances last a long time in the environment and build up in the food chain, where they can have toxic effects on animals and people. PBTs include heavy metals like mercury, lead, and cadmium; dioxins and furans, and the well-known DDT – banned for use (but not manufacture) a decade after Rachel Carson's *Silent Spring* raised awareness about PBT pesticides.

Other problems associated with building homes include deforestation, energy intensive production contributing to global warming, toxic chemical pollution from production facilities and incineration, and land filling or incineration of construction and demolition waste. This section highlights a few of the problems with some of today's common building supplies.

### ► POLYVINYL CHLORIDE

Polyvinyl chloride – also known as vinyl or PVC – is one of the most popular plastics for use in building supplies, mainly because of its versatility. Unfortunately, PVC relies upon and creates highly toxic chemicals throughout its entire life cycle. PVC is virtually useless without toxic additives to stabilize it (heavy metals like lead or cadmium) or make it more flexible (phthalates linked with reproductive harm). The production, use, and disposal of this seemingly innocuous plastic will expose people to toxins such as dioxins, vinyl chloride, phthalates, heavy metals and hydrochloric acid. Go to the Center for Health, Environment and Justice web site at [www.chej.org](http://www.chej.org) for more information on current PVC campaigns.

On February 26, 2007, the Technical Science Advisory Committee of the U.S. Green Building Council (USGBC) released the results of its long awaited assessment of the health and environmental impacts of PVC building materials, finding them to be consistently worse than

alternatives when appropriately considering human health impacts. The findings can be summarized to conclude that if people screen out PVC from their materials choices, they will always get better human health options, but may (or may not) trade off some or all of the other environmental attributes, depending on which material is chosen.

According to a 2003 Healthy Building Network report *PVC in Buildings: Hazards and Alternatives*, of the more than 14 billion pounds of PVC which are produced per year in North America, an estimated 75% of all PVC is used in building materials. The largest uses of PVC include piping, siding and flooring, but it can be found in products like roof membranes, window and door frames, electrical wire insulation, carpet backing, shades and blinds, gutters, weatherstripping, moldings, shower curtains and even furniture. Below, we've outlined the major toxic hazards associated with PVC. In light of these hazards and the fact that alternatives exist, many companies have eliminated or plan to eliminate PVC from their products. For example, in mid-2005 Firestone Building Products stopped offering PVC roofing. The company had previously sold over 6,000 tons of PVC annually, making this one of the largest phase-outs in the building industry.

**PVC and Dioxin**—The EPA considers dioxin to be one of the most dangerous chemicals ever created, due to its toxicity at extremely low levels. Because it is a PBT (persistent bioaccumulative toxin), it lasts a long time in the environment, and builds up through the food chain to humans. Most human exposure to dioxin comes from consuming dioxin-contaminated foods like meat, eggs and milk. The largest material source of dioxin comes from the production and destruction of PVC.

**PVC and Vinyl Chloride Monomer**—Vinyl chloride (the basic building block of PVC) is one of the few chemicals classified as a known human carcinogen. There is no safe level of exposure to it. Many thousands of tons per year of vinyl chloride monomer are released into the environment, exposing workers and communities.

**PVC and Phthalates**—To make flexible PVC products such as roofing, flooring, wall covering, and sheathing for wire and cable, plasticizers known as phthalates are added to the polymer during PVC production. Since they aren't chemically bonded to the plastic, phthalates are easily released from PVC products during regular use – a topic around which there is growing consumer concern. According to Healthy Building Network, PVC accounts for about 90% of total phthalate use. In his report “Environmental Impacts of PVC Building Materials,” Dr. Joe Thornton reports that an estimated 80 million tons of phthalates are contained in the accumulation of PVC products now being used in buildings and other applications. DEHP (diethylhexyl phthalate), one such commonly used phthalate, is reasonably anticipated to be a human carcinogen by the Department of Health and Human Services and has been classified as a probable human carcinogen by the EPA. Known to cause cancer in animals, phthalates can also lead to infertility, testicular damage, reduced sperm count, abnormal testicular development and other reproductive damage. American phthalate exposure is now roughly equal to the EPA's maximum “acceptable” exposure. Phthalates in indoor air can also trigger asthma attacks and other respiratory conditions.

**PVC and Heavy Metals**—Persistent, bio-accumulative, and toxic heavy metals such as lead, cadmium and organotins are added to PVC as heat stabilizers, since on its own PVC can break down when exposed to heat and light. Mercury is emitted during the process of chlorine production, of which PVC is the single largest end-use. Lead and mercury damage developing brains, lower IQ, and can cause learning disabilities even in small amounts. The US Department of Health and Human Services (HHS) has determined that cadmium and cadmium compounds may reasonably be anticipated to be carcinogens, and it is linked to respiratory and digestive diseases. Organotins, used increasingly in building supplies, can suppress the immune system and disrupt the endocrine system.

**PVC and Hydrochloric Acid**—PVC also should be avoided in building products because it increases the dangers associated with house fires (as well as backyard burning and waste incineration). In addition to releasing dioxin, burning PVC releases lethal gases, such as hydrogen chloride, which becomes hydrochloric acid when inhaled. This hydrogen chloride gas poses the biggest threat to firefighters, occupants and neighbors in the event of an accidental house fire since it can burn the respiratory system, leading to suffocation, asthma or death. Hydrochloric acid also contributes to acid rain.

**Vinyl and Toxic Mold Growth**—When used as a wall covering, vinyl forms a barrier that encourages the growth of mold beneath its surface. Some molds that thrive in vinyl-sealed wall cavities produce toxic substances which contaminate indoor air and can lead to severe health conditions. For more on mold remediation, see page 19.

## ► FORMALDEHYDE

Volatile organic compounds (VOCs) include a variety of chemicals that are emitted as gases from building supplies and products. Formaldehyde is a well-known VOC that can be released into the air we breathe from latex paint, some glues and adhesives, paneling, floor finishes, and interior plywood and particle board, as well as furniture and cabinets made with it. Fiberglass products, new carpets, decorative laminates and fabrics treated with VOC's to be “permanent press” also give off formaldehyde. Particle board is a major contributor of formaldehyde in the home environment because the adhesive, urea formaldehyde, breaks down and releases formaldehyde into the air.

People who work and live in brand new offices or mobile homes are often exposed to higher levels of formaldehyde since it is given off as a gas from manufactured wood products often used in these settings.

According to the US Department of Health and Human Services (HHS) and the International Agency for Research on Cancer (IARC)

formaldehyde is reasonably anticipated to be a human carcinogen. Formaldehyde has been linked to “sick building syndrome” where people living or working in a particular building develop symptoms and ailments that aren’t connected with a specific disease. Some people who are exposed to formaldehyde develop chemical sensitivities, which means they can suffer painful symptoms from very low levels of exposures to particular toxins – even at levels that healthy individuals might not notice otherwise.

Phenol formaldehyde is an alternative used in exterior grade plywood which off-gasses much less than urea formaldehyde does. While safer, formaldehyde-free alternative resins exist, including MDI (methylene diphenyl isocyanate) and PVA (polyvinyl acetate), they are derived from fossil fuels and therefore still have toxic chemical problems associated with their manufacture. Luckily, safer products are on the way: Columbia Forest Products has developed a soy based adhesive for plywood called PureBond which is non-toxic and renewable.

### What are PBTs?

Persistent, bioaccumulative and toxic pollutants, known as PBTs, are long-lasting substances that build up in the food chain to levels that are dangerous to human and ecosystem health. According to INFORM, 90% of PBT chemicals are leaving factories in products, not in waste. Because they don’t break down, even well known examples like DDT and PCBs continue to cause harm decades after they were banned. Some PBTs in wide use include mercury, lead, dioxin, and poly brominated diphenyl ethers (PBDEs), also known as brominated flame retardants. Siding, flooring and plumbing products are often made from Vinyl (PVC) which contain lead and other heavy metals and release dioxin when produced and incinerated. Brominated Flame Retardants are added to furniture, electronics and insulation where they leach out and contaminate household dust. Mercury is used widely in production of switches and thermostats.

PBTs are associated with a range of adverse human health effects, including effects on the nervous system and reproduction and development. Particular risks may be posed to the developing fetus or young child in whom critical organs are still under development. Many PBTs have also been linked to cancer. PBTs affect public health and the environment throughout their entire life cycle. The production of PBTs harms workers and those along the fenceline where production facilities exist, often affecting low income people and communities of color. During use, PBTs often leach from the products they’re used in, and when disposed of or incinerated, they are released into the environment, where they contaminate drinking water and harm wildlife.

The more consumers become aware of the danger of PBTs and choose other alternatives, the more manufacturers will continue to develop PBT-free solutions. For example, Armstrong makes both vinyl (PVC) and natural linoleum flooring and Chemtura makes both PBDEs and less toxic phosphorus-based flame retardants. In 2005, Firestone Building Products phased-out production of PVC membrane roofing, and Shaw Carpets have stopped using PVC backing. Companies like these are part of a broader economic trend in which businesses are increasingly incorporating healthier, more sustainable materials into their operations. In addition, many state and city governments, including New Jersey, Maine, Boston, Buffalo and NYC, are adopting green purchasing strategies to shift their procurement budgets toward safer alternatives. When we choose to build green and shop safer, we become an important part of the market shift as well – a shift that will not only make our homes safer, but will reduce chemical exposure and toxicity of the waste stream.

## Construction and Demolition Debris

Construction and Demolition (C&D) debris consists of the waste generated during construction, renovation, and demolition projects. This is a large and complex waste stream, covering a wide array of materials that can include vinyl siding and other plastics, wood, concrete, steel, brick, and drywall. Reducing C&D debris conserves landfill space, cuts down on potential toxic pollution emissions from incineration and ground water contaminants, reduces the environmental impact of producing new materials, and can reduce overall building project expenses through avoided purchase and disposal costs. The EPA estimates that a staggering 136 million tons of building-related C&D debris was generated in the United States in 1996!

Careful consideration of how C&D debris is created and managed is an important element of green building. If you're building a new home on land where an old house exists, consider moving it to a site where someone else could use it. If this isn't possible, offering free building materials is a great way to get "helpers" to take apart the home and cart away salvageable materials like wooden beams and bricks. This can be fun and can help you reduce land filling costs. Estimating the correct amount of materials before building and reusing materials from deconstructed buildings are some ways to alleviate C&D problems. Eliminating extra built layers also helps prevent waste – for example, finishing the concrete slab to become the floor rather than installing a layer of adhesive and tile or carpet. You can plan a decorative use for the cut ends of studs, such as retaining walls or raised flower beds. There are hundreds of ways to use materials more effectively and more efficiently. For sources of salvaged building materials in NY, see our list at the end of this guide.

### RESOURCES FOR

#### What's Wrong with Conventional Products?

- ATSDR - Agency for Toxic Substances and Disease Registry: The NCEH/ATSDR Information Center 888-422-8737, Fax: 404-498-0093 [www.atsdr.cdc.gov](http://www.atsdr.cdc.gov)
- CHEJ – Center for Health, Environment and Justice [www.chej.org](http://www.chej.org)
- EPA - US Environmental Protection Agency [www.epa.gov](http://www.epa.gov)
- HHS - US Dept. of Health and Human Services [www.hhs.gov](http://www.hhs.gov)
- Healthy Building Network (HBN) which has great information on many aspects of green building, including information about Formaldehyde: [www.healthybuilding.net/formaldehyde/index.html](http://www.healthybuilding.net/formaldehyde/index.html) and PVC: [www.healthybuilding.net/pvc/index.html](http://www.healthybuilding.net/pvc/index.html)
- Healthy Building Network, "PVC in Buildings, Hazards and Alternatives" 2003. [http://www.unityhomes.org/pvc/HBN\\_FS\\_PVC\\_in\\_Buildings.pdf](http://www.unityhomes.org/pvc/HBN_FS_PVC_in_Buildings.pdf)
- INFORM Inc's Fact Sheet on Construction & Demolition Dumps [www.informinc.org/pub\\_summaries.php](http://www.informinc.org/pub_summaries.php)
- Thornton, Joe, Ph.D. "Environmental Impacts of Polyvinyl Chloride Building Materials", A Healthy building Network Report, 2002. [www.healthybuilding.net/pvc/ThorntonPVCSummary.html](http://www.healthybuilding.net/pvc/ThorntonPVCSummary.html)

## TOXIC PROBLEMS IN EXISTING HOMES

IT CAN BE DIFFICULT TO THINK about going green when you and your family are still haunted by toxic hazards from the past. Even if you aren't building, there are important ways to ameliorate hazards in your existing home, especially if it was built when toxins like lead paint and asbestos were in common use. The following section

is designed to give you a brief overview of the harmful effects posed by lead, asbestos, arsenic and mold, and present options available for dealing with them. We suggest hiring a professional, experienced contractor to help you make these decisions. While the methods explained here are not necessarily "green" in and of themselves, dealing with these toxic hazards correctly

is an important step towards a safe living environment where you can start making other healthy, environmentally friendly decisions.

### ► LEAD PAINT

Homes built before 1978, when lead-based paint was banned, are likely to contain some lead-based paint which can be extremely dangerous to you and your family. According to the National Safety Council, today there are still about 38 million homes that contain some lead paint—about 40% of all US housing. While there are other sources for lead contamination, including PVC products, lead dust from deteriorating paint is the most common source of lead poisoning in children. According to the

Center for Disease Control (CDC), approximately 310,000 U.S. children aged 1-5 years have blood lead levels higher than the CDC recommended level of 10 micrograms of lead per deciliter of blood – however, no amount of lead should ever be considered safe. Lead poisoning can affect nearly every system in the body: it is a potent neurotoxin which even in very small amounts can cause permanent damage to the brain including learning disabilities and reduced IQ, and it can cause damage to the kidneys and hearing.

Do you have lead paint? Lead-based paint may be present on any interior or exterior surface in an older home, particularly on woodwork, doors, and windows. To find out if there is lead paint in your home, you should hire a lead inspector to test all the paint, which can take anywhere from 1 to 4 hours depending on the size of your home. To test painted surfaces for lead yourself, at-home lead tests, such as Pro-Lab's Lead Surface Test (under \$10 for 6 tests), can be purchased at home improvement stores or online.

Lead removal and abatement can be a serious endeavor, and experts agree that homeowners should never undertake the process without help from qualified contractors experienced in lead removal. However you plan to proceed, it is your responsibility to ensure that your home is a safe place to live. Renovating a home with lead paint is hazardous even if the lead source has been painted over. Sandpaper, scrapers, chemicals, and torches or heat guns used in contact with lead paint all produce harmful dust and fumes. Be careful: if lead paint remediation is done incorrectly and dust and particulates are freely released into the air, your home may be far more dangerous after this work than it was before.

There are a few ways that lead exposure can be avoided:

**Enclosure and Encapsulation** involves covering up a surface, or bonding materials right to the existing paint. This is often the easiest solution but it doesn't fix the problem in the long run. If you're going to be renovating, or if

### Lead in Your Soil

Be aware that if you want to grow vegetables, soil that is in the runoff areas of your home should be avoided as planting area. If rainwater has been running over exterior lead paint and then into your yard for years, you can bet those lead toxins will end up in the vegetables you grow.

To minimize absorption of lead by your vegetables you should maintain soil pH levels above 6.5. Lead is relatively unavailable to plants when the soil pH is above this level. If needed, add lime according to a soil test recommendation. Another way to reduce possible lead uptake into growing plants is to add organic matter to your soil. In soils with high lead levels, adding one-third by volume organic matter will significantly reduce lead availability. Organic compounds bind lead and make it less available to the plant.

One proposed method of removing lead from lead-contaminated soils is to grow lead accumulating plants on these soils and then harvest and remove the plants. This process, termed bioremediation, is unfortunately not as successful in lead remediation as in remediation of other heavy metal contaminants. Research is currently under way to determine if some plant species can accumulate greater quantities of lead.

The best way to avoid lead uptake in your vegetables remains replacement of the soil and/or placement of your garden in areas away from possibility of history of exposure to run-off from lead paints.

the new surface is damaged, however, lead poisoning will still be a threat. This method should never be used, for example, on operable windows or doors as the repeated abrading of the wood in motion against the frame will release toxic lead dust.

**Replacement** is one of the easiest solutions, since removing lead based paint from windows, doors, or woodwork is difficult and dangerous. Replacement can allow freedom from many lead removal problems while also allowing the homeowner to make better choices, such as energy efficient windows and doors. Caution must still be taken to avoid lead dust exposure during removal of these items. For more on this, see the precautions taken during paint removal. Also, it is important that these materials are properly disposed of. Lead painted windows and doors shouldn't be recycled unless the lead is sufficiently removed for the new owners. Look out for lead paint if you're planning to reuse doors or painted wood from older homes.

**Removal** must be done carefully. When removing lead paint, there are many materials that the EPA lists as being essential to the process. These include a HEPA (high efficiency particulate air) filter equipped vacuum cleaner; a NIOSH (National Institute for Occupational Safety and Health) certified respirator, also equipped with HEPA filters; heavy duty plastic sheeting and duct tape for sealing off rooms; wet sanding equipment; spray bottles to keep dust down; and cleaning supplies like all-purpose cleaners, buckets with wringers, debris containers, heavy duty plastic bags, rags, rakes, shovels, mops and sponges. Workers need to wear protective clothes such as coveralls, shoe covers, goggles, face shields, and gloves to keep dust off skin. Paper and cloth dust masks will not protect you from inhaling lead dust and fumes.

There are several ways to remove lead based paints, including wet hand scraping or wire brushing with a non-flammable liquid paint removal compound, wet hand sanding or power sanding only with a HEPA filtered vacuum attachment, and heat stripping, using a low tem-

perature heat gun followed by hand scraping. A heat gun will result in lead dust and vapors so should only be done by experienced workers wearing respirators.

Never use open flame burning or torching, machine sanding without a HEPA attachment, power washing without a method to trap water and paint chips, or abrasive blasting or sand blasting to remove lead paint.

Lead paint removal outside will contaminate the ground around the site, so its important to lay down heavy plastic sheets raised at the outer edges to trap dusts, debris and liquid wastes.

Proper clean-up is important. Everyday, the debris should be misted with water (this keeps the dust to a minimum), swept up and double bagged. All surfaces should then be wet-dusted and wet mopped. After the project is completed, only a HEPA-equipped vacuum should be used on all surfaces, including walls and ceilings. The area should then be wet-mopped with a household cleaning solution, followed by another HEPA vacuuming session. Consider hiring a professional to test areas for lead dust after final clean-up (see phone number referenced below).

#### RESOURCES FOR

#### Lead Paint

- NYS Dept. of Health <http://www.health.state.ny.us/environmental/lead/index.htm>
- US Environmental Protection Agency [www.epa.gov/lead](http://www.epa.gov/lead)
- The National Safety Council <http://www.nsc.org/issues/lead/>
- For more information, the EPA has excellent lead resources. Before undertaking any project that entails lead abatement work, we suggest you see *Reducing Lead Hazards when Remodeling Your Home* (26 pp. PDF) found at <http://www.epa.gov/lead/pubs/rpamph.pdf>
- For detailed information or questions, or for a referral to a lead-testing professional, you can call the National Lead Information Center (NLIC) and speak with an information specialist Monday through Friday, 8:00 am to 6:00 pm eastern time at (800) 424-LEAD.

Contact your local health department for help in identifying contractors experienced in lead removal.

### ► ASBESTOS

Like lead, asbestos is an extremely dangerous substance that can be found in many applications. It was mostly phased out in 1989, but not before plaguing schools, workplaces and homes with expensive and health-threatening clean-up projects.

Asbestos is the name for a number of naturally occurring, fibrous silicate minerals that were mined for their useful properties, including thermal insulation, stability, and strength. In homes, asbestos can be found in cement in some roofing and siding shingles, insulation in some homes built between 1930 and 1950, textured paint and patching compounds used on wall and ceiling joints before 1977, and coatings and “blankets” on hot water and steam pipes, among other things. Breathing asbestos in high levels can lead to an increased risk of lung cancer, mesothelioma (a cancer of the lining of the chest and abdominal cavity), and asbestosis, a condition that scars the lungs, making it difficult for oxygen to get into the bloodstream.

It is important to note that having asbestos in the home does not necessarily mean that it must be dealt with. If asbestos is in good condition, the best thing to do is to leave it alone, since it is only a danger if fibers are released and inhaled. If you are going to have your home remodeled though, find out whether asbestos materials are present in the areas that will be disturbed by having sampling and analyzing done by a qualified professional. Similar to lead paint removal, if done incorrectly, asbestos sampling and removal can be more hazardous than leaving the material alone.

If you have ascertained that your home contains asbestos materials that are deteriorating, or which may be disturbed during remodeling, there are a couple ways to proceed. The following actions should be undertaken only by professionals with experience in asbestos handling.

**Repair** options involve either sealing or covering the asbestos material. This is cheaper than removing the material, but does not eliminate the risks if the area is disturbed. It can also make later removal more difficult and costly.

Repair by sealing, also called encapsulation, means treating the material with a sealant that will actually bind the asbestos fibers together to prevent release. Repair by covering, or enclosure, involves placing something over and around the material that contains asbestos to prevent release of fibers. For example, exposed insulated piping may be covered with a protective wrap or jacket. Whether the repairs are minor or large scale, there is always the risk of exposure to fibers when asbestos is disturbed, so the work should be done by a professional.

**Removal** of asbestos materials is usually the most expensive option, and since it poses the greatest risks of fiber inhalation it should be the last resort (unless required by state or local regulations). Removal may be essential if there is extensive damage that can't be repaired, or if remodeling will disturb the asbestos material. Again, the removal process is complex, so it must be done by a specially trained contractor. This job should not be taken lightly. When you hire a contractor, you must make sure that the proper equipment is used; that the contractor is careful to avoid spreading the material; that the work site is clearly marked as a hazard area with no people or pets allowed; that a wetting agent is applied to keep dust out of the air; and that the area is cleaned thoroughly with wet mops and sponges, and a HEPA vacuum cleaner. It may also be a good idea to have someone (not connected to the contractor) monitor the air to ensure that the contractor's job is being done correctly. For more on hiring a professional, see the box on page 17.

#### Resources for

#### **Asbestos**

Our source for the information presented in this section, where you can find more information about asbestos and how to find a professional contractor, was compiled by the American Lung Association, the Consumer Product Safety Commission (CPSC), and the Environmental Protection Agency, and can be found on the EPA website at [www.epa.gov/asbestos/pubs/ashome.html](http://www.epa.gov/asbestos/pubs/ashome.html)

## Hiring a Professional Inspector or Contractor for Remediation Work

Do you need expert help? If working with lead and asbestos, you should contract with a certified professional. For mold, this can depend on the severity of the mold problem and the health of the homes occupants. Working with arsenic treated wood does not require professionals trained to do so, but be sure to handle and dispose of it with extreme caution.

- When hiring a contractor, check credentials carefully: Is the professional trained, experienced, reputable, and accredited?
- Before hiring, ask for references. Were previous clients satisfied?
- Ask the professional if they've handled situations similar to what your home requires.
- Ask for cost estimates (and explanations) from several professionals, as charges for this work can vary.
- Know what services are available and what precautions are necessary to do the job right. No matter who you hire, you are responsible for the safety of your home. Have you ensured that all family members and pets cannot pass through the work area? Is proper clean-up happening after each work day to avoid tracking lead dust into your home? Especially during asbestos work, guard against firms who may incorrectly claim what should be replaced, or who may remove materials improperly.
- Check with your local air pollution control board and the Better Business Bureau to be sure the firm has no safety violations or legal actions against it.
- Before asbestos removal work begins, get a written contract specifying the work plan, cleanup and applicable federal, state, and local regulations which the contractor must follow (for these regulations, contact your state and local health departments, EPA's regional office, and the Occupational Safety and Health Administrations regional office).
- Consider hiring a separate inspector to monitor the air during asbestos clean-up to ensure that the work is being done correctly.

### ➤ ARSENIC TREATED LUMBER

Chromated Copper Arsenate, referred to as CCA, is the most common arsenic formulation used to treat wood in the United States. It is also referred to as pressure treated wood, and consists of chromium VI (a bactericide), copper (a fungicide) and arsenic (an insecticide). Virtually all outdoor lumber sold in the last few decades that is not redwood or cedar is CCA treated lumber. Production of CCA lumber for residential use ceased in 2003, but it may still be on store shelves. On January 8, 2007 the EPA announced its intent to deny all applications for registration of acid copper chromate, known as ACC, a similarly harmful alternative wood preservative pesticide intended for residential use. Despite the EPA's cancellations which are meant

to protect public health, arsenic treated lumber remains a risk to children who play on structures made with the wood, and homeowners are likely to come across these types of pressure-treated lumber when pulling out old decks, playgrounds and gardens.

According to Environmental Working Group, a 12-foot section of pressure-treated lumber contains about an ounce of arsenic, or enough to kill 250 people. The World Health Organization (WHO), the Department of Health and Human Services (DHHS), and the EPA have determined that Chromium VI and inorganic arsenic are human carcinogens, with arsenic being linked to skin, bladder, liver and lung cancers. The Agency for Toxic Substances and Disease Registry (ATSDR) states that arsenic can

also cause respiratory and digestive ailments, damage to the circulatory system and serious skin conditions. Chromium VI can damage the nasal passages, lead to ulcers, kidney and liver damage, and even death. Some individuals are extremely sensitive to it and can also develop severe skin irritations.

Never burn pressure treated wood to dispose of it. When pressure treated wood is sanded, sawn, or burned, arsenic can be inhaled from the sawdust or smoke. Burning arsenic treated wood creates a highly toxic ash: one tablespoon of it contains a lethal dose of arsenic (<http://www.origen.net/ccawood.html>)! This has serious implications for firefighters and clean-up operations. There have also been cases of cows eating the ash and dying, children playing in fields where arsenic impregnated wood has been burned, and of arsenic poisoning limited access supply watersheds. Because one of the most popular uses for this lumber has been decks and playground equipment, children's exposure remains a major concern.

### Reducing the Risks

Ideally, the best way to protect against arsenic exposure is to avoid using it and to fully replace all play sets and decks constructed with ACC and CCA treated lumber. While this is not economically feasible for all families, there are steps that can be taken to reduce exposure to pressure treated lumber.

- If you can't replace the entire deck or play set, replace high-contact areas like handrails or deck floorboards with arsenic-free wood.
- Keep children and pets out of "under deck" areas where the soil will be contaminated with arsenic. Do not store toys in these areas.
- Always cover picnic tables with a table cloth. Be especially careful with small children, who are liable to put food directly on swing sets and decks while they play. Always make sure children wash hands after playing in these areas, especially before snack time.
- Do not pressure-wash pressure treated wood decks, as the water spray will contaminate a larger area with arsenic.
- Treating the wood often with a paint or stain formulated for this use can help prevent the poisons from leaching out. While not always environmentally friendly, it has been estimated that sealing your deck can reduce arsenic leeching by 90% (<http://www.origen.net/ccawood.html>). Look for water-based sealants with low-VOC content if possible. See our paints and stains section on page 73.
- Avoid growing food in soil near pressure treated lumber, as arsenic may contaminate the plants. Little research has been done in this area, but there's plenty of reason for concern.

### Removal

If you decide to remove the arsenic treated lumber from your property, wear gloves and protective clothing to eliminate skin contact. If sawing or sanding, wear protective goggles and a dust mask. After working with the wood, wash hands and exposed areas, and launder the clothes separately from other clothing. It is important to cleanup all the sawdust and scrap wood to minimize contaminating your yard or work area.

When replacing arsenic and chromium treated structures, replacing soil underneath these structures might also be a consideration. According to the EPA, pressure-treated wood can be disposed of with regular municipal trash in most places. However, some state or local laws may be stricter than federal requirements. In New York State, CCA-treated wood may be disposed of in construction & demolition (C&D) debris landfills and municipal solid waste landfills that are authorized to accept construction and demolition debris. If you have questions, contact your landfill or waste hauler to make sure they accept C&D debris, or contact the appropriate DEC regional office for information on disposing of CCA-treated wood. For information on other state policies, contact the waste management agency in your state, which you can find at <http://www.epa.gov/epaoswer/osw/stateweb.htm>.

Resources for

### Arsenic Treated Wood

- ATSDR—Agency for Toxic Substances and Disease Registry 888-422-8737 [www.atsdr.cdc.gov](http://www.atsdr.cdc.gov)
- EPA—US Environmental Protection Agency [www.epa.gov](http://www.epa.gov)
- Environmental Working Group, where you can order do-it-yourself test kits <http://www.ewg.org/issues/arsenic/20070104/index.php>
- Healthy Building Network <http://www.healthybuilding.net/arsenic/index.html>
- Richard Martin's informational site about CCA lumber [www.origen.net/ccawood.html](http://www.origen.net/ccawood.html)

### ► MOLD

While mold remediation is perceived as pretty straightforward, this can be among the most frustrating of jobs. Unlike lead paint, mold can (and often will) grow back if the circumstances that allowed it to grow are not eliminated. Mold spores are everywhere, in both indoor and out-

door air, but they only become problematic when the mold spores find a moist place in your home and a food source.

Molds produce allergens, irritants, and in some cases, potentially toxic substances called mycotoxins, otherwise known as black mold. Inhaling or touching mold or mold spores may cause allergic reactions in sensitive individuals. Allergic responses include sneezing, runny nose, red eyes, and skin rashes. Allergic reactions to mold are common and can be immediate or delayed. In addition to causing asthma attacks in some asthmatics, mold exposure can irritate the eyes, skin, nose, throat, and lungs. A number of health problems have been linked to mold, with some more serious than others. Eliminating mold is also important because – just like it does outside when it grows in leaf piles – inside it also gradually destroys the things it grows on,

## Managing Pests

Pest problems can lead to unhealthy homes. Structural damage from gnawing, toxins and allergens from pest waste, as well as chemicals you may use to try to get rid of them can all threaten your home and your health. Aim for a non-toxic integrated pest management (IPM) approach in building and in maintenance of your home. IPM is the application of an interconnected set of methods for managing pests, which minimizes the potential for adverse effects on health and the environment. IPM also helps to ensure that pests don't continue to become resistant to stronger and stronger chemical pesticides.

Homeowners and apartment-dwellers can use IPM practices indoors to battle kitchen, bath, fabric, and wood pests. Outdoors, IPM practices reduce pesticide reliance in lawns and gardens.

Eliminate ants, termites and mice by removing their ability to enter your home and by properly and safely removing them once they get in. Here are some tips to keep your home pest free:

- Check for and seal any cracks or openings around the outside of the house.
- Check all rooms for leftover food and keep all countertop surfaces clean.
- Vacuum out all the drawers and cupboards in the kitchen and bathroom.
- Keep pet food and birdseed tightly sealed or stored out of the house.
- Rinse out bottles and cans and recycle them often!
- Check plants you bring in from outside.
- Try non-toxic traps for insects, or live-catch mousetraps. The best way to ensure a mouse-free house may be to get a cat!

For more information about IPM, see Cornell University's IPM program at <http://www.nysipm.cornell.edu/whatiscomm.asp>

which can lead to expensive structural damage over time.

**Prevention** is the most important way to avoid mold. Some common indoor sources of moisture that can provide adequate mold-growth conditions include flooding, leaky plumbing, steam from laundry, cooking, or showering, hanging clothing indoors to dry and too much humidity. These situations are preventable:

- Reduce indoor humidity by venting bathrooms, dryers, and other moisture-generating sources to the outside; increasing ventilation; use exhaust fans whenever cooking, dishwashing, and cleaning; and insulate pipes and other cold surfaces to prevent condensation from making a happy home for mold.
- Clean and dry any damp or wet building materials and furnishings within 24-48 hours to prevent mold growth.
- Take care of flood damage as soon as you can to avoid a mold party in your basement. Mold often shows up in homes after disasters like floods. Sometimes, such water damage allows the spores to “set-up-shop” undetected – they remain unnoticed until later when humidity allows the mold to flourish.
- Avoid vinyl coated wallpapers, which can trap moisture in and cause irritating, hidden mold growth behind it. In areas where there is a perpetual moisture problem, do not install carpeting (i.e. on concrete floors with leaks or frequent condensation).
- Design your home to avoid locations that are possibly wet and choose materials that don’t provide food for the mold. For example, paper faced gypsum wall board should not be used in areas that tend to be damp (basements) as the paper will allow spore growth.
- Install a fluorescent light in your duct system. If you have ductwork in your home and suspect there is presence of mold, clean it up (of course) and install a fluorescent light just before the exhaust fan. The light will kill the spores and reduce chances for mold to prosper.

**Eliminating mold** can be difficult. For small mold problems, good ventilation and scrubbing off the mold with a non-toxic household cleanser will do the trick. As long as the moisture source is eliminated that should be the end of it. In bathrooms where moisture often can’t be avoided, the best bet is to keep mold to minimum by cleaning it up more often. Avoid exposing yourself or others to mold during intensive clean-up by wearing gloves, goggles and an N-95 respirator, available at many hardware stores and the internet, costing from \$12 to \$25. After scrubbing, make sure to dry the areas completely. Some sources suggest using a HEPA filter vacuum cleaner after scrubbing to eliminate mold spores that could otherwise take root again. Also, dead mold can be as toxic as live mold, so using HEPA vacuum until you’re sure it’s gone will be the best bet to keeping your home healthy.

Absorbent or porous materials, such as ceiling tiles and carpet, will probably have to be thrown away if they become moldy.

If there is significant mold, or there is mold in your HVAC (heating, ventilation, air conditioning) system, then a professional should do the work. Like any contractor you hire, make sure they are qualified and have experience in the situation you are presenting them with (for more on hiring a contractor, see the box on page 17).

#### Resources for

#### **Mold**

- US EPA publication, “A Brief Guide to Mold, Moisture, and Your Home” <http://www.epa.gov/mold/moldguide.html>
- For more information on mold, look for websites that aren’t trying to sell something, such as Mold Help [www.mold-help.com](http://www.mold-help.com) and Mold Action Guide [www.inspect-ny.com/sickhouse/action.htm](http://www.inspect-ny.com/sickhouse/action.htm).

## Radon and Your Home

Radon is a serious and commonly found danger in existing homes, though unlike the other toxic problems in this section, it is not a result of unhealthy building materials. This naturally occurring, radioactive gas is invisible, odorless and tasteless – underscoring the importance of testing homes to be certain that radon is not present.

The US Surgeon General states that radon causes lung cancer. In fact, according to the EPA, radon is the leading cause of lung cancer among non-smokers and is the second leading cause of lung cancer in America, claiming more than 20,000 lives annually.

Fortunately, radon is easily detected and mitigated. US public awareness of radon risks has increased due to government support through Public Service Announcement campaigns. However, radon testing of homes and any subsequent actions for radon mitigation remains primarily the responsibility of the homeowner.

The US government has plenty of information regarding radon in homes.

- EPA radon information: <http://www.epa.gov/radon/>
- In NYS, you can call the Department of Health at 1-800-458-1158 ext. 27556 or (518) 402-7556.
- New York State Department of Health  
Bureau of Environmental Radiation Protection  
547 River Street  
Flanigan Square, Room 530  
Troy, NY 12180-2216  
[radon@health.state.ny.us](mailto:radon@health.state.ny.us)
- For NY state and county charts that show average radon rates, go to <http://www.health.state.ny.us/environmental/radiological/radon/>



## SECTION TWO

# Before You Build



**When building green, planning well in advance is essential. You'll want to have most everything you need for the project before you build (or at least know where it's coming from), as some items take time to procure. Thoughtful planning can help you avoid building delays and extra labor costs. Also, with the environmental impact and rising cost of dumping fees, planning carefully can help you minimize your building waste.**

**While this entire guide is meant to introduce you to attainable green options to help you with the planning process before you build or renovate, this section includes some other options to consider while you plan – such as alternative home construction techniques, renewable energy systems, and other unique ideas that can influence your design. This section is meant to inspire you to think about the possibilities beyond the conventional so that by the time you get to our tips on talking with your designer and contractor, you'll have a clearer idea of what you want them to do for you!**

## SPACE USE, SIZE, AND SITING

### ➤ REBUILD, REMODEL, OR REARRANGE?

Many homeowners will ponder this question at some point: does it make sense to start over from scratch, or add on, working with the existing home? Remodeling is greener (assuming you tighten up the existing building so it's not an energy sink), since you won't need all new materials or be contributing to sprawl. However, sometimes building new is the only way to solve your families housing needs. Talk to your designer about what makes the most sense for your situation.

The first step in making these decisions is an important one: clean out. This can be hard to tackle mentally and emotionally, but physically and financially it is the easiest and most sensible thing to do. Go through your things with a critical eye and decide what is valuable in your life, and what isn't. Keeping excess stuff that you don't use is a recipe for critter infestations and stagnant air that may produce mold if water gets into the equation. It also steals valuable space from you. As you clean, be sure to donate

still-useable items to second hand stores, day-care facilities or to neighborhood garage sales. Anything that is not useable should be properly recycled. This is especially important when getting rid of electronic equipment. Check out [www.earth911.org](http://www.earth911.org) for local information on where to properly recycle computers and cell phones, as well as information on household hazardous waste.

Then, after a complete reassessment of your “stuff,” consider whether you really want and need more space. Additional space means more furniture, more to clean, more resources and more energy to heat and cool. Other changes like opening up rooms, adding new windows and doors to let the outside in, painting with lighter colors, adding porches or decks, or just rearranging furniture can make a small space look and feel larger. Small spaces can be a great thing – forcing you to get rid of extra clutter while allowing you to carefully choose well-made, healthy furnishings. For inspiration, check out Sarah Susanka's book *The Not So Big House*.

### ► SMALL HOMES

Small scale building rejects a consumptive attitude, and thus is an important part of building green. Small homes take up less space, and use fewer resources in construction, operation and maintenance. They also make more sense for people who want less to care for and those on a budget. Most green building rating systems don't give much weight to house size, however even a conventionally built small home will often use much less energy than a large green home – so imagine how much energy a small green home can save!

Ideas to consider when planning small homes:

- Keep the floor plan and structure simple – you'll avoid extra costs and material consumption if you avoid complex or curvy building designs.
- Easy transitions between rooms allow you to make the most of your space rather than wasting space in unnecessary hallways.
- Rather than spreading out your living space horizontally, make use of the space contained within the roof volume. A loft, storage space, or higher ceilings can make your small home feel larger.
- Built-in furniture is an efficient way to conserve space in a small home, and can save you from spending more on manufactured furniture. Custom built furniture like beds, and built in windows seats or shelves can soften spaces, give the room character, utilize otherwise odd spaces. Built-in furniture is also sustainable in that it means doing more with fewer materials. For example, building a cabinet into the corner eliminates the need for a back and side wall of the cabinet.
- Alcoves can make more of a small space: a partial wall, screen or plant can allow you to have a private section of a larger room.

It is important to realize that smaller homes can cost more per square foot, since a small projects often can't take advantage of economy of scale – buying a large amount of product to get a lower price. However, you will still be consuming less, and shrinking your ecological footprint. You will also be creating spaces that are

well-thought out and that meet your needs, rather than adding square footage without thinking it through.

Recently, small homes have been growing in popularity. Magazines like “Cottage Living” and many books on building small homes are extremely popular, and point out the allure of living in cozy houses. For ideas, Lester Walker is author to some tiny home books, including “A Little House of my Own: 47 Grand Designs for 47 Tiny Houses.”

### ► BUILDING UNDERGROUND

Earth sheltered homes, typically built into the side of a hill, are extremely energy efficient because they're sheltered from the elements and can take advantage of constant soil temperature. About 8 feet underground, the temperature of the earth is about 55 degrees year round, meaning your home or finished basement can be naturally cool in summer and easy to heat in winter. An earth sheltered home takes careful siting and planning to ensure it will get enough sunlight, have correct drainage and waterproofing, and will take advantage of the earth's thermal mass. Also, a home built partially into the ground may not have the same storage capacity as a conventional home with a basement, since what could be basement/storage area will probably be daily living space.

Another consideration for using the earth's temperature to your advantage is to include a root cellar in your home plans. You'll not only increase your storage capacity without the need for refrigeration, but you can support local farmers and store food for when it's no longer in season. This allows you and your family to eat healthier without depending on produce shipped long distances.

### Site Decisions and Energy Savings

The choices you and your designer make in siting a new home or addition are among the easiest and most beneficial you can make, allowing you to save energy and money through passive solar heating, natural day lighting and natural ventilation.

### ► PASSIVE SOLAR

Choosing the right site and design allows you to optimize solar resources and facilitate natural temperature control. Passive solar heating takes advantage of the sun's energy coming through windows to heat the home and addresses controls so that glare and overheating don't make your living arrangements uncomfortable. Properly orienting your home south-southwest with south facing windows will maximize passive solar gain as well as allow you to illuminate homes naturally through "daylighting." With proper overhang, the design of the house can also work to minimize summer sun, while letting in controlled winter sun. Similarly, deciduous trees will shade the house in summer and then lose their leaves to allow winter sun to reach the house. Fewer windows on the north and east walls will protect from harsh winter weather. High-quality windows to the north can maintain performance levels and still allow views in this direction. Another passive solar heating technique is to place thermal mass, such as a concrete slab floor or a heat absorbing wall, close to the windows. In many cases, incorporating passive solar design means your heating costs could be more than 50% lower than the cost of heating the same house without these considerations.

Check out the following for more information about passive solar designs:

- The Department of Energy's website provides a basic overview of passive solar and how it works. [http://www.eere.energy.gov/consumer/your\\_home/designing\\_remodeling/index.cfm/mytopic=10250](http://www.eere.energy.gov/consumer/your_home/designing_remodeling/index.cfm/mytopic=10250)
- The Northeast Sustainable Energy Association's passive solar principles and resource information. <http://www.nesea.org/buildings/info/passivesolar.html>

### ► DAYLIGHTING

Daylighting is the controlled use of natural light for indoor illumination. Comprehensive daylighting systems tend to play a role in larger commercial buildings where the energy savings from reduced lights can be tremendous. In

homes, daylighting is much simpler: properly shaded windows facing south or southwest, or a skylight. For interior rooms further from the top of the roof, where a traditional skylight is impractical, you can use "sun pipes" that are skylights with reflective pipes that bounce light down to the interior room's ceiling. This cuts down on use of electric lights during the day in dim parts of the house and can even reduce cooling costs since electric lights can generate significant heat. Solatube ([www.solatube.com](http://www.solatube.com)) makes residential sun pipes.

Be careful about installing overly large skylights, which can increase heating and cooling costs and make a room uncomfortably bright. Daylight and sunlight are not the same thing – direct sunlight beaming into a space will result in heat gain and significant glare. Daylighting is indirect light which is bounced into a space or diffused through control systems making for a comfortable space by providing a broad visible spectrum of light.

### ► NATURAL VENTILATION

As explained throughout this guide, proper ventilation is critical to good indoor air quality. Moving air always feels cooler than still air, so allowing breezes to flow naturally through a home will also allow you to deal with higher temperatures without using electricity. When planning your home with an architect, communicate that you want to site in a way that makes the most of natural ventilation, which will save money on energy costs from fans, air conditioning and sometimes even heat. With natural ventilation, wind and changes in temperature and pressure all effect how air passes through the home. Wind can blow air through openings in the wall on the windward side of the building, and suck air out of openings on the leeward side and the roof. Likewise, temperature and humidity differences between warm air inside and cool air outside can cause the air in the room to rise and exit at the ceiling or ridge, and enter through lower openings in the wall – referred to as the "chimney effect." Two windows located directly opposite each other will cool

only those areas in between, in the direct path of the airflow. You'll cool more of your home if the air must take a longer path between the inlet and outlet.

In our Northeast climate, relying on natural ventilation in the winter isn't effective since you'll waste energy by heating the outdoors. If you've built a very tight house, you'll need an active heat recovery ventilator (HRV) that

warms the incoming air with the outgoing air. In humid climates, energy recovery ventilators (ERVs) also capture the latent heat of evaporation and keep humidity down.

For more information on natural ventilation, see the Whole Building Design Guide's (WBDG) article on natural ventilation by Andy Walker, at [www.wbdg.org/design/naturalventilation.php](http://www.wbdg.org/design/naturalventilation.php)

## RENEWABLE ENERGY

**T**HANKS TO HIGH OIL AND NATURAL gas prices and the availability of government grants and tax incentives, many people are converting to renewable energy sources such as solar and wind power systems. Renewable energy helps reduce our dependence on fossil fuels, translating to reductions in greenhouse gas and mercury emissions from coal burning power plants.

In New York State, grant money from the New York State Energy Research and Development Authority (NYSERDA) is available to help cover the cost of installing renewable power systems, and is collected largely from utility rate-payers. See also Heating, Ventilation and Cooling on page 75 for information on geothermal heating, another way to reduce fossil fuel energy use.

If you are considering renewable energy, first reduce your home's electric load to a minimum through insulation, air sealing, HVAC upgrades, lighting, and appliance improvements. It doesn't do much good to invest a lot of money installing these systems for a home that is otherwise inefficient.

### Solar Power

In addition to passive solar and day lighting, described in the previous section, there are a wide selection of solar "tools" to choose from, ranging from solar lights for walk ways, to full PV panels for the rooftop.

While the initial expenses are quite high, most homeowners who use solar power say that

the up-front cost is well worth the energy savings, the independence from relying solely on "the grid," and the knowledge that they're doing something good for the environment.

### ► SOLAR WATER HEATING

A thermal solar water heater is a great way to use "passive" solar power. These systems work when sunlight passes through flat glass or plastic panels and is collected by a dark absorber plate which then warms liquid passing through pipes.

Direct solar water is an efficient use of solar energy since water carries heat well. In the Northeast, however, direct solar water can be problematic because the pipes need to be insulated or heated in the winter to prevent freezing. If you use this system with a glycol solution in the exterior pipes and then a heat exchanger, you reduce the efficiency a little, but eliminate concerns with freezing. In this case the warmed water can be either used as pre-warmed water for domestic uses, or used in a closed loop for pre-warmed water for radiant floor systems or other water-based heating systems.

According to PowerhouseTV.com, replacing an electric water heater with a solar model can cut down on water heating costs by 50 to 80 percent every year. Also, over the 20-year lifespan of the equipment, more than 50 tons of carbon dioxide emissions will be displaced.

The initial cost of a solar water heating system ranges from \$1,500 to \$3,000. In many cases, the cost will be paid back in energy sav-

ings in less than eight years. Check your local building codes before making a decision, since many communities require a conventional water heater as a back up.

### ➤ PHOTOVOLTAICS

Photovoltaic devices, or solar cells, use semiconductor materials to convert sunlight directly into electricity. More than 10,000 homes in the United States are entirely powered by solar energy.

Some people choose to live independent of the grid, but “grid-tied” PV systems are also available. While not all states allow grid-tied solar, some, like New York actually pay about half the installation cost. Grid-tied systems are less expensive because they don’t need batteries to store the energy. Instead they feed their output back into the power company’s grid and your meter runs backwards. At night or any time you need more electricity than your panels can provide, the electricity comes in from the grid. While these systems currently have a long payback period, too, they are coming down in cost (and will payback sooner as energy costs continue to rise).

There are many advantages to a photovoltaic (PV) system: its operation is non-polluting, can be used almost anywhere and it operates silently and requires little maintenance. Photovoltaic power systems also have very long lifespan and can be stored in deep-cycle batteries for evening or back-up use.

Drawbacks include the initial cost for solar panels and the fact that the production of the PV panels is an environmental detriment. Also, there is currently no proper way to dispose of the batteries. Even with these considerations, PV systems will reduce use of fossil fuel and allow you a bit of independence. While Photovoltaics have generally not been cost-effective for the average homeowner, this is changing as many jurisdictions are now giving tax and rebate incentives. In many locations, solar electric power can now pay for itself in five to ten years.

For homeowners concerned about the cost of PV systems, the CitizenRe REnU program

(<http://renu.citizenre.com>) is something to consider. Citizenre offers homeowners the option to “rent” PV systems which are installed with no cost and no obligation. Check out their website to learn more about this growing program which may change the way we know solar.

#### Resources for Solar Power

- The U.S. Department of Energy: Energy Efficiency and Renewable Energy <http://www.eere.energy.gov/>
- Energy Information Administration (EIA) <http://www.eia.doe.gov/cneaf/solar/renewables/page/solarphoto/solarpv.html>
- To learn more about NYSERDA’s Energy Smart program, with incentives for solar energy systems: <http://www.powernaturally.org/Programs/Solar/incentives.asp>
- To learn about CitizenRe’s REnU Program which offers no-cost solar power systems to homeowners, go to <http://renu.citizenre.com>.

#### Wind Power

A wind turbine collects kinetic energy from the wind and converts it to electricity that is compatible with a home’s electrical system. Like solar power systems, with most residential wind systems, a home is also served by the local utility. The home will draw power from regular utilities if the system cannot generate its full needs. If the wind turbine produces more energy than is needed by the home, the “grid” automatically takes the excess: nothing is wasted, and tons of fossil fuel emissions are prevented. Wind turbine operation produces no pollution and offsets pollution that would have been generated by the utility company. According to the American Wind Energy Association (AWEA), a small residential wind turbine can offset approximately 1.2 tons of air pollutants and 200 tons of global warming pollutants over its lifetime.

The economic savings of a residential wind turbine over time will depend upon its cost, the amount of electricity the home uses, and the average wind speed at the site, among other factors. Research the average wind speeds in your location. In NY, the western and central parts of the state are great for wind power, while the Hudson River Valley is not as ideal.

NYSERDA, through its New York Energy Smart program, has incentives to help people install wind turbines at their home or business to offset their electricity purchases from the utility. For locations with predictable power output, wind systems have a low cost per watt hour. It is estimated that a residential wind turbine typically lowers a household electricity bill by 50% to 90% (AWEA).

Residential wind turbines have been installed in at least 47 of the 50 states, but the majority of the units in the country are in the Northeast and the Midwest. It is important to do your research: in some places, there is an expensive and extensive process for getting a permit for a

wind turbine. Also, this is not a good option for a suburban or urban setting – homeowners with some land are better candidates, since the turbine is a large structure. Other drawbacks include the cost of erecting the towers, some noise associated with high winds, and moving parts that will eventually wear out.

Another option is to sign up for wind energy on your utility bill. Non-profit organizations who work to promote wind energy in your area, such as Community Energy, can help you make the switch. Community Energy offers all electricity customers in New York State the opportunity to support the development of wind energy.

## PROFILE



### The Delano Solar Power System

John Delano, Troy, NY

Our home is located in a rural environment east of Troy and was constructed in 1972. In order to (a) provide ourselves with some measure of energy independence during occasional power outages, and (b) to make a positive contribution to environmental sustainability, we had a 3.2-kilowatt array of solar photovoltaic (PV) panels installed by a NYSERDA-certified installer, Mr. Lloyd Hoffstatter.

The financial incentives from New York State and the U. S. Federal Government to offset a substantial portion of the total cost for this grid-connected system have increased substantially since our installation. The 30 solar PV panels are not mounted on the roof of the house, but rather on three large racks in a south-facing field located about 200 feet from the house. The DC electricity from the solar panels is delivered via underground copper cables to the basement of the home where it is used to maintain a peak-charge on the 14-large storage batteries, and to convert DC to AC electricity for powering the electrical circuits in the home.

During sunny days, the excess energy is put back into the New York State (NYS) grid, which causes our electric meter to go backwards during the daylight hours. After sunset, we draw on the National Grid system so that the meter is usually back to positive values by the next morning. When the NYS grid goes down, the house continues to function normally by drawing on energy stored in the batteries overnight and on cloudy days, and by generating additional electricity on sunny days. The electricity that we purchase from the NYS grid is purchased from Community Energy, which is a green source of electricity (i.e., wind turbines). The option to purchase 'green electricity' is available to all rate-payers in upstate New York. We believe that our purchasing and generating 'green electricity' for our home is an important contribution to doing a portion of our share toward environmental sustainability.

## What is LEED Certification?

Leadership in Energy and Environmental Design, LEED, is a nationally recognized, voluntary rating system for green commercial building design, construction, and operation developed by the US Green Building Council (USGBC). The LEED rating system measures a building's performance in terms of sustainable site development, water savings, energy efficiency, materials selection, and indoor environmental quality. Building projects qualify for LEED certification by registering and meeting certain minimum credit standards. Builders are awarded Certified, Silver, Gold, or Platinum certification depending on the number of credits they achieve.

USGBC's LEED for Homes is a similar program to promote design and construction of high performance "green" homes, which use less energy, water, and natural resources; create less waste; and are healthier and more comfortable for the occupants. USGBC began the pilot test of LEED for Homes in August 2005. The pilot test will conclude in spring 2007 and USGBC will publicly launch the LEED for Homes rating system in summer 2007. LEED for Homes weighs heavily on proper use and respect for the site as well as right-sizing and comprehensive testing of all energy systems in the home. LEED gives homeowners confidence that their home is durable, healthy, and environmentally friendly, but is not essential to be LEED certified to have a "green" home. To learn more about this program, go to [www.usgbc.org](http://www.usgbc.org).

Resources for

### Wind Power

American Wind Energy Association [www.awea.org](http://www.awea.org).

The following organizations have useful websites devoted to wind and renewable energy in NYS:

- Alliance for Clean Energy New York [www.aceny.org](http://www.aceny.org), a project of the American Wind Energy Association to promote the development of the wind energy industry in New York.
- Northeast Sustainable Energy Association (NESEA) [www.nesae.org](http://www.nesae.org) has information on energy deregulation and renewable energy.
- Renewable Energy Long Island [www.renewableenergylongisland.org](http://www.renewableenergylongisland.org) is a non-profit organization promoting clean, sustainable energy use and generation for Long Island.
- Community Energy [www.newwindenergy.com](http://www.newwindenergy.com) is a non profit offering electricity customers the opportunity to support the development of wind energy in their local regions.
- To learn more about NYSEERDA's Energy Smart program and incentives for wind energy systems: <http://www.powernaturally.org/Programs/Wind/incentives.asp?i=8>

## ALTERNATIVE & NATURAL BUILDING MATERIALS

**M**OST OF THIS GUIDE PROVIDES useful information for building or renovating a traditional wood-frame house. However, there are sustainable building options that don't rely on the traditional techniques or materials.

Some of these alternatives allow builders to construct walls which also double as the insulation, therefore reducing the cost, labor, and materials need for this extra step. Before you make "concrete" decisions about additions and renovations, consider the potential of natural build-

ing methods to your new or improving home.

In *The Philosophy of Sustainable Design*, author Robin McLennan discusses how sustainable design is centered in the idea that nature is the model for our building designs and it demands that our homes honor the differences that exist between places. The decisions people make as home builders have always been a result of the climate and natural resources where they live. Today we have more products and technologies at our fingertips than ever, yet working with the techniques most appropriate to our local area can save both money and energy by consuming

fewer resources and relying on inexpensive, locally available, healthy materials.

Natural building materials can allow us to create safe, beautiful, unique homes that fit with the surrounding environment. With each of these building techniques and materials, there are great advantages. However, what is a draw for one person maybe a drawback for another: there are certain characteristics with each that can be restricting depending on where you live and what effects you want to achieve. With all materials, it is crucial to fully understand the characteristics and limitations so that the construction process and the finished result can be as rewarding as possible. For more information about the following methods, see our resources at the end of this section.

### ADOBE

Adobe homes are built with mud bricks that are made with clay and sand mixed with water and dried in the sun.

**Pros**—Building with adobe has numerous advantages: adobe bricks consume low amounts of energy, emit low levels of pollutants during manufacturing, and in combination with good passive solar design, make for an effective energy-saving solution. Adobe is most economical in regions with a relatively dry climate, where bricks can be made and cured on-site.

**Cons**—While Adobe is made from inexpensive materials, its production can be labor intensive and precautions must be taken to ensure its durability through wet weather. It is not ideal for wet, cold climates.

### BAMBOO

Bamboo is a renewable resource and has been used in the construction of homes for hundreds of years in Asia, Central America and South America.

**Pros**—Bamboo is often considered to be nature's most sustainable resource since it's grown without chemicals or pesticides, is biodegradable, and is naturally regenerative. While hardwood trees in the US require 25 to 70 years to mature, bamboo grows to maturity and can

be harvested in just 4 to 6 years. This material is growing in popularity for hundreds of uses, including ply boards and flooring, replacements for wood and steel, pins in straw bale construction, to create trusses and other structural members, as decorative elements, and even plumbing.

**Cons**—Many bamboos are imported, increasing their "travel cost." Also, if harvesting is done unsustainably, cropping can endanger fragile ecosystems. Unlike lumber certified by the Forest Stewardship Council for sustainability, there is no such 3rd party system in place for purchasing bamboo. Some bamboo building materials may also be manufactured in unfair labor conditions and may also use urea formaldehyde as a binder. Bamboo can be tricky in that it cannot be joined with many of the traditional techniques used with wood thus making ancient methods of working with bamboo important.

### COB

Similar to adobe, cob construction utilizes sand and clay, but with straw mixed in. The special mud mixture is applied to the foundation in continuing layers. Because there are no forms, ramming, cement or rectilinear bricks, cob lends itself to organic shapes: curved walls, arches and niches.

**Pros**—When dry, the walls are very hard and load bearing. Cob building techniques are easy to learn and inexpensive to build. In dry climates, cob homes are cool during the day and warm at night.

**Cons**—Because of all the straw, cob can be more insulating than adobe, but would not make a very comfortable house in a climate of extreme temperature. While materials are inexpensive, this process is labor intensive.

### CORDWOOD

Cordwood masonry combines the texture of stone masonry with the beauty of wood by laying short logs widthwise within mortar.

**Pros**—This is a low-cost, easily constructed and aesthetically pleasing building technique

that can utilize what would otherwise be scrap wood. Materials can be procured from local sawmills, furniture workshops, and even the building site itself. Cordwood walls derive excellent thermal mass characteristics from insulation sandwiched between the inner and outer mortar joints. In some environments, cob can

be used as mortar, making this technique even more eco-friendly.

**Cons**—The disadvantages and limitations are minimal. The process can be time consuming, similar to laying stones. The use of traditional mortar means relying on cement which is extremely polluting to produce.

## PROFILE



### Earthwood Building School

Rob and Jaki Roy, West Chazy, NY

Earthwood Building School was established in 1981 by Rob and Jaki Roy and specializes in various green building techniques including cordwood masonry, earth sheltered housing, living roofs, and timber framing. The business is a “mom and pop” affair, with occasional help from sons Rohan and Darin.

The school developed out of the Roy’s pursuit of a self-reliant lifestyle back in the late 70s. Rob wrote books about the couple’s first two homes, Log End Cottage (a cordwood masonry home) and Log End Cave, which was mostly underground to take advantage of the earth’s tempering influence. The Roys continued their home-building experiments at Earthwood, a round two-story cordwood masonry home. Forty percent of the home’s external walls are earth-sheltered and the building is capped by a living roof of wild grasses and flowers. Now the Earthwood campus consists of the home and ten outbuildings, including three student guest houses, a mess hall, a library, office, and sauna. The entire complex is off-the-grid, deriving its energy from photovoltaic panels. The main building is heated by a 23-ton masonry stove, and



all the water is pumped in – and pressurized – by a bicycle pump system.

From May to October, Rob and Jaki conduct one- to five-day workshops at the school. Most of them include hands-on training for prospective owner-builders. They also do regional workshops throughout North America and have taught cordwood masonry in Chile and New Zealand. Rob has now written 13 books, including works on mortgage freedom, sauna, and stone circles.

Rob’s 40-year passion with megalithic stone circles dates back to his first visit to Stonehenge in 1965. The Roys built a stone circle at Earthwood in 1987, and have conducted several how-to workshops since 2000. Their work in this field will culminate August 7–11, 2007, when they host a major megalith conference at Earthwood, during which several of the world’s experts in heavy stone building will share their techniques. MegaCo/07 will be co-sponsored by the Anthropology Department at Plattsburgh State University.

Earthwood also acts as a clearing house for Rob’s books and videos, as well as books by other authors in related fields. For a brochure, write to Earthwood at 366 Murtagh Hill Road, West Chazy, NY 12992, or call 518-493-7744. Earthwood’s website is [www.cordwoodmasonry.com](http://www.cordwoodmasonry.com) and MegaCo/07 is featured at [www.bigstones.com](http://www.bigstones.com). Email Rob and Jaki at [robandjaki@yahoo.com](mailto:robandjaki@yahoo.com).

**PAPERCRETE**

Papercrete, also called fibrous cement or paper block, is a building technique which utilizes recycled paper fibers mixed with sand and cement to form walls, blocks, panels, domes, etc.

**Pros**—This building material is cheap, utilizing unwanted newspapers, magazines, cardboard and other recycled paper materials. Constructed correctly, papercrete homes will not mold, swell, or attract insects, and are surprisingly fire resistant because they are mixed with concrete. This method has enormous potential for do-it-yourself builders.

**Cons**—This relatively new method is still

untested in some environments. While most recipes call for as much cement as is used in a solid concrete wall, some practitioners are experimenting with clay as a binder. Concerns include flammability in some examples, as well as the effects of freeze-thaw. Also, if it is buried in dirt, papercrete will wick moisture from the ground leading to mold growth and deterioration.

**RAMMED EARTH**

David Easton, who began a company known as Rammed Earth Works in the late 70's, is known as the preeminent advocate for this building

**PROFILE**

Photo courtesy of Mark Dye/TAUNY

**Strawbale & Timber Frame Home**

Hilary Oak & Chris Affre, Parishville, NY

Chris and I designed and built our house with the intention of making it as earth-friendly & energy efficient as possible in its design, construction, and long-term use. It's a passive solar design with south facing windows and deep eaves. It is completely off the grid and powered by 12 solar panels which provide all of our electricity – except for some supplemental power from a gasoline generator during the

darkest, shortest days of the year.

We used recycled wood, windows, and doors from auctions and construction sites whenever possible. The house has a composting toilet, an on-demand water heater, and a small propane fridge. It's heated by a wood stove, and a small propane furnace provides back-up heat if we're not home. There are about 550 two-string bales of oat straw in the walls. We used a very small amount of fiberglass and rigid foam insulation in places where the straw just wasn't appropriate.

There are many social aspects of our home. Lots of friends helped with the construction during the timber frame raising, two strawbale building days, and a plaster party. The timber frame design allowed us to have an open floor plan for the kitchen, dining, and living areas. Each year we welcome folks to see the house during alternative energy and green building tours, and field trips from area colleges and schools. We always like to share what we've learned about building with straw and living with solar power. Often people will walk in and say something like "Ooohhh, I thought it would be much more primitive."

The straw construction has many advantages. The house is easy to heat or keep cool in the summer. The thick walls create a quiet and cozy environment, and the deep, rounded window and door openings are an interesting visual feature. I am working on a mosaic mural in the plaster wall of the kitchen with broken dishes and trinkets which add a variety of color and texture to the room.

It really feels good to have a house created with natural materials that provides a warm, spacious, and comfortable shelter but makes a relatively small impact on our environment. The house is very sturdy and will live on long after we are gone. When it does finally wear out it is nice to know that almost all of the materials will be able to return to the earth harmlessly.

## Hybrid Structures

Hybrid building techniques are an outgrowth of the progress of natural builders experimenting with various techniques. Essentially, all buildings are hybrids because they are composed of mixtures of different materials. In terms of natural and alternative building, “hybrid” refers to combining more than one of these methods. Hybrids can mix several of the processes and materials described on these pages, highlighting the best qualities of each to increase building efficiency as well as unique artistic qualities.

Combining building techniques can allow you to be creative and reduce the use of a particular material, such as wood or metal. For example, building with exposed timber-frames surrounded by materials such as papercrete, straw bales, or cob can capitalize on the beauty and structure of wood while eliminating excessive use and still adhering to building codes. Many building techniques lend themselves to mixing and matching. For example, earthbag and cordwood masonry walls can both be built with papercrete as mortar rather than cement. While some of the building techniques make for thick straight walls, like rammed earth, adobe, or straw bale, other materials can make beautiful, more organic additions to this, like cob or earthbag techniques. Even a traditional wood framed home can incorporate natural building components, like earthen floors or cordwood constructed interior walls as room dividers.

There is also great potential for incorporating recycled building supplies into your creations. For example, tires make great retaining walls or foundations, and aluminum cans or glass bottles can be mortared into walls of any shape.

Currently, there aren’t many builders with wide experience in a number of techniques, illustrating the need for increased communication, idea sharing, and experimenting with different techniques in a multitude of climates. By combining alternative building processes with builder creativity, new solutions to common building problems become possible.

technique. Homes from rammed earth, also known as stabilized earth, are created by pounding damp soil into movable, reusable frames with manual or machine-powered tampers, creating firm, steady structures.

**Pros**—The walls absorb solar energy during winter days and then re-radiate that energy to offset nighttime heat losses within the building. In the summer months, the mass of the walls absorbs excess heat generated during the day, keeping the inside spaces surprisingly cool. In a properly designed and oriented building, this can mean significant savings in heating and cooling bills. Rammed earth buildings are fire resistant, pest resistant, long lasting, resistant to weathering, and do not outgas hazardous fumes.

**Cons**—Rammed earth is extremely labor intensive and building codes demand special reinforcing in earthquake-prone areas.

## STRAW BALE

Building with tightly packed straw bales has become increasingly popular in recent years.

**Pros**—Straw bale buildings boast quiet, well-insulated walls, relatively simple construction, and the conversion of an annually renewable agricultural byproduct into a healthy building material. Properly constructed and maintained, straw-bale houses remain waterproof, fire resistant, and pest-free. Erecting bale walls can go very quickly, and does not take a lot of skill. The rest of the creation of the building is similar to any other wood framed house.

**Cons**—In humid climates, efforts need to be taken to prevent moisture accumulation. The cost of finishing a straw bale house can exceed that of standard construction because of work that goes into plastering both sides of the walls and current code restrictions which call

## PROFILE



### Common Fire Housing Co-op

The Common Fire Foundation, Tivoli, NY

The Common Fire Foundation is a non-profit organization that seeks to build a diverse and powerful movement of people with a shared commitment to sustainability and justice through workshops, retreats, and community institutes. Construction of our green housing co-op, located in the Hudson River Valley, was completed in the fall of 2006. The housing co-op earned Platinum LEED certification, making it the highest scoring green building in the Eastern US.

When envisioning the Common Fire Housing Co-op, we knew we wanted the construction of the building to reflect the integrity of the individuals who would be living there. As a home for people doing a diversity of social justice and sustainability work, this meant examining the building process in detail to choose methods and materials that lessened the building's detrimental environmental and social impacts. And before we knew it we were on the path to building the "greenest" building in the Eastern USA!

In order to take into account all the factors we wanted represented in the building we knew that the design process was fundamental. We chose to work with designer Chuck Silver of Hudson River Design, as he has a long history in green building. One of the most important design factors was how the building was sited. It was oriented east-west and the solar gain of its southern exposure was maximized with large windows and glass French doors from Pella's Designer Series. The northern exposure was set partially in the ground to minimize the building's heat loss and large overhangs were designed to block the hot summer sun and maximize the winter sun.

When it came to purchasing the materials used in the building, we found ourselves struggling to balance several, sometime opposing, factors. We were committed to buying as locally as possible, but had to juggle that with our commitment to purchasing socially responsible products such as Forest Stewardship Council (FSC) certified wood (some of which came from Minnesota) or products made out of waste or recycled materials, such as straw walls (which came from Texas), as well as factoring in cost. We were also committed to using no PVC plastic in the building, not only because it off-gases but because of the socially and environmentally degrading practices of the companies that manufacture it. PVC (vinyl) is used as siding, piping, electrical insulation, flooring and more. We were able to find alternatives though, and the building ended up 99.9% PVC-free! While it was a challenge, with research we were able explore our options for different building materials, their prices and locations, and make the best individual material decisions we could for the project while keeping our eye on the big picture.

Check out Common Fire on the web at <http://www.commonfire.org/>, where you can find a guide to the products and companies they used in building the co-op.

for wooden frames. According to [greenhomebuilding.com](http://greenhomebuilding.com), straw bale houses typically only save about 15% of the wood used in a conventionally framed house. Appropriate bales can sometimes be difficult to locate, and if they are inadequately stored, can be damaged by rain.

### EARTHBAG

Earthbags are just what they sound like: earth filled tubes or bags that can be stacked together to build homes or buildings. Many natural

builders have taken to using the bags as simple foundations for straw bale or cob structures, or for simple site walls.

**Pros**—The walls are massive and sturdy, they resist severe weather, and they can be erected easily with readily available components. Advantages of this technique include the opportunity to build in wet conditions and in sites prone to flooding. In dry climates, earth bag walls have been successfully finished off with papercrete "plaster." Many of the techniques

mentioned in this section can lend themselves to similar mixing and matching, creating what are referred to as hybrids.

**Cons**—Earth bag walls may be too “organic-looking” for some, since a lot of plaster is needed to make them smooth. Like many natural building methods, this construction can be labor intensive.

Resources for

### Alternative and Natural Building Materials

- Straw Bale Central [www.strawbalecentral.com/techniques3.html](http://www.strawbalecentral.com/techniques3.html)
- Green Home Building [www.greenhomebuilding.com](http://www.greenhomebuilding.com)
- David Easton’s site about rammed earth construction [www.rammedearthworks.com](http://www.rammedearthworks.com)
- McLennan, Jason F. “The Philosophy of Sustainable Design,” Ecotone publishing LLC, [www.ecotonedesign.com](http://www.ecotonedesign.com)
- For more information on straw bale construction and other natural building supplies, as well as where to find a straw bale provider check out The Last Straw: The International Journal of Straw Bale and Natural Building [www.thelaststraw.org](http://www.thelaststraw.org).
- DVD, Building with Awareness: The Construction of a Hybrid Home, is available at [www.buildingwithawareness.com](http://www.buildingwithawareness.com)
- For more information on cordwood construction, Earthwood Building School offers classes and workshops, as well as useful literature, at [www.cordwoodmasonry.com](http://www.cordwoodmasonry.com)

## HIRING GREEN HELPERS: DESIGNERS & BUILDERS

**A**S MORE AND MORE PEOPLE make the choice to build with environmental health in mind, green designers and contractors have been emerging – professionals who are committed to planning and building homes using sustainable technologies and materials. Finding a contractor that advertises as “green” can save some time and research, since they’ll likely already know, for example, which brands of VOC-free paint are available locally and where to procure FSC-certified flooring. These contractors will also have knowledge that comes with using a variety of greener materials, so they may be able to help you make decisions you’ll appreciate.

While there are plenty of designers and contractors that advertise as sustainable builders, it’s our hope that after reading this guide you’ll have a foundation of information to work with any architect or builder out there – and that in order to prosper, they’ll all be incorporating greener materials and techniques into their work. Many architecture schools incorporate green design into coursework so fully that it isn’t seen as a separate process at all. Large retailers such as The Home Depot are now labeling

greener products on store shelves in response to consumer demand – meaning that builders are also becoming more accustomed to working with these options (and requirements). Some businesses are members of the US Green Building Council (USGBC), while others are certified by Green Advantage, meaning the contractors attended green building training and passed an exam. While these programs are important, the critical component for homeowners is finding someone you can talk to, who understands what you want, and who is as excited to build your home green as you are. Keep in mind that many builders who haven’t had a lot of experience building green homes are enthusiastic to undertake these projects and gain the know-how people are looking for.

After you’ve read this guide and done some of your own research, you may be able to teach your hired professionals something about green building – a big deal, since they will go on to influence the building decisions in many homes (and families) to come. When builders start incorporating even small changes to their work, like recommending certain materials over others, it can make a real difference.

## Tips for Hiring a Contractor

- Choosing a contractor you trust and who you get along with is important.
- Find a contractor who has done some sort of green building projects in the past. Speak to former clients and ask to see the spaces.
- Communication is extremely important: be clear about your goals and vision from the start. See our questions in the next section.
- Read, and if needed, ask for clarification about the paperwork you sign.
- Be flexible with your budget – since all projects will change.
- Consider a “performance based” payment structure instead of % of construction cost. Set a base fee for the work – remember it is harder to design well than to design in the same old way, then add a “bonus” if the performance of the building meets certain important levels – like reduced energy usage or measurable high quality of air.
- Don’t underestimate the disruption, noise, dirt and emotional stress of the job on your home!

### Talking with Your Architect & Contractor

Before you begin talking to architects and builders about your project, it’s important that you have a firm grasp of what you and your family want, both in terms of the finished product, and throughout the process itself. The rest of this guide will give you a great starting place for talking more with professionals about your building choices.

Don’t start by asking yourself: “Do I want a green building?” This inadvertently suggests that you can treat sustainability as an add-on process and add-on service. If sustainability is the real deal (and it is) it needs to be a part of every project in some way and it should be as natural to all of us as breathing.

Here is a list of questions, formulated by Jodi Smits-Anderson of Collins + Scoville Architects, P.C., which will better help all involved parties to understand what kind of sustainability a specific project will work to achieve.

Each choice will help guide design decisions throughout the process. For example, if energy use reduction is your top goal, it might mean the most efficient heating system comes from a company 3,000 miles away – meaning you wouldn’t purchase a local product or be able to

rely on fast, local service. If being off the grid is your main goal, then you will have to make tough choices that reduce the size of your home and minimize its energy use so you’ll be able to supply all of your own energy demand.

The answers will help you balance your priorities and should then be accommodated in the program, so at each phase review the architect and owner can make sure they are meeting the goals that were agreed upon.

### ► ENERGY AND WATER

- Do you want to improve your energy performance 50% (or any other % goal) over code?
- Do you want to maximize the “free” stuff the site offers – sun, wind, water, and shading? This entails starting by planning the building and your use needs around those elements.
- Do you want to look into alternate energy production such as wind or PV? If so, do you want to be off the grid? Do you want to feed the grid and generate power on-site?
- Do you want to produce enough power to be “safe” in times of system outages? This might mean designing in a battery back-up system that is fed by renewable energy production.

- Can you consider eliminating mechanical cooling (or minimizing mechanical cooling) from the design? Do you feel comfortable with opening windows for ventilation in the summer months? Do you have security issues related to this? Do you need direct connection between window operation and mechanical systems to reduce heat losses?
  - Do you have any concerns about glazing and sun glare? Are there any items that need protection from fading such as museum prints or other artwork?
  - To what extent do you want to reduce operations and maintenance costs through choosing long-lasting, high efficiency systems (with possible higher up-front cost) and materials that are durable?
  - Do you want to focus on reducing water consumption beyond installing low flow fixtures? This can mean incorporating the most water efficient appliances possible and using grey water for flushing toilets.
  - Do you want to incorporate a water catchment system to reduce runoff and provide water for landscaping?
- **MATERIALS AND TOXINS**
- Do you want to eliminate toxins from building materials? Do you or members of your family have chemical sensitivities, eczema, or asthma? Express your concerns about indoor air quality to your architect or builder and talk both about purchasing building materials, finishes and furnishings that are low-emitting and about providing an adequate amount of ventilation.
  - Can you store all fuel burning equipment (cars, lawnmowers, etc) away from this building? Or better, can you work to eliminate these items?
  - To what degree are you interested in incorporating natural building materials, like straw bale insulation or cordwood construction, into your home?
  - Do you want to source materials locally whenever possible to promote local production? Similarly, what is the maximum distance that you would be willing to ship environmentally preferable products to your building site? Many green builders recommend buying the majority of materials from within a 500 mile radius to reduce embodied energy through transportation, however this is not always possible when limited manufacturers offer products you want to use.
  - Are you interested in sourcing materials from reuse centers and salvage yards whenever possible? See the end of this guide to help you find reclaimed materials in NY.

## Renovating & Mental Health?

There is no question that having your home constantly under construction can make you feel unsettled. Most likely it's a combination of the disarray, lack of privacy from workers tromping through, and innumerable set-backs and delays.

A relatively new phenomenon, however, is the sense of emptiness, and even depression, that can result when the work is finally done and the contractors have packed up for good. In a February 2007 article in the New York Times, Fred Bernstein used the term "post-renovation depression" to describe this feeling. Although ridiculed for its consumer-driven implications, this sort of depression is not uncommon for people who have been working on any sort of large project for a long period of time – including novels and artwork.

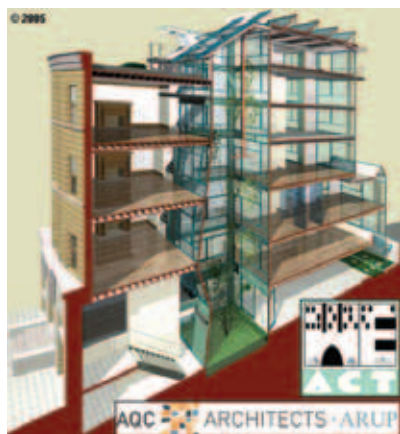
Sometimes these feelings are caused by project failures, but usually it's simply the end of the excitement of planning which gets home-owners down. Either way, staying realistic and flexible about possible outcomes and remaining engaged in other exciting projects or activities can allow you to rejoice rather than feel "empty" when the building project is done.

- Do you want to procure FSC (Forest Stewardship Council) certified lumber as much as possible for projects using wood?
- Do you want to work to minimize material use? This is best achieved by reducing layers of finish, for example: stained concrete flooring and elimination of suspended ceiling to expose structure and services.
- During home renovations and building, do you want to salvage and donate all reusable building supplies and make sure to recycle construction and demolition debris? Make it clear that you want to reduce, reuse and recycle as much as possible so that your building team will help you eliminate extra landfill waste. This may mean hiring a deconstruction crew rather than a demolition crew for remodeling.

➤ **SPACE USE, APPEARANCE AND PURPOSE**

- Do you want us to work towards reducing your footprint on the site (without sacrificing use requirements)? This might mean combining several uses in one space if applicable or exploring building more than one story.
- Is it possible to improve usage ratios for all the spaces of your house? For example, this might entail having a guest room that functions as an office for 90% of the time and as a guest room for 10%.
- Are you interested in built-in furniture, such as window seats, or shelves and storage that can maximize usable space?
- To what extent would you like to work with and maximize the existing landscape and vegetation? For example, you may like to save the topsoil, dig up perennials, shrubs and trees that would otherwise be harmed, build driveways and entrances that align with the natural topography, and even build your home partially into a hill which can help with heating and cooling costs.
- Do you want to use your home or building to educate visitors or students learning about sustainability? This can mean building in a way that allows occupants to see the building materials - for example, a straw bale home can have a peek-through window or “door” allowing people to see how it was made.
- Do you want to be “stealth” or do you want to shout out about the greenness of the home? This may also depend on the location, as some homes must be built to fit into existing neighborhoods or buildings.
- Is it important to you to earn a LEED (leadership in energy and environmental design) for homes rating to prove that it is green?

## PROFILE



### The WE ACT Environmental Justice Center of New York

WE ACT, Harlem, NY

With plans for a remodeled green building in West Harlem's Hamilton Heights, West Harlem Environment Action (WE ACT) moves from successfully advocating for sustainable development in Northern Manhattan to leading by example. WE ACT is a non-profit, community-based, environmental justice organization dedicated to building community power to fight environmental injustice and improve environmental health, protection and policy in communities of color. WE ACT accomplishes this mission through community organizing, education and training, advocacy and research, and public policy development.

What will soon be the WE ACT Environmental Justice Center of New York is now an abandoned Harlem townhouse that will be renovated into the first non-residential "green" building in Northern Manhattan. The Center will embody WE ACT's guiding principles: community mobilization, knowledge-based action, leadership around sustainability, and Environmental Justice movement expansion. The Center will house youth leadership developmental programs, a fully accessible library of environmental and environmental health resources, and flexible meeting space for community workshops and WE ACT partners.

The transformation is scheduled to begin this summer and will be completed in 2009. The Center is designed to attain LEED Gold rating. It will be energy-efficient, incorporate replicable and affordable environmental technologies, utilize environmentally responsible building materials, and employ environmentally friendly construction processes. Green features of the Center include:

- An atrium waterfall and garden fed by rainwater from roof runoff;
- A greywater system cycling roof runoff into the building's toilets;
- Non-toxic paint, carpeting and furniture to promote healthy indoor air quality;
- Modular organizing systems built from locally produced, sustainable materials;
- A ventilation system that uses the atrium as a lung to bring fresh air into the entire building, blurring the lines between indoor and outdoor space;
- A self-watering green roof to lower energy costs and reduce roof runoff;
- Photovoltaic solar collectors powering outdoor lighting for garden space;
- A solar hot water heater to heat tap water; and
- A geothermal heating system to reduce heating and cooling costs.

"Planned green features are environmentally conscious as well as practical," says Peggy Shepard, WE ACT's Executive Director. For example, using a geothermal exchange system and green roof will result in savings of approximately two-thirds the cost of a conventional heating and cooling system.

To head up design, WE ACT selected AQC Architects (AQC), a Harlem-based firm that has developed a niche for construction focused on revitalization of neighborhoods in central cities. The green building development team also includes AKF, ARUP (a leader in "green" and sustainable engineering worldwide), DeSimone, EKLA, and Langan.

Prior to construction, the team will evaluate the townhouse for the presence of hazardous materials – which by precedent may include asbestos, oil contamination and lead paint. All hazardous material will be identified and abated prior to removal, when the building will be disassembled down to its structural components. The architect will catalogue all materials for recycling or reuse in accordance with LEED procedures. For instance, heavy wooden beams in the townhouse will be reused or sold to a local company – such as the Demolition Depot in East Harlem – for use in future building projects.

For more information about the WE ACT Environmental Justice Center of New York, please visit [www.weact.org](http://www.weact.org) or call (212) 961-1000.

## Finding Green Helpers

**T**HE FOLLOWING COLLECTION of natural and green builders and designers is meant to give you a starting point to find people in NYS who have the kind of experience you want. These are some of the early adopters – but there are plenty of other professionals who incorporate sustainable building strategies and many more who will by the end of this year! In addition, there are hundreds of experienced builders and contractors who don't advertise their sustainable values – but who have the knowledge and enthusiasm to work with you and your family. Asking around may be one of the best ways to find the right green helper.

Keep in mind that many folks who have experience building green don't do it for a living; they're "owner builders" – people who have learned the techniques while creating their own homes. Participating in "green home tours" and visiting energy and green building fairs can help you meet people who would love to give you advice and share their experiences.

One of the missions of this guide is to educate homeowners and builders about the feasibility of building with green strategies and materials. We encourage everyone to incorporate green techniques and products into construction so that green building becomes mainstream – and not an add-on procedure. That's where you come in. Your decisions about what kind of home you want, combined with the knowledge you can glean from this and other green building resources

mean that you can talk to almost any builder, contractor, or architect to help you build a greener, healthier home!

The following lists were compiled from various sources including Sustainable Sources Directory ([www.directory.greenbuilder.com](http://www.directory.greenbuilder.com)), Green Home Guide ([www.greenhomeguide.com](http://www.greenhomeguide.com)), and Natural Building Network ([www.naturalbuildingnetwork.org](http://www.naturalbuildingnetwork.org)).

### Natural Builders in NYS

#### Earthwood Building School

West Chazy, NY  
Rob and Jaki Roy ([robandjaki@yahoo.com](mailto:robandjaki@yahoo.com))  
[www.cordwoodmasonry.com](http://www.cordwoodmasonry.com)

A small business offering classes, workshops, building plans, conferences, books and videos that promote an integrated approach to home design, emphasizing energy efficiency, self-sufficiency and responsible stewardship of natural resources.

#### Hudson Valley Natural Building

Albany, NY  
Jonah Vitale-Wolfe ([jonah@hvnb.net](mailto:jonah@hvnb.net))  
(518) 434-8010  
[www.hvnb.net](http://www.hvnb.net)

HVNB is a community-based artisan company that focuses on the application of natural building in the urban setting through custom renovation and landscaping, educational workshops, and community work. HVNB uses natural building practices and materials as a sustainable alternative to conventional methods.

#### Holistic Homebuilders

Ithaca, NY  
Sarah Highland ([hiberry@lightlink.com](mailto:hiberry@lightlink.com))  
607-273-8671

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

Sarah and her crew work with old and new timbers to build homes, naturally decay resistant play sets, and buildings that will last centuries, using time-honored tools and techniques. Sarah is also the founder of Finger Lakes Natural Builders Network.

#### Just Another Way Builder

Clark Sanders  
East Meredith, NY  
607-278-5144

Clark specializes in design/build and research development in straw bale, cob, plasters and adobe floors suited for the northeastern climate.

#### Strawbale Systems

Rochester, NY  
David Vail ([dvail1@rochester.rr.com](mailto:dvail1@rochester.rr.com))  
585-292-5697

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

David is an experienced straw bale builder providing project management and design execution for the owner-builder, as well as consulting, equipment for stucco application, and straw bale workshops and classes.

#### Sun Mountain

Larry Brown  
([sunmountain@netstep.net](mailto:sunmountain@netstep.net))  
Woodstock, NY

Larry is a builder and contractor specializing in solar installations with experience in natural building and straw bale construction.

## Green Architects and Designers in NYS

### Chaleff and Rogers, Architects

Water Mill, NY  
631-726-4477

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

LEED Accredited staff. Firm is affiliated with the USGBC and founder Suffolk Co. Solar Energy Commission. Materials and methods used include: super insulation (cellulose), condensing high-efficiency gas boiler, local materials, earth-bermed, efficient lighting, low VOC paint, brick & tile finishes, cellulose ceiling.

### Chris Benedict, R.A.

New York, NY  
212-477-6016

Specializes in rehabilitation, adaptive reuse and new construction projects that are healthy, durable and energy efficient for the same price as typical construction.

### Cheryl Thompson

Ithaca, NY

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

NYS licensed architect specializes in designs for buildings made of natural materials including timber frame, straw bale, earthbermed, rammed earth, and many other techniques.

### Collins + Scoville Architects, P.C.

Albany, NY

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

518-463-8068

Specializing in green design for schools, commercial projects and affordable housing. This firm is committed to bringing vital knowledge of sustainable design to

homeowners through all projects since this information can inform their votes and input into school and community projects as well their work on their own homes.

### Dave Sadowsky, Architect, P.C.

Petersburg, NY

518-658-2830

[www.albany.net/~sadowsky/](http://www.albany.net/~sadowsky/)

A small firm with a socially conscious approach to building which focuses on energy conscious design, low maintenance materials, and high quality construction techniques. Home designs include highly efficient energy-saving heating systems, appliances, water saving products, and proven high insulation systems.

### David Bergman Architect

New York, NY

212-475-3106

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

Residential and commercial renovations, additions and new construction, utilizing sustainable and recycled materials, non-toxic finishes and energy efficient lighting. Services include architecture, interior and custom furniture design. David Bergman is also the founder and designer of Fire & Water, a company producing award-winning decorative eco-lighting.

### D-V Design

Dragana Vlatkovic

Niskayuna, New York

518-280-8992

[www.d-vdesign.com](http://www.d-vdesign.com)

D-V Design provides interior and architecture design for new construction and renovation with application

of alternative building systems such as panelized systems, prefabricated construction and sustainable or green design.

### Green Home Concepts, LLC.

Sag Harbor, NY

631-899-3486

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

USGBC member and LEED accredited consulting firm offering green building support services for homeowners, developers, architects, contractors, and anyone else interested in energy efficient, environmentally sustainable construction and design.

### Ikan Consulting

Cuba, NY

585-899-9606

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

LEED Accredited. Green building consultants work directly with owners, developers, architects, engineers and other real-estate professionals to integrate energy and resource-efficient, environmentally progressive design into specific building projects

### Judith M. McNealus, Designer, Associate AIA

MLA Design Services

Queensbury, New York

518-542-0501

[mal\\_jmcn@adelphia.net](mailto:mal_jmcn@adelphia.net)

Providing residential design services, specializing in sustainable design, energy efficiency and both active and passive solar systems. 20 years of experience.

## Finding Green Helpers CONTINUED

### Kevin V. Connors & Associates

Buffalo, NY

[kcanda@aol.com](mailto:kcanda@aol.com),  
[sanheiser@rochester.rr.com](mailto:sanheiser@rochester.rr.com)

Provides architecture, engineering and planning for ecological recreational, institutional, commercial and residential development with a focus on architecture and spirit, therapeutic design.

### Maggie Wood Design, LLC

Jamesport, NY

631-276-9633

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

Design and consulting firm specializing exclusively in green residential home design – creating healthy and beautiful living environments using quality sustainable building practices, products and materials.

### Thread Collective

Brooklyn, NY

718 389 1852

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

Active members of GreenHomeNYC, a sustainable design advocacy group. Thread Collective offers design services incorporating architecture, landscape and interior design with an emphasis on green building concepts.

### Sunstone Cottage and Cabin

Anne & Don Sacilowski

Depew, NY

[sunstonecottage@aol.com](mailto:sunstonecottage@aol.com)

Cottage & cabin design specializing in small dwellings under 1,000 sq. ft., with an emphasis on promoting healthy building materials.

## Green Builders and Contractors in NYS

### NYC/LONG ISLAND

#### Carpistry

New York, NY

917-509-8034

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

Carpistry is a small, high-end NYC home improvement construction company which resulted from the founder seeking solutions to his family's mold allergies through green processes and products.

#### Duce Construction Corp.

New York, NY

212-316-2400

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

Membership in the Apollo Alliance, NYSERDA, US Green Building Council, EBA, NYSEIA and NESEA. Building projects incorporate recycled thermal and sound insulation and low-VOC adhesives and paints.

#### GreenStreet Construction, Inc.

New York, NY

212-234-1027

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

GreenStreet has two LEED Accredited project managers on staff, is a member of the USGBC, and works in high end residential green building.

#### Urban Green Builders

New York, NY

212-410-6336

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

Urban Green Builders is a small company specializing in urban regeneration projects.

### Zephyr Improvement Inc

Bayville, NY

516-628-2296

Zephyr Improvement utilizes green building materials and techniques including cotton insulation, zero VOC paint, little or no PVC, radiant heat, thermal mass walls, and recycled building materials.

### Josh Neretin Design and Construction

Brooklyn, NY

718-832-1930

USGBC member. Designer, contractors, construction managers and consulting (Pre-purchase and pre-renovation walk through services). Conventional and green construction.

## CAPITAL REGION/HUDSON VALLEY

### Dutch Hill Enterprises

Tannersville, NY

518 589-6379

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

USGBC member and Energy Star partner focusing on sustainable construction, design, and project development in both new and remodeling projects.

## CNY

### Mustang Construction Group

Camillus, NY

315-299-8085

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

Member of USGBC. Custom home-builder and renovation experts.

## Green Landscaping Services in NYS

### Stone and Garden

Hancock, NY 13783

917-771-9382

[www.stoneandgarden.net](http://www.stoneandgarden.net)

Natural stone and environmentally friendly garden installation and design. These green projects employ permaculture principles, focusing on edible plants and herbs, water harvesting, and composting systems.

### Susan Wisniewski Landscape, LLC

Beacon, NY

845-231-4003

Landscape Architecture which combines design with a healthy functioning environment by incorporating indigenous plantings, use of local building materials, on site storm water management, preservation of existing vegetation, green roof design and maintenance of watershed and wildlife corridors.

## Other Sources for Professionals

To see a list of LEED (Leadership in Energy and Environmental Design) accredited professionals in your area, go to

[www.usgbc.org/LEED/AP/ViewAll.aspx?CategoryID=1306&CMSPageID=1585](http://www.usgbc.org/LEED/AP/ViewAll.aspx?CategoryID=1306&CMSPageID=1585)

To find eligible alternative energy installers, see the "Power Naturally" pages by NYSERDA (New York State Energy Research and Development Authority)

PV Systems: [www.powernaturally.org/Programs/Solar/Installerspv\\_all.asp?i=1](http://www.powernaturally.org/Programs/Solar/Installerspv_all.asp?i=1)

Wind Systems: [www.powernaturally.org/Programs/Wind/Installers\\_all.asp?i=8](http://www.powernaturally.org/Programs/Wind/Installers_all.asp?i=8)



## SECTION THREE

## Time To Build



**This section includes greener possibilities for each major step in the building process – from digging the foundation and building the frame to picking out flooring and wall coverings. Please note that there are often many companies that offer materials similar to those we’ve highlighted throughout this section. Our suggestions for availability are not comprehensive – rather they are meant to give you a starting point to locate your desired materials and do not imply recommendation by CEC.**

## FOUNDATIONS

**A**FTER YOU DECIDE ON THE size, shape and basic floor plan of your home-to-be, the next important set of decisions concerns the foundation. Most homes today rely on the use of poured concrete. Other options, such as concrete masonry block, are popular in some parts of the country, while permanent wood and stone foundations are used less frequently.

Concrete foundations are generally pest and moisture resistant. However, concrete alone is a poor insulator. Also, concrete contains Portland cement which isn’t a green choice because it contains so much embodied energy, emitting huge amounts of green house gases in its manufacture. According to the National Center for Appropriate Technology ([www.ncat.org](http://www.ncat.org)), it has been estimated that approximately 8% of the world’s carbon dioxide emissions comes from cement production.

In an effort to create “greener” concrete, people have reduced the amount of cement, substituting it with fly ash, which comes from coal fired power plants. The addition of fly ash makes the concrete stronger, easier to pump, and gives it a smoother finish. It’s also considered “beneficial use” of a product that would otherwise require hazardous waste disposal. On the other hand, because this concrete contains heavy metals including mercury, cadmium, chromium and lead, there are concerns that

they will leach out over time, leading to toxic contamination of your property and groundwater. There are many concrete companies and even green building websites that advocate for the use of fly ash on the internet, making it difficult to find information about the potential hazards. More research may be needed to prove whether or not fly-ash can be used safely in any application.

#### ► CONSERVING RESOURCES WHEN BUILDING FOUNDATIONS

While the “greenness” of using concrete itself may hold no easy solutions, there are questions you or your contractor can consider in order to conserve resources when pouring your foundation:

Can the project design be simplified to reduce the amount of material used in the foundation? Assess systems that use less material to see if they are appropriate for your project and your site. For example, would a thinner than standard foundation be structurally adequate for this project?

Is a pier foundation an option for the project? A structure with a pier foundation mimics a standard table with legs, and is ideal for a small structure with nearby trees that would otherwise be damaged by digging a traditional foundation. A pier foundation works well for small buildings like workshops or garden sheds. For occupied basements, would an insulating

## Damp Proofing

There are several key steps to keep water from entering your house, preventing mold and rot. These involve both waterproofing: keeping liquid water from being forced through small holes into your house, and damp-proofing: keeping water vapor from seeping through the foundation.

**Sealing the Foundation.** This is typically done with asphalt, rubber or cement which are effective options, but are not the best for the environment. A non-toxic and non-polluting option is *Bentonite clay fabric* by A.H. Harris. It is made from 100% natural sodium bentonite clay which expands when it encounters moisture, forming a water-tight seal.

**Drainage.** To keep water away from the foundation, it is surrounded by a perforated pipe and gravel. The pipe is directed away from the house. Given PVC's toxic lifecycle and its tendency to get brittle over time, consider using polyethylene plastic pipe or clay pipe (see page 65 for more on pipes and plumbing). Wrapping the gravel and pipe in landscape fabric is an extra step that can keep silt and dirt from clogging it.

**Landscaping.** By ensuring the ground slopes away from the house, by at least 5%, or 6 inches over the first 10 feet, you can help keep water from pooling by your foundation walls.

**Gutters and overhangs.** Keep water away from the walls with adequate overhangs on eaves and by correctly installing gutters and drain spouts that move rainwater away from the house.

concrete form foundation wall or panelized pre-cast foundation offer material savings? Insulated concrete forms (ICFs) are large hollow blocks that are locked together with rebar (a type of metal rod for reinforcement) and filled with concrete to create a structurally sound, insulated foundation wall.

Some forms are made from 2 x 10 sawn lumber cut from old growth forests. The contractor can eliminate the need for separate forms if you plan to insulate your foundation before backfilling to minimize heat loss (highly recommended). Use rigid foam as forms and leave them in place to serve as thermal insulation for the building. Contractors can use reusable wood form boards. To minimize use of large sawn boards, carefully

remove and separate the forms, allowing their reuse several times.

If you don't plan to insulate, the contractor can buy metal forms that can be used over and over at multiple locations. These forms come in all shapes and sizes and produce a smooth finished surface on the concrete. Despite higher initial cost, they can be used many times, and pay for themselves after only a few builds.

Resources for

### Foundations

- Green Tree, Decisions for Environmental Buildings [www.ncat.org/greentree/](http://www.ncat.org/greentree/) has helpful introductory planning questions for foundations, floors and wall systems.
- "Pier Foundations Protect Trees" on Tim Carter's *Ask the Builder* website [www.askthebuilder.com](http://www.askthebuilder.com)

## THE FRAME OF THE HOUSE

**I**N MOST CONVENTIONAL HOMES, the frame of the house is made from wood. Because lumber is essential for all sorts of home improvement projects and not just framing, we have outlined the uses of wood for the framing process and have created a lumber section to explain these options in more detail. For more information on alternative homes which will not necessarily rely on wood see page 29.

The sill plate is first layer of wood that is built over the foundation. Because it comes into contact with moisture, building codes require pressure treated lumber so as to resist rot and pests. Arsenic treated lumber is banned for residential use, but still may be available in some places (see page 17). Instead, look for ACQ (Alkaline Copper Quaternary) or CBA (Copper Boron Azole). Because they are corrosive, both ACQ and CBA require the use of hot-dipped (not electro-plated) galvanized or stainless steel fasteners to prevent premature rusting.

The wood for the floor frame and the framing that constitutes the walls should be built from lumber that is sustainably harvested. In choosing wood for framing, look for the Forest Stewardship Council (FSC) certified lumber or consider engineered lumber. If you live in an area where deconstruction firms disassemble buildings, consider salvaged framing.

Careful design can also reduce the amount of framing lumber you need. By lining up the wall studs and rafters so a top wall plate is unnecessary, eliminating large window and door headers where they aren't required and using sheetrock "corner clips," the amount of framing lumber is reduced. This not only saves lumber, but increases the amount of insulation in the wall. Other ways to improve energy efficiency when designing your house or addition can include using 2 x 6 construction for outer walls so that you can add thicker insulation, or by staggering 2 x 4 studs so that blown insulation, such as cellulose (shredded newsprint treated with boric acid), can form a continuous layer.

The sub-flooring, which provides the base for the final floor surface, and sheathing, which acts as the outside shell of the house, are usually composed of either plywood or oriented strand board (OSB). Low or no formaldehyde content options will prevent off-gassing into indoor air. As prices for wood products have gone up, Homasote and rapidly renewable ply-wood and particle board substitutes, described in the lumber section, may be more environmentally sound choices to replace standard plywood and particle board.

Another option to consider are SIPs, or Structurally Insulated Panels, which fit together

### The Frame: Wood vs. Steel?

Wood has been the traditional framing material for homes for hundreds of years, but as it becomes more precious and therefore more expensive, steel frames are being touted as environmentally friendly.

Some benefits of steel include its stability and its uniformity - it doesn't warp, rot, buckle, split or splinter and is great for long, open spans because of its uniformity. Likewise, each component has a place, so there is no waste generated on-site. Steel framing is usually made with post-consumer recycled content, and has no need for toxic additives to make it pest-free and rot resistant. These factors make it a consideration for home owners in parts of the US where termites and earthquakes are a major problem.

On the downside, steel frames are more expensive and must be properly covered to avoid corrosion from moisture. Many builders prefer wood because building with steel requires different tools and skills and because it's so heavy, it can cause more harm if handled improperly. While it is recyclable and saves trees, steel has extremely high embodied energy, meaning that the trade-off for saving trees may mean much more pollution through its lifecycle. Overall energy use, CO<sub>2</sub> and other emissions, and water demand in the construction, extraction and manufacturing of virgin steel mean that wood is often still the greener choice.

offering support and insulation in one step. SIPs can be used for wall, floor, or roof construction, and are made with expanded polystyrene foam sandwiched between OSB. Also, SIPs are made to fit together, so there is little or no construc-

tion waste. While SIPs are made with petroleum based foams, and OSB which may not be sustainably produced, the energy and material savings may outweigh these costs.

## LUMBER

**M**ANY WOOD PRODUCTS ARE harvested unsustainably, tearing apart intact ecosystems and removing old growth trees. Due to rapid growth in building construction, there is increasing pressure to log the few remaining stands of these ancient trees around the world. According to a 2006 Greenpeace study, North America destroys 10,000 square kilometers of ancient forests every year. Using Forest Stewardship Council certified lumber, wood reclaimed from other sites, and sustainably produced engineered lumber can take the pressure off old growth trees.

Other factors to consider with wood include its durability, and whether or not it's local – since, like all materials, there are energy costs associated with transporting it. Builders will often be faced with the difficult decision of shipping sustainably harvest lumber long distances or settling for a more local lumber source that may not be harvested with the future in mind.

### ➤ CERTIFIED LUMBER

To make sure the wood you use has been harvested sustainably, look for the Forest Stewardship Council's certification. The FSC is an independent non-profit which is supported by environmental groups worldwide and has a reliable chain of custody system which enables them to track wood from the forest floor to the consumer. The FSC also has a rigorous set of criteria for managing forest lands, including protecting the rights of indigenous people who live in and utilize the forests. The Forest Stewardship Council was founded in 1993 by conservation and forest sustainability groups including Greenpeace, Sierra Club, and World

Wildlife Fund, and is the only wood accepted for United States Green Building Council's Leadership in Energy and Environmental Design (LEED) green building rating system (For more on LEED, see page 29). Using FSC lumber may add to lead time, as it can be more difficult to procure.

There are many other types of wood certification programs which have different standards for what they consider to be sustainable. For example, The American Forest & Paper Association has developed its own program for its members, called the Sustainable Forestry Initiative (SFI). They have weaker standards and no credible chain of custody to keep out illegal wood. FSC certified lumber offers the greatest certainty that you are buying lumber directly from a sustainably harvested forest. Keep in mind that if a company has FSC Chain of Custody certification, it does not mean that what is being sold is FSC-certified. Chain of Custody certification gives companies the right to buy and sell FSC-certified wood, but it doesn't mean they are selling it. This is particularly the case in the wood flooring industry. Also, while large retailers like The Home Depot and Lowe's have committed to purchasing FSC and otherwise certified lumber, not all sales associates are aware of what FSC means. If you want to be certain you are getting FSC certified wood, make sure the product itself is labeled.

More information about the Forest Stewardship Council is available on-line at [www.fscus.org](http://www.fscus.org). They also have an FSC product finder form at [http://www.fscus.org/faqs/fsc\\_products.php](http://www.fscus.org/faqs/fsc_products.php).

Local mills and lumberyards may be a good place to start looking for FCS certified wood. If you live in upstate New York, Saranac Hollow

Lumber in Saranac, NY [www.saranachollow.com](http://www.saranachollow.com) offers FSC certified products. Other lumber centers may be able to special order the lumber you're looking for.

The Rainforest Alliance [www.rainforest-alliance.org](http://www.rainforest-alliance.org) has compiled a "SmartGuide," listing companies who offer FSC certified building materials. You can find this extremely useful PDF at <http://www.rainforest-alliance.org/programs/forestry/smartwood/find-certified-products.cfm> or by searching "SmartGuide" from the Rainforest Alliance main page.

### ► SALVAGED LUMBER

Rather than using newly-cut lumber, you can choose lumber from a building that has been deconstructed – taken apart carefully to allow reuse of the components. Reclaimed parts are often high quality, tightly grained piece – often better quality than wood available on the market today. Vintage wood can be salvaged from weathered barns and old train trestles, often giving its appearance more character. The labor intensive process of taking apart old homes and barns can make these components more expensive than new lumber, and more difficult to find. If you have a renovation project that involves demolishing part of an older house, consider deconstructing it to reuse the materials for the renovation project. While it may cost more in labor, it will save resources, landfill space, and disposal costs.

For sources for reused building supplies in New York State, see our list at end of this guide.

### ► PRESSURE TREATED LUMBER

ACQ (Alkaline Copper Quaternary) or CBA (Copper Boron Azole) treated lumber are better options than Arsenic treated lumber which has been banned for residential use. Both ACQ and CBA are available at home supply stores and require hot-dipped galvanized or stainless steel fasteners to prevent premature rusting. Plastic Lumber, described below, is another alternative to pressure treated wood for outdoor use.

### ► ENGINEERED LUMBER AND PLYWOOD

Wood sheet products like oriented strand board (OSB) and Plywood are used for sheathing, sub flooring, and in some cases, siding. As old growth resources become scarcer and more expensive, people have sought engineered lumber. As a result, there are now many different products that get their strength from resins and glues, and rely on bits of wood from smaller trees and wood from fast growing "plantation" trees to make them nail-able and screw-able.

Examples of engineered lumber include wood that is glued and laminated together (known as glulams); laminated veneer lumber and plywood; wood I-joists which are similar to steel I-beams, used to replace large timbers for floors and ceilings joists; and oriented strand board (OSB) made from small bits of wood layered in perpendicular directions. Most of these are glued together with urea formaldehyde based adhesives or methyl diphenyl diisocyanate (MDI). Exterior grade plywood is made with Phenol formaldehyde, which can still be harmful, but off gasses much less. Columbia Forest Products has completely eliminated formaldehyde from its standard veneer-core panel production by developing a non-toxic, soy based adhesive for plywood called Pure-Bond. In addition to safer adhesives, look for plywood and other wood products made from Forest Stewardship Council certified lumber.

The benefits of engineered lumber include use of smaller trees, reducing pressure on old growth forests; because they are created by humans, they are more reliable and consistent; and they are stronger than similarly sized all-wood timbers. Because it is manufactured, however, engineered lumber requires more energy to produce, and the manufacturing process requires the use of some toxic materials in the resins. While engineered lumber is important and can offer affordable substitutes for large-sized lumber, for long-term ecological sustainability, we will need to find other solutions.

### ► PLASTIC LUMBER

Although it sounds environmentally harmful, plastic lumber substituted for pressure treated, outdoor use wood has “green” potential. Plastic lumber reduces lumber use and can utilize the safest forms of post-consumer recycled plastic. A recent report by the Healthy Building Network evaluated the environmental impact of 30 types of plastic lumber, finding one third of these to be “most environmentally preferable.” The report recommends that consumers favor products with the highest levels (50% or more) post-consumer plastics which are associated with fewer chemical hazards and impacts (like high and low density polyethylene, known as HDPE and LDPE,), and those made by pro-

ducers using resins from local municipal recycling programs. Avoid plastic lumbers that contain PVC, polystyrene, and fiberglass (unless being used for structural applications that call for reinforced lumber). Also avoid plastic lumber made from non-recycled plastics. To learn more about the results of this report as well as a list of products that were found to be most environmentally preferable, find it through the Healthy Building Network at [www.healthybuilding.net](http://www.healthybuilding.net).

### ► BAMBOO

Bamboo, a type of woody grass, has been gaining widespread popularity as a building material – in most cases, as a sustainable floor-

## PROFILE



### Green Community Building at the SJC

Social Justice Center, Albany, NY

The Social Justice Center (SJC) is a grassroots organization in Albany committed to building strong community activism to fight oppression. Since 1981, the three-story, brick SJC building has hosted community events, provided desks and meeting spaces for activists, and has been a place for community members to browse the lending library, play chess, or just hang out and talk.

Over the past year, Victorio Reyes, Executive Director of the Social Justice Center, created an advisory committee to help formulate a plan to green the SJC building. Several notable people joined the committee including, Joe Fama from the Troy Architectural Program, Jonah Vitale-Wolfe from Hudson Valley Natural Building, and Scott Kellogg from the Rhizome Collective. When the SJC wasn't approved for the initial grant they applied for, Victorio and his crew decided to move forward with a grassroots version of that plan: “We're going to scale it back

a bit,” says Victorio, “We probably won't be able to do the green roof anytime soon, but the roof needs replacing, so we may go with a rubber roof made from recycled tires.”

The plan also calls for a renovation of the main level, where member organizations hold meetings and community events. Among other changes, the worn hardwood floor will be refinished with an environmentally friendly varnish, and the electric bill will soon be converted to wind power through Community Energy. Most importantly, the construction of some indoor natural walls will become a classroom for interested local people. The SJC plans to charge a small fee in return for a hands-on workshop lesson in natural wall techniques. The money raised through these workshops will help the SJC continue to focus on greening the building where numerous organizations, including Citizens' Environmental Coalition, got their start. By working with volunteers and through workshops to move toward this goal, the SJC will inspire similar building owners that just like other progressive actions, sustainable renovations are possible one small change at a time.

ing option. The sustainability of bamboo continues to be a question as folks weigh its fast growth and durable consistency with the need to transport it overseas which contributes to its embodied energy. Also, there is speculation that some bamboo manufacturers rely on sweatshop labor and clear cut forests in China and elsewhere to create bamboo plantations.

As with everything, do some research and take a comprehensive life cycle approach. With different manufacturers, consider whether the bamboo grower uses pesticides, has clear-cut existing bio-diverse forests or displaced local communities. Many bamboo product makers investigate these aspects and will certify their products come from correctly managed lands. Teregren Bamboo products are among a growing number that are low-VOC, advertised to be sustainability harvested and easy to find in many locations. Go to [www.teragren.com](http://www.teragren.com) to find a local retailer. For information on bamboo grown in the US, check out the Northeast Chapter of the American Bamboo Association [www.americanbamboo.org](http://www.americanbamboo.org) which is located in Albany, NY.

### ► OTHER NON-WOOD PRODUCTS

Products including gypsum board (drywall or Sheetrock), strawboard, and Homasote have been designed to replace plywood or particle board in many applications. Homasote is made of recycled paper and the manufacturer claims it was the sheathing of choice from the 1930s to the 1970s. Homasote also creates products that can be used in subflooring. There are also many

particle board-like products made from wheat straw, such as PrineBoard and Stawboard which can be used in sheathing and subflooring. Products such as “Plyboo” Bamboo Plywood, “Dakota Burl” (made from sunflower seed husks), “Durapalm” Coconut Palm Plywood, Kirei Board (made from reclaimed agricultural fiber from the Sorghum plant) and wheat board are all sustainable options that are becoming more available for sheathing, wall coverings, furnishings, floors and counter tops. Bettencourt Green Building Supplies [www.bettencourtwood.com](http://www.bettencourtwood.com) has more information about many of these products, with links to their manufacturer’s websites.

#### Resources for Lumber

- Bettencourt Green Building Supplies [www.bettencourtwood.com](http://www.bettencourtwood.com) has information about natural lumber alternatives like “Plyboo” and wheatboard.
- Forest Stewardship Council [www.fscus.org](http://www.fscus.org) and [www.forestethics.org](http://www.forestethics.org) both have more information about sustainability harvested lumber.
- Greenpeace’s report on the worlds remaining intact forests, can be found at [www.intactforests.org/index.htm](http://www.intactforests.org/index.htm)
- Healthy Building Network [www.healthybuilding.net](http://www.healthybuilding.net) has a helpful report evaluating the feasibility of plastic lumber as a green building material.
- Homasote Company [www.homasote.com](http://www.homasote.com) produces Homasote as a lumber alternative.
- The Rainforest Alliance [www.rainforest-alliance.org](http://www.rainforest-alliance.org) has compiled a “SmartGuide,” listing companies who offer FSC certified building materials. <http://www.rainforest-alliance.org/programs/forestry/smartwood/find-certified-products.cfm> or search “SmartGuide” from the Rainforest Alliance main page.

## WINDOWS & DOORS

**W**INDOWS AND DOORS ARE the openings through which most energy flows in and out of your home. They have the potential to provide free heating, cooling, and lighting, and to make your home more pleasant. Window placement is important for energy savings through natural ventilation,

day lighting, and passive solar heating. For more on these strategies, see page 25.

Windows can also lead to costly leaks during the heating season. Make sure your window frames are thermally broken and that installation includes adding insulation to fill gaps around the window and in the frame. Like other building materials, the choices we make for win-

dow frame and door materials can impact the environment.

### What to Avoid

Avoid **leaky, lead-painted windows!** Old, wood-frame, single-pane windows usually seal poorly, leading to costly energy loss. While reusing materials from old homes and buildings is generally a good thing, buying the right new windows will be more energy efficient and therefore eco-friendly in the end. If you do reuse, look out for lead paint which can easily chip from old window frames, posing serious health threats to your family (See page 14 for more on lead abatement).

**Polyvinyl Chloride (PVC)** has become a popular replacement material for old windows, but it should be avoided in all applications because it is highly polluting and energy intensive in production, relies on heavy metal additives to keep it from breaking down rapidly, and can off gas toxins into the home environment. For more on these and other environmental and health problems associated with PVC, see page 10. PVC may be difficult to avoid completely, as it is used in composite windows as well as jamb liners and hardware parts in many “non-PVC” windows.

### Greener Possibilities

No matter what material your windows are made from, look for Energy Star-rated windows and doors with windows. Energy Star is a program developed by the U.S. Department of Energy and Department of Environmental Conservation to promote and register energy efficient products including energy-efficient windows, electronic devices and appliances. For up-to-date manufacturer lists, go to [www.energystar.gov](http://www.energystar.gov).

#### ➤ WINDOW FRAMES

**Wood** is generally the greenest material for windows because it has low embodied energy, is a good insulator, is less prone to condensation, is unaffected by temperature extremes and can enhance your home’s visual appeal. Wood windows usually need more maintenance than

composite materials or vinyl, but they can last a lifetime when finished to protect against deterioration and painted as needed.

FSC certified wood is the best option when purchasing wood framed windows since these products promote the use of wood from well-managed forests. For more on FSC lumber see page 48.

*Availability:* Wooden windows and doors are widely available.

FSC certified windows may be more difficult to find locally, but like other green building materials, the more people request them, the more available they will become!

For suppliers of FSC-certified windows, see the Rainforest Alliance’s SmartGuide, which can be found at [www.rainforest-alliance.org](http://www.rainforest-alliance.org) or FSC’s product finder form at [http://www.fsc.us.org/faqs/fsc\\_products.php](http://www.fsc.us.org/faqs/fsc_products.php).

**Other widely available materials for windows and doors**, such as wood and metal combinations, fiberglass, and composite materials, include more embodied energy in their production than wood. Major manufacturers are making windows which are extremely energy efficient. For most green builders, this is sufficient reason to offset the environmental cost of the frame material. Always look for green attributes, like high recycled content in window frame materials – but keep in mind that energy efficiency will reduce pollution over the long run by lowering your utility bill.

Manufacturers that produce windows often offer doors made from similar materials. Like windows, when choosing a wooden door, try to procure FSC certified wood.

*Availability:* Humabuilt [www.humabuilt.com](http://www.humabuilt.com) produces formaldehyde-free, Wheatcore doors which are sustainably produced with low-VOC adhesives.

#### ➤ WINDOW PANES

While frame materials are important, energy performance is the primary green consideration of windows. New innovations in window technology enable today’s products to far outperform older windows. Among the improvements

are multiple glazing layers, low-conductivity gas fills, better seals on insulated glazing units, heat-reflective (low-emissivity) coatings, and advanced weather-stripping.

For energy efficiency in windows (and doors with windows), look for double or even triple paned options, which can insulate twice as well as single glazing. They can make the house quieter, less drafty, and more comfortable during all seasons, while saving energy and money.

For an additional 10-15% in up-front cost, windows can be purchased that have low-emissivity (low-E) coatings on the glass and low conductivity gases, like argon or krypton in the air space between each pane. The coatings and gases help prevent heat transfer by increasing the insulating value. However, many professionals are coming to the conclusion that gas-filled window panes aren't worth the extra cost because they offer little improvement and dissipate over time (and can even leave a cloudy film between the panes when they do).

Standard low-E coatings are appropriate for climates like New York, where heating is more of a concern than air conditioning. This glass reflects the room's heat back inside, reducing the need for winter heating. Standard low-E coatings don't significantly affect sunlight, permitting the sun's heat to enter your home. In hot climates, however, builders may consider a second type of low-E coating, often called "solar control," "low solar gain" or "spectrally selective." These limit the sun's heat energy enter-

ing through the glass, reducing the need for air conditioning.

*Availability:* Energy Star rated windows are widely available through large retailers like The Home Depot and Lowes. Pella offers windows which count toward LEED certification. To learn more, go to <http://www.pella.com/about/environment.asp>.

### Other Ideas

For translucent windows, useful for privacy in bathrooms or as shower screens, consider recycled glass blocks, which need no other treatment and can give homes a contemporary feel. These can be found in building centers and do-it-yourself stores. For other artistic touches, recycled glass bottles or stained glass can add color and light. Note the stained glass often contains lead used as a binder between the panes.

### Resources for Windows and Doors

- Energy Star Windows [www.energystar.gov/index.cfm?c=windows\\_doors.pr\\_windows](http://www.energystar.gov/index.cfm?c=windows_doors.pr_windows) is a partnership between DOE, EPA, and the fenestration industry to promote energy efficient windows, doors, and skylights. The Energy Star Window label is placed on products that meet energy efficiency performance standards.
- Recycle Works [www.recycleworks.org](http://www.recycleworks.org) is a program of San Mateo County, California, which has organized a useful website with information about windows, as well as many other aspects of energy and resource efficient building.
- Efficient Windows Collaborative [www.efficientwindows.org](http://www.efficientwindows.org) and National Fenestration Rating Council [www.nfrc.org](http://www.nfrc.org) both provide information on the benefits of energy-efficient windows, descriptions of how they work, and recommendations for their selection and use.

## INSULATION

**A** WELL-INSULATED HOUSE IS A key ingredient in its energy-efficiency, so choosing an insulation that is both health-protective and effective is important. The most important considerations when insulating your home are to make sure that you have enough insulation, that you've selected the best type for your particular

circumstances, and that your home is properly air sealed.

For energy efficiency, the higher the overall "R-value" (the amount the material resists heat transfer), the better. The R-value varies by type of product, application, thickness, and brand, so if you're looking for new insulation, get accurate measurements for your job and use that in-

formation to find the best insulation for you. The US Department of Energy has created some guidelines for ideal R-value, based on climate, type of home, and heat source, which can be found at <http://www1.eere.energy.gov/consumer/tips/insulation.html>.

The initial cost of installing some insulation may be higher than traditional fiberglass insulation; however, the savings in utility bills every month, year after year, can greatly outweigh the extra cost.

When it comes to insulation, sometimes less is more. Installing too much insulation can be counterproductive. Insulation needs to be surrounded by airspace in order to make it most effective - thus, forcing material into a wall cavity will compress it and diminish its R-value. Also, too much insulation in an attic can block an eave or vents that are needed to prevent condensation, mold and rot.

However, R-value is not the only consideration when it comes to insulating. R-value is helpful in choosing insulation, but it doesn't guarantee being effective against the other two methods of heat transfer: convection, which is transfer of heat by moving air; and radiation, the transfer of heat in the form of electromagnetic waves. Convective heat loss is significant if you have air leaks that pull cold air in and warm air out. Most homes are not perfectly sealed. For this reason, dense pack cellulose which functions as an air retarder can be preferable to loose pack cellulose even though it has a lower R-value.

### What to Avoid

**Fiberglass** is probably the most popular insulation used today, made of tiny fibers which can irritate the skin, eyes, nose and throat when inhaled. The fibers are also easily imbedded in the lungs and may be carcinogens. Even though it can be made from recycled materials, this insulation also usually contains toxic chemicals like phenol formaldehyde and asphalt adhesives. If installed correctly, fiberglass insulation will usually not pose a problem for building occupants, however when considering lifecycle

costs, fiberglass is also harmful to the environment during production. Mineral wool, or slag wool, has the same problems. If you choose to install this kind of insulation, look for formaldehyde-free formulations and be sure to cover all skin and wear a dust mask during installation. Fiberglass insulation has a good R-value, but is a poor air retarder, meaning that while it functions well in a perfectly sealed home, it isn't good at stopping heat loss through air movement.

There are several rigid and sprayed-in foam insulations composed of petrochemicals. These tend to have greater environmental impacts than other types due to extraction, refining and transport of raw materials, and the use of ozone-depleting compounds in manufacture. However, these do effectively close gaps and eliminate the need for an additional air barrier.

### Greener Possibilities

**Structurally Insulated Panels (SIPs) and Insulated Concrete Forms (ICFs)** are expanded polystyrene insulation systems that can be considered before your home is built, since they're used in foundations and framing. Both are gaining widespread acceptance because of the energy savings they offer. ICFs may be a consideration for foundations (see page 45) Typically used for wall, floor, or roof construction, structurally insulated panels sandwich expanded polystyrene foam between oriented strand boards (OSB). The expanded polystyrene used in both insulated concrete forms and structural insulated panels offers sustainable R-values throughout the structure's life. SIPs are made to fit together, reducing waste. While SIPs and ICFs use petroleum based foams, cement, and OSB which may not be sustainably produced, the energy and material savings may outweigh these costs. Talk to your architect or builder to see if these materials work to meet your green values.

*Availability:* See the Structurally Insulated Panel Association [www.sips.org](http://www.sips.org) for more information.

**Cementitious foam** is cement mixed with air to form a "mousse" that can be injected into your existing walls, or applied to new construc-

tion. It is non-toxic, pest resistant, can fill in around all pipes and wires, and flexible enough to run new wires through. It is also entirely fire-resistant, as it contains nothing that will burn. Because it's made from concrete, it has high embodied energy.

*Availability:* Air Krete [www.airkrete.com](http://www.airkrete.com)

**Soy Based foam** is an ultra-light weight, soy based polyurethane foam which expands and then hardens after being sprayed into place. Like cement-based foam, it can fill in around pipes and wires, but this foam is made from a renewable resource. It also emits no VOCs or CFCs, contains no formaldehyde, and is pest and fire resistant.

According to a LEED certified Architect, however, the soy content is less than half of the product – the rest is still composed of petrochemical. And although soy is a renewable resource which does help to reduce petroleum consumption, some consumers may be concerned about potentially supporting farms that grow GMOs (genetically modified organisms). Soy based foams can only be installed by a trained certified contractor.

*Availability:* BioBased 501 [www.biobased.net](http://www.biobased.net) 800-803-5189, also available through Coler Natural Insulation [www.coler.com](http://www.coler.com) 585-624-2499, which provides insulation service throughout much of upstate NY.

**Cellulose insulation** is made predominantly of recycled newsprint treated with non-toxic boric acid for flame and pest retardant purposes. Cellulose insulation may be blown in horizontal applications such as attics and crawl spaces, around pipes and wires, and professionally sprayed into wall cavities and attics.

Cellulose has an excellent R-value, low cost, and low embodied energy. It is non-toxic, non-irritating, natural, and made from at least 80% recovered, post-consumer paper fiber. Manufacturing cellulose insulation involves a fraction of the energy use and associated pollution involved in mineral wool and fiberglass insulation manufacture. Additionally, scrap cellulose generated during installation can be reused, cutting down on waste.

Concerns with cellulose used to include settling that would reduce R-value and the fear that it would absorb water leading to mold growth. However, water vapor activated spray-in cellulose “glues” to the cavity and won't settle, and borates eliminate concerns with mold and fire. There are three methods of installing cellulose: low density, high density and wet. Low density was the conventional method and it provided the highest R-value, however it wasn't a good air retarder and was prone to settling. High density cellulose uses more material and has a slightly lower R-value but is a better air retarder and doesn't settle. Wet cellulose, applied before the sheetrock is installed, is the best air retarder and least likely to settle. Cellulose is typically more expensive than fiberglass, and must be installed by a certified installer. Loose-laid dry cellulose can be installed in attics by the homeowner.

*Availability:* Cocoon/US Green Fiber [www.cocooninsulation.com](http://www.cocooninsulation.com) 800-228-0024, Thermolok cellulose insulation by Hamilton Manufacturing Inc. [www.hmi-mfg.com](http://www.hmi-mfg.com) 208-733-9689, Apple Gate Insulation [www.applegateinsulation.com](http://www.applegateinsulation.com) 800-627-7536, National Fiber [www.nationalfiber.com](http://www.nationalfiber.com) 800-282-7711

For more information on Cellulose insulation, check out the Cellulose Insulation Manufacturers Association [www.cellulose.org](http://www.cellulose.org).

**Cotton and wool insulation** with non-toxic fire retardants has a similar R-value to cellulose for a given thickness of insulation. “Green” characteristics include that it is a natural, renewable resource. Also, recycled cotton, denim or wool materials don't offgas harmful chemicals, and unlike fiberglass, can be handled with no itch. Nontoxic boric acid is used as a fire and pest retardant. Bonded Logic, listed below, is made from 85% post-industrial recycled natural fibers. Cotton batts can be used in the same places as fiberglass or mineral wool batts, rolled out between open roof rafters, ceiling joists or wall studs. Loose fill is also suitable for attic floors and wall cavities. As with any cavity insulation and any natural material, too much moisture will reduce R-Value.

Cotton insulation can cost twice as much as fiberglass for similar insulation effectiveness. Other natural fibers, including hemp, are also emerging and perform similarly to cotton.

*Availability:* Inno-therm [www.innotherm.com](http://www.innotherm.com) 828-466-1147, UltraTouch/Bonded Logic [www.bondedlogic.com](http://www.bondedlogic.com) which is available from Green Depot in Brooklyn, NY [www.greendepot.com](http://www.greendepot.com) 718-

782-2991, or from Coler Natural Insulation [www.coler.com](http://www.coler.com) 585-624-2499, which provides insulation service throughout much of upstate NY.

### Other Ideas

**Rice hulls**, usually considered a waste product, are gaining ground as an economically feasible option for insulation. Composed of rigid

## Evaluating Energy Use and Weatherproofing

Residential homes are responsible for 21% of greenhouse gas emissions and 22% of energy use in this country. A home energy audit will help assess how much energy your home consumes and help you pinpoint exactly where your home is losing energy. With this information, you'll be able to evaluate ways you can make your home energy efficient, saving money and reducing pollution that contributes to global warming. In the Northeast, weatherproofing or "winterizing" your home is crucial to saving energy.

### Hiring a Professional Energy Auditor

If you hire a professional home energy auditor, there are a few things you can do to help the process go smoothly:

- Make sure they'll be doing a thermographic inspection, meaning they'll use infrared to measure heat loss through the home's shell.
- Before the auditors come, make a list of any existing problems such as condensation or drafty areas.
- Have copies or a summary of energy bills for past year.

### Do-It-Yourself: Energy Audit and Weatherproof

A do-it yourself home energy audit includes finding and eliminating air leaks, checking insulation, and considering the energy use of heating and cooling systems and lighting. Weatherproofing can help correct these problems right away. For the long term, however, more efficient windows, doors, or insulation will be a more effective investment than continually sealing against drafts.

When auditing your home, keep a checklist of areas you've inspected and problems you've found. The following information, compiled by EERE (Energy Efficiency and Renewable Energy) will help you prioritize your energy upgrades:

**Make a list of obvious air leaks (drafts) which can save from 5% to 30% of energy use per year.** Check for gaps and leaks around pipes and wires, mail slots, electrical outlets, switch plates, window frames, baseboards, weather stripping around doors, fireplace dampers, attic hatches, and hall- or window-mounted air conditioners. The easiest and most popular draft solution is self-sticking weather-stripping tape. Many weather proofing supplies are made from vinyl (PVC), rubber or silicon products. If possible, avoid those made from vinyl because they contain phthalates and can off gas chemicals into your home. AFM Safecoat makes a nontoxic caulking compound for caulking windows and filling in cracks.

**You can check for drafty windows by walking around them with a lit incense stick on a windy day.** You'll be able to see the smoke moving and you'll know which areas need attention. In the winter months, increase the heat-retention capacity of your single pane windows and doors by purchasing a DIY plastic window wrap kit, available at any hardware or home improvement store. Using a hairdryer on the applied

plastic film will eliminate the wrinkles, but is not essential for it to work. If you don't shrink the plastic, the window treatments can be carefully taken off for use the next year.

**To check doors**, have someone shine a flashlight around the perimeter of a door while you stand on the other side and look for light shining through. Also, try sliding a sheet of stiff paper under the doorway to see if there is a space. If so, door sets can be nailed around the sides and top of exterior doors, or a new door threshold can seal the opening underneath. Draft-proof under seldom used doors or along other cracks with long cloth sacks filled with buckwheat or rice to absorb airflow. If your home has an attached garage, you can purchase garage door kits to that seal out drafts from all around it.

**If you are having difficulty locating leaks**, conduct a basic building pressurization test by first closing all exterior doors, windows, and fireplace flues. Next, turn off all combustion appliances such as gas burning furnaces and water heaters. Then turn on all exhaust fans (generally located in the kitchen and bathrooms) or use a large window fan to suck the air out of the rooms. This test increases infiltration through cracks and leaks, making them easier to detect. You can use a lit incense stick to locate these leaks.

**Outside the house**, inspect all areas where two different building materials meet: exterior corners, where siding and chimneys meet, and areas where the foundation and the bottom of exterior brick or siding meet.

**When sealing any home**, you must always be aware of the danger of indoor air pollution and combustion appliance "backdrafts." Backdrafting is when the various combustion appliances and exhaust fans in the home compete for air. An exhaust fan may pull the combustion gases back into the living space. This can obviously create a very dangerous and unhealthy situation in the home.

**In homes where a fuel is burned** (i.e., natural gas, fuel oil, propane, or wood) for heating, be certain the appliance has an adequate air supply. Generally, one square inch of vent opening is required for each 1,000 Btu of appliance input heat. When in doubt, contact your local utility company, energy professional, or a ventilation contractor.

**Inspect the attic.** If the attic hatch is located above a conditioned space, check to see if it is at least as heavily insulated as the attic, is weather stripped, and closes tightly. Determine whether openings for items such as pipes, ductwork, and chimneys are sealed. While you are inspecting the attic, check to see if there is a vapor barrier of tarpaper, plastic or Kraftpaper attached to insulation batts. If not, you might consider painting the interior ceilings with vapor barrier paint to reduce the amount of water vapor that can pass through the ceiling. Moisture can reduce the effectiveness of insulation leading to structural damage.

**Check the wall's insulation level.** This is more difficult – you can make a small hole in a closet or in some other unobtrusive place to see what, if anything, the wall cavity is filled with. Of course, this method cannot tell you if the entire wall is insulated, or if the insulation has settled. A thermographic inspection by a professional energy auditor can do this.

Inspect the basement. If your basement is unheated, determine whether there is insulation under the living area flooring.

**Your water heater, hot water pipes, and furnace ducts should all be insulated.** You can buy tubular foam pipe insulation which is pre-slit to slip onto pipes of various diameters. On hot pipes, it cuts wasteful heat loss. On cold pipes, it stops sweating and helps prevent freezing.

If your heating and cooling unit is more than 15 years old, you should consider replacing your system with one of the newer, energy-efficient units.

**Check your lights.** Reduce wattage wherever possible, and change bulbs with longer lasting, more efficient CFLs (compact fluorescent lights).

Source: Adapted from US Department of Energy, Energy Efficiency and Renewable Energy: Energy Audits. [www.eere.energy.gov](http://www.eere.energy.gov)

opaline silica and lignin, the hull keeps its shape and doesn't attract insects. Rice hulls are considered a great insulating material because they are difficult to burn, less likely to allow moisture to propagate mold or fungi, and have great thermal insulating properties due to the natural air spaces that their sturdy structure maintains. Rice hulls are completely renewable and can even be free in places where rice is processed, although it may take some detective work to procure enough material to insulate an entire home. The states where rice mills accumulate hulls include Louisiana, Texas, Arkansas, Missouri, Mississippi, Florida, and California. Because they are so light, transporting them would be relatively inexpensive.

Soon, homeowners may be able to grow their own insulation made from **mushrooms!** Rensselaer Polytechnic Institute Student Eben Bayor invented what may become an environmentally sound replacement for synthetic foam insulation, made from a combination of water, flour, minerals and mushroom spores. In this patented process, the fungus spores are injected

into a mold where they feed on starches until they grow into a tightly woven network. After graduating in 2007, Eben and fellow RPI classmate, Gavin McIntyre, plan to create a company called Greensulate to commercialize the technology.

Check out the section of this guide devoted to natural building materials and you will see that building systems incorporating straw bales, straw-clay, cob, rammed earth, adobe and even cordwood, all have degrees of insulating properties.

#### Resources for **Insulation**

- Thomas A. Hirsch. "Keeping the Heat in..." [www.harmonyhomeconstruction.com](http://www.harmonyhomeconstruction.com)
- "New Ideas for Green Insulation" posted August 10, 2006 at [www.inhabitat.com](http://www.inhabitat.com)
- Kelly Hart. "Amazing Rice Hulls" [www.greenhomebuilding.com](http://www.greenhomebuilding.com)
- Alex Pennock. "Choosing the Right Insulation Delivers Energy Savings" [www.greenhomeguide.com](http://www.greenhomeguide.com)
- Oak Ridge National Laboratory's Insulation Fact Sheet [http://www.ornl.gov/sci/roofs+walls/insulation/ins\\_01.html](http://www.ornl.gov/sci/roofs+walls/insulation/ins_01.html) gives an in-depth look at insulation materials, when and how to insulate, and how much to use based on your home and location.

## SIDING

**C**HOOSING SIDING CAN BE A DIFFICULT task when weighing cost, benefits to the house, and environmental impact of the product. It must withstand all types of weather, and be affordable to buy, install and maintain. Also, the siding you choose will really set the tone for the look of your home, so it's important to choose an attractive and durable material that you'll enjoy coming home to!

### **What to Avoid**

**PVC siding** has been growing in popularity over the past few decades, as the PVC industry plays up the easy install (even on top of older siding), low up-front cost and supposed energy efficiency. What they don't tell you is that that

the manufacture of PVC is anything but energy efficient and safe. Also, PVC can be hazardous to occupants in the case of fire, as PVC does not burn but smolders, creating dioxin and hydrochloric acid (a fatal threat to occupants). For more on the lifecycle costs of PVC products, see page 10. For many people, vinyl siding isn't considered as nice looking as wood, stone or cement board. In historic areas it is often against zoning laws to install vinyl siding. Vinyl siding has also been connected with moisture entrapment leading to mold growth.

**Aluminum siding**, while recyclable, durable and requiring little maintenance, does emit significant air pollution during manufacture. If you're set on metal siding, however, shop around for those created with high recycled content.

## Greener Possibilities

**Wood** has traditionally been the most popular siding material in this country, leading to decades of over harvesting and subsequent declining quality. Wood siding that is locally harvested or FSC certified is a low energy, renewable resource. The downside is that wood siding is not a fire-resistant option.

Cedar is a popular wood choice because it is resistant to decay, moisture, and insect attacks. It is also a dimensionally stable wood that lies flat and stays straight. Other wooden siding includes exterior grade plywood and hardboard. T1-11 siding is a wood or wood based siding product that is still produced, but was much more popular before other options like vinyl and composite materials took-off. Look to the lumber section on page 48 for more on FSC lumber and wood replacement materials for sheathing, framing and sometimes even siding. Availability: There are a growing number of lumber companies that provide FSC certified siding, but it may be difficult to find a local source. Maibec purchases a large portion of its

log supply from the Seven Islands Land Company, a recognized FSC harvester in Bangor, Maine. One can specify that a Maibec siding order (Clapboard or Shingle) be certified, and it will be produced within the Chain of Custody specifications of the FSC. [www.maibec.com](http://www.maibec.com) 418-659-3323.

To locate more suppliers of FSC siding and other building materials, check out The Rain Forest Alliance's "SmartGuide," which can be found at [www.rainforest-alliance.org](http://www.rainforest-alliance.org).

For T1-11, which can double as sheathing and siding, and other wood paneling options go to [www.apawood.org](http://www.apawood.org).

**Composite or Mineral-fiber siding** is a combination of wood fiber and cement which is made to simulate wood. These are often available in the form of panels, planks, shingles and trim designs and can resemble stucco, wood clapboards, or cedar shingles. Mineral-fiber or cement-based siding products are inexpensive and very durable. They are considered sustainable because of their extremely long life span – they call for little maintenance and rarely need

## Your External System: Keeping The Rain Out

As you make building decisions, keep in mind how the components of your home work together as a system. When picking out external materials like roofing and siding, don't forget about the details – like house wrap, flashing, and gutters which can prevent expensive replacements. The external shell of your home needs to be attractive, resistant to fire, and be made from safe materials that keep your home dry and mold-free. Siding is a "weather barrier;" it protects the house from blowing wind and rain – but it isn't waterproof.

Leaving a space called a "drainage plane" between the siding and the building wrap allows water that penetrates the siding to drain out. If this water can't drain out, then it often ends up in the insulation where it causes no end of problems! Some building wraps have a crinkled surface to create a drainage plane, but many builders use strapping to create a space. Every window, door and hole in the drainage plane must be sealed with flexible flashing tape to shed water. Only a proper drainage plane will effectively keep water out of the house, maintaining a safe, healthy and durable structure.

When installed properly and well maintained, gutters help keep water out of a structure. However, if installed and maintained poorly, gutters can actually direct water into rather than away from a structure. Gutters are usually not needed on a building on high ground with good drainage. If your home requires them, choose durable and recyclable ones, like aluminum or copper, and make sure they are installed properly for your location. Downspouts should terminate at least five feet from the house. If you including a rainwater collection system for irrigation, you won't have to worry about drainage and you'll be able to reduce your water usage for landscaping.

replacement. Many have 50-year guarantees, are more durable than wood or stucco, and are also fire resistant.

As a drawback, the wood for the fiber source is hard to supply because there are a limited number of trees that can hold up to being processed this way – and they aren't locally grown or guaranteed to be sustainably harvested. The

energy intensive process required by cement in combination with shipping the fibers and manufacturing the products mean that these panels have high embodied energy and aren't as green as FSC certified siding.

*Availability:* Mineral-fiber siding is available from various manufacturers. Hardiplank is the brand name for mineral-fiber siding manufac-

## PROFILE



### Local Materials and Labor Make a Dream Home Come True

Tracy Frisch, Argyle, NY

I've always wanted to build my own house, but didn't get the chance until I was in my late 40s and finally able to purchase land in a rural setting in Washington County. The small (1,000 square-foot) energy-efficient house I built with the help of friends utilizes local wood and non-toxic building materials as much as possible.

In order to prevent mold growth during rainy springs, and to conserve resources, I chose to build my house on an insulated cement slab with no basement. The foundation consists of 4-foot-high frost walls, as is required by code, filled with gravel to ensure proper drainage. Perimeter and subslab drainage tile channels water away from the structure. We placed recycled polystyrene insulation panels (backed with cement), which come from school roofs, under the slab that serves as the first floor of the house, and on the outside of the frost walls. A company in Mayfield, NY, resells and delivers them.

Virtually all of the lumber in the house was purchased from local sawmills. The framing wood was full dimensional white pine and the second floor is made with tongue and groove knotty pine decking, both produced by local sawmills. I decided not to use any manufactured wood products, like plywood or particle board, so I sheathed the outside with 1" x 8" local pine shiplap. I finished the interior sheetrock walls with low-VOC paint by AFM, and the interior wood trim, stairs, and shelves with pure tung oil diluted with citrus solvent.

I use renewable energy, independent from the utility grid: four 102 watt solar panels and a bank of 8 batteries for storage at night and on cloudy days allow me to produce almost all the electricity I use. Rather than a typical refrigerator, I have a 7' x 7' pantry which is insulated from the rest of the house. An awning window on the north side allows for ventilation and additional temperature control to provide natural refrigeration during the cooler months. During warmer months, I use two or three coolers and ice packs from a small freezer I expect to soon move to my off-grid house.

For heat, I rely on solar energy coming in the south/southwest facing windows, supplemented with a small efficient woodstove. For the past two years I have burned less than one cord of firewood per year. The house is super-insulated (R38 in walls and R60 in attics) with fiberglass. The house has a lot of natural light so I rarely use any lights during the day. The windows are argon filled low-E, with pine frames that are aluminum-clad on the exterior.

In keeping with my goal of local, natural materials and minimal future maintenance needs, I splurged on the roof. As I live near a major slate mining area, I found a local roofer who is skilled with slate and paid about \$10,000 for a 100-year roof. The house itself, with all its quality materials and including the septic system, spring-fed water supply, site work, woodstove, solar electric system, etc., cost \$75,000. Sweat equity, including significant portions of three years of my life and on-going help and guidance from friends, made my house project possible.

tured by the James Hardi Company. [www.jameshardie.com](http://www.jameshardie.com) 800-348-1811

Other common brands include Certain-Teed and Cemplank.

**Stucco** siding is a coating made with cement and a combination of lime and polymer. The type of stucco you choose can vary from mud plaster taken from site soil, applied and maintained by the owner/builder, to contractor applied stucco that may be much more expensive, but easier to maintain. It is fire-resistant, can be made with natural materials and the natural color means there is no need to paint it. Stucco is the most common way to finish straw bale homes, and some of the other natural building techniques mentioned on page 29. Cement used in stucco does have high embodied energy and some polymers used to produce it can off gas toxic fumes.

*Availability:* Look in the phonebook under Stucco. For the stucco manufacturers association, go to [www.stuccomfgassoc.com](http://www.stuccomfgassoc.com).

**Brick** homes are sturdy, natural and won't

burn. They also last a long time, but are very expensive. The cement needed to lay brickwork also has high embodied energy. Though bricks are often available as a salvaged material, re-used bricks will often not bond properly with mortar and are better used for walkways and less important structures.

*Availability:* Look in the phonebook under Masonry. Find more information at The Brick Industry [www.bia.org](http://www.bia.org).

### Other Ideas

Natural building materials like cordwood, adobe, and cob offer interesting alternatives and textures without the need for traditional siding. These building materials can act as walls, insulation, and exterior siding all at once! For more on these building options, see page 29.

#### Resources for Siding

Oikos, Green Building Source's article on siding and sheathing options <http://oikos.com/library/vision/index.html>

## ROOFING

**T**HE ROOF IS ONE OF THE HOMES most important "systems" – it's how an exterior shell sheds moisture. A roof system is made up of wood sheathing, also called the deck, under layer (fiber-glass-reinforced paper that helps keep the wood deck dryer), leak barrier membranes and metal flashing to keep out water intrusion, ventilation to prevent mold and moisture from damaging the sheathing, and shingles to withstand the elements. In addition to moisture control, your roof can be a passive solar device – roof overhangs can be designed to block out summer sun and allow winter sun to reach the home.

Ideally, a roof would keep our home dry and provide temperature control, minimize fire danger, look beautiful and collect water for landscapes. Finding a roofing choice that can do all these things and work well with your climate and values is tricky.

Regardless of the type of material you choose, the color will influence heating requirements. A black or dark colored roof will absorb more heat, increasing cooling costs in summer. A lighter, more reflective roof will decrease these costs but will not play significant a role in winter heating costs.

### What to Avoid

If you can help it, avoid **asphalt and tar**, since the facilities that produce them release noxious chemicals such as formaldehyde, hexane, phenol, polycyclic organic matter, and toluene. Exposure to these air toxics may cause cancer, central nervous system problems, liver damage, respiratory problems and skin irritation. These types of roofs are also a waste of oil since they're rarely recycled after lasting a mere 10 to 20 years. Along with vinyl siding waste, asphalt shingles are among the most disposed of

building materials. Ending up in a landfill, they then leach toxins into the soil and groundwater. VOCs also off gas from asphalt shingles while they're in use – and can affect the indoor air quality of your home. In addition, water that runs off these kinds of roofs should not be used for water catchment. While alternatives are usually much pricier, the large environmental cost of tar and asphalt roofs, combined with the actual cost of replacing them are a turn-off to green builders.

Avoid **PVC roofing membranes**. As with many PVC products, phase-outs by large companies are helping consumers: Firestone Building Products announced that they would stop making Vinyl roofing in 2005, due to health and environmental hazards. This action led to WalMart's planned elimination of these products, since Firestone is a supplier. Firestone now offers roofing membranes made with TPO, or Thermoplastic Poly Olefin, an alternative which is comparable in cost and performance to PVC, yet is much less harmful to produce and dispose of. See page 10 for more on PVC.

### Greener Possibilities

**FSC harvested wooden shingles**, usually cedar, can make nice natural roofs which last much longer than asphalt if properly installed. Cedar shingles or cedar shakes, are naturally tough, resistant to insect damage, UV ray damage, and other sorts of decay. These roofs must be installed with great care to make sure they work properly and are not good for low pitched roofs or those under tree canopy. A drawback is that they will burn, and the fact that many cedar shingles are harvested unsustainably.

*Availability:* The Rainforest Alliance's "Smart Guide," found at [www.rainforest-alliance.org](http://www.rainforest-alliance.org) can help you find a company that offers FSC roofing shingles.

**Recycled rubber** refashioned into imitation slate and cedar shake tiles is nice looking, durable and a good use of resources. Manufacturer Eco-Star claims a fifty-year life and warranty, along with the eventual recyclability of the product when its useful life as roofing mate-

rial is finished. Recycled rubber is very expensive - about eight to ten times higher than for asphalt shingles. For those wanting a slate roof, it is about half the cost of real slate, but most likely includes more energy to produce and transport. For flat roofs, there are also recycled rubber sheets that come in rolls.

*Availability:* EcoStar, a division of Carlisle SynTec [www.premiumroofs.com](http://www.premiumroofs.com) 800-211-7170

**Composite** roofing is made from a combination of materials. Some may be more environmentally friendly than others depending on the amount of recycled material used and the durability. Also, many contain a large plastic component, which may include PVC. Fiber-cement materials are durable, but not recommended for freeze-thaw climates. Recycled synthetic shingles are a better option, though they are still somewhat energy intensive to produce. Enviroshake is Greenspec listed and is made with 95% recycled post-industrial plastics, fibers and tire derived rubber. This product looks like wood, but is easier to install than actual cedar shake and has a 50 year warranty.

*Availability:* Enviroshake [www.enviroshake.com](http://www.enviroshake.com) 866-423-3302

**Slate** is an excellent choice for roofing as long as it doesn't have to be shipped far. Since Slate comes from the Northeast and Mid-Atlantic states, it can be a smart option for homes in New York. It is very expensive, but lasts 100 years or more. It is minimally processed, fireproof, resists hail damage, and is beautiful.

*Availability:* To find a slate contractor in your area, as well as local sources for new or salvaged slate, visit the Slate Roofing Contractors Association website at [www.slateroofers.org](http://www.slateroofers.org).

**Metal** roofs are usually made from recycled copper, steel or galvanized aluminum. They are easy to install, long lasting, fireproof and are rigid. Lead-free metal roofs are the best material for water catchment systems and are great for northern climates because snow slides off easily. Many metal roofs also have high emittance, meaning that they can effectively reflect heat, reducing cooling costs in summer. The impact on the earth to manufacture metal is

sizeable however, and should still be considered. The prices for metal roofs vary widely, but often range from \$2-6 per square foot installed.

*Availability:* Widely available. Metal Roofing Alliance [www.metalroofing.com](http://www.metalroofing.com) can help you find local contractors.

**Tile** can either be made from clay or cast-concrete. Clay tiles are popular in the southwest since their shape allows for a cooling effect. Concrete tiles are more energy intensive to produce and are pretty heavy, so may entail extra structural work to support them. Both types of tiles are expensive to install and repair. Also, tiles are generally not a good choice in northern climates where freeze-thaw cycles can damage them.

*Availability:* The Tile Roof Institute [www.tile](http://www.tile)

[roofing.org](http://roofing.org) can help you find manufacturers and contractors.

**Photovoltaic/solar cell roof shingles** have recently appeared in the marketplace. They are relatively expensive and have smaller production efficiency than stand-alone PV panels, but may prove to be a durable, energy efficient roofing material over time. According to information by the Department of Energy, the dark color and high absorbing quality of PV shingles can actually heat up the home or building unless the roof is properly thermally isolated from the building. The climate and thermal insulation level will determine whether solar shingles help or hurt the building's energy performance.

## Buyer Beware

Don't be fooled. When researching products on the web, look for third party certifications, and seek out articles that compare and contrast materials rather than relying solely on manufacturers websites. These are often reputable companies, but they still have a product to sell. Look out for companies market with hollow claims to make their products seem greener than they really are. Here are some common terms to take with a grain of salt:

**"Recyclable"**—it can be a benefit that a product is made with a material that is recyclable, but this means nothing unless someone takes the time to recycle it at the end of its useful life. The most environmentally conscious consumers often find that recycling facilities for their materials don't exist locally. Much more meaningful is a product made from something that's already been recycled – post-consumer recycled material means it was actually saved from landfills.

**"Energy efficient"**—PVC manufacturers often use this claim to show you that PVC materials can save you money on your energy bill if you install them in your home. While this can be the case, the term doesn't take into account the embodied energy – the amount of fossil fuels needed to manufacture, transport and maintain the product throughout its life cycle. A truly energy efficient product will both reduce your energy consumption and contribute less to green house gas emissions before you get your hands on it!

**"All- Natural"**—just like food, natural doesn't always mean better. Learn about the processes that create the products you buy before you decide they're better for you and the environment.

**"Made from renewable resources"**—a material may be renewable, but can be harvested unsustainably, or can still be manufactured using toxic materials, such as formaldehyde. Being renewable is a good thing, but consider other environmental and health benefits.

While these and other marketing strategies are effective and can be well-founded, these examples underscore the importance of considering the life cycle of a material. That way, you can be sure that whenever possible, you're supporting processes you approve of and bringing home products you want in your home.

*Availability:* PV panels are being manufactured by United Solar Systems Corporation [www.uni-solar.com](http://www.uni-solar.com) and are locally available in NY through [www.sunwize.com](http://www.sunwize.com).

**Thatched roofs** are made by gathering, bundling, and securing harvested vegetation (usually wetland reeds or straw) to the roof structure. In places like Denmark, people have been building long lasting (60 to 80 years) thatch roofs for generations. They have similar characteristics to cedar shake, are pest resistant and beautiful, often giving homes a “fairy-tale” look. The roof pitch needs to be steep and thatch usually acts as both the exterior shingle and the insulating under layer.

*Availability:* To learn more, go to [www.thatch.org](http://www.thatch.org), a site full of advice and experience written by a thatch expert. Also, see McGee and Co. Roof Thatchers at [www.thatching.com](http://www.thatching.com).

### Other Ideas

If you have a flat roof, consider creating a “green roof” – a roof covered with plants. These start with a membrane like TPO (thermoplastic poly-

olefin), and then have a layer of growing substrate (engineered soil) that selected plants can grow in. Green roofs can range from a manicured garden to a simple, self-maintaining growth. Benefits include cutting down on cooling costs, keeping rainwater from simply running off into streams or sewers and helping reduce air pollution. In Europe, they are widely used for their storm water management and energy savings, as well as their aesthetic benefits. Green roofs are very heavy, so must have extra structural support. Similarly, green “walls” allow you to hang a vertical garden on the wall like a picture!

*Availability:* For more information on green roofs and walls, check out Green Living Roofs, LLC [www.agreenroof.com](http://www.agreenroof.com) and Greenroofs.com [www.greenroofs.com](http://www.greenroofs.com).

#### Resources for

#### Roofing

- David Johnston and Kim Master, “Green Roofing Options,” *Smart Home Owner* July/August 2006.
- Thomas A. Hirsch, “To Have a Roof Over Our Heads,” Harmony Home Construction, LLC [www.harmonyhomeconstruction.com](http://www.harmonyhomeconstruction.com)

## ELECTRICAL WIRES & CABLE

**A**LMOST ALL ELECTRICAL WIRE and cable is coated with PVC because it is flexible and fire-resistant. Even extension cords and Christmas tree lights are made with PVC, and they contain lead that can rub off onto your hands. Be sure to wash hands after handling cables and cords, and especially don’t allow children to play with them! For more on the environmental health problems posed by PVC, see page 10.

The National Electrical Code (NEC) requires the use of wire and cable for homes which has a high kindling point – and PVC coated, or halogenated wire and cable are therefore what we have to work with. What most people don’t know is that smoldering PVC emits poisonous chlorine gas that endangers

building occupants and fire fighters.

PVC-free, or non-halogenated materials made from polyethylene (XLPE and LLDPE) are available for projects that do not need to conform to the NEC. If you are trying to cut down PVC in your home, it is a good idea to ask your contractor or electrician if it is possible to use PVC-free cable for certain applications.

*Availability:* Many manufactures make non-halogenated wiring, including Beldon, EZ Form Cable Corporation, and Brim Electronics – though it can be difficult to find a vendor.

#### Resources for

#### Electrical Wires and Cable

GreenPeace [www.greenpeace.org](http://www.greenpeace.org) outlines the problems with PVC wiring and cable in Wiring and Cable Alternatives <http://www.greenpeace.org/usa/news/how-to-find-and-avoid-toxic-vi/wiring-and-cable-alternatives>

## What is Proposition 65?

If you've purchased holiday lights, or other products made with PVC, chances are you've come across a label which says something to the effect of: "This product contains lead, a substance known to cause cancer in the state of California." Ever wonder why Californians get the warning and the rest of us just come across it from time to time? In 1986, California approved "Proposition 65," a ballot initiative requiring warnings about exposures to toxic chemicals. The law requires the California governor to publish a quarterly updated list of chemicals that are known to cause cancer, birth defects, or other reproductive harm. Currently, there are hundreds of chemicals on this list, which can be viewed at California's office of Environmental Health Hazard Assessment <http://www.oehha.ca.gov/prop65.html>.

Lawsuits have been filed against electrical wire and plumbing companies, among others, who were not complying with the labeling requirements. Companies that make products with harmful chemicals need to label the products, however, only if they are selling them in California. On some products, including K-mart Halloween masks purchased by CEC in 2006, black tape had been used to cover the Prop. 65 warning from upstate NY consumers. This is often shocking to parents buying the products, but it's not illegal since NY has no similar labeling law. Our best bet right now is to be knowledgeable and avoid products like PVC which contain persistent bioaccumulative toxins (see page 12 for more on PBTs).

Source: <http://www.oehha.ca.gov/prop65.html>

## PIPES & PLUMBING

**G**REENING" YOUR PLUMBING IS an opportunity to consider the health and environmental impacts of materials choices as well as to realize important energy and water savings with more efficient products. For more on water efficiency, see fixtures on page 81.

### What to Avoid

**PVC pipe** is very popular for drainage and waste water pipes because it is lightweight and easily installed. However, it lacks durability and has numerous health and environmental impacts, highlighted in more detail on page 10.

### Greener Possibilities

There is a range of traditional and new materials that don't rely on PVC – offering the same or improved qualities with fewer lifecycle hazards. The pipe products you choose will depend on your project needs, since pipes are used for various purposes both in and outside of the

home. Polyethylene pipe, or PEX is useful where weight is a primary consideration, while clay or cast iron can be good options where durability is most important. While some of these options can be prohibitively expensive, be sure to consider the life span of products, including cost of repeated installation or repair, when comparing costs.

**PEX** is the common name for cross-linked high-density polyethylene (HDPE). PEX tubing is used widely in hydronic radiant heating systems and has recently become popular as a viable alternative to PVC for residential water supply and heating pipes. It is more flexible than other pipe options, making the system itself quieter than rigid pipes. It is also able to withstand extreme high and low temperatures better than other materials, which translates to durability. PEX is said to have ideal corrosion resistance, making it more attractive than metal options. PEX is usually made from recycled materials, and is comparable in cost to PVC.

Availability: PEX is widely available though wholesale plumbing suppliers and is becoming available in many retail building supply outlets.

**Copper and other metal** choices for plumbing are better for above ground drainage, for example soil and vent pipes and rainwater drainage. Materials such as zinc, cast iron, copper, galvanized steel or aluminum are all used, though some of these options can be prohibitively expensive and there are still embodied energy concerns with these metals. Metal guttering has a longer service life than PVC.

*Availability:* Many manufacturers. Most large retail building stores will carry some copper, cast iron, and galvanized steel alternatives. Ramsco is a waterworks distributing company with offices in Watervliet, Utica, and Rochester. [www.ramsco.com](http://www.ramsco.com) 518-273-6300

Charlotte Pipe and Foundry (Charlotte, NC) is one manufacturer that offers GreenSpec listed cast iron pipes. [www.charlottepipe.com](http://www.charlottepipe.com) 800-438-6091

**Clay pipes** are often harder to find than PEX and iron or copper alternatives. Vitrified clay pipes are useful for underground sewage pipes because they are extremely durable – lasting about 100 yrs, which is 4 to 5 times longer than PVC systems. While clay is more expensive, choosing it can save materials, as well as labor costs over time. Clay pipes also have a high resistance to chemicals in waste water.

*Availability:* Most plumbing suppliers do not carry clay, but there are many manufacturers including Logan Clay Products company (Logan, OH) [www.loganclaypipe.com](http://www.loganclaypipe.com) 800-848-2141, and Superior Clay Corporation [www.superiorclay.com](http://www.superiorclay.com) (Uhrichsville, OH) 800-848-6166.

Resources for

### Pipes and Plumbing

Greenpeace [www.greenpeace.org](http://www.greenpeace.org) has compiled plenty of useful information about PVC alternatives. For more information, check out their PVC Alternatives to plumbing list at <http://www.greenpeace.org/usa/news/how-to-find-and-avoid-toxic-vi/pvc-pipe-alternatives>.

## FLOORING

**T**HERE ARE MANY OPTIONS FOR flooring: hard surfaces, like wood or tile, resilient surfaces like linoleum, or carpeting. Each choice can have both environmental and health impacts.

### What to Avoid

For all flooring (and building) choices, **avoid shipping heavy materials long distances**, as this will add to the environmental cost of that particular product.

Other important things to steer clear of include **unsustainably harvested hardwoods**, **vinyl (PVC) flooring materials** (found in resilient flooring as well as some carpet backing), and **toxic adhesives, stain treatments, and finishes that will off-gas VOCs** into your indoor air. Find safer adhesives for floors on page 70 and non-toxic finishes on page 73.

### Greener Possibilities

#### ► HARD FLOORING

Hardwood is the most popular choice for hard floors, but other materials include bamboo, stone, tile or concrete. See our sources for salvaged building supplies in New York State at the end of this guide for ideas where you may find reclaimed materials. Whatever material you choose, finish the floors with a low or non-VOC sealer (see page 73).

**Hardwood** floors treated with a non-toxic finish are durable, attractive, and low in embodied energy. Seek Forest Stewardship Council (FSC) certified hardwoods to protect the sustainability of our forests. If you live near local timber mills that harvest sustainably, you can support local business while decreasing the transportation energy needed for your materials.

Using reclaimed lumber from older structures as flooring is a great way to reduce envi-

ronmental impact. Reclaimed lumber can create beautiful floors with more character than new hardwood flooring. Salvaged flooring is available in many colors, wood varieties, and degrees of weathering.

*Availability:* FSC certified flooring is usually available at Green Depot [www.greendepot.com](http://www.greendepot.com) 718-782-2991

For FSC certified floors, The Rainforest Alliance [www.rainforest-alliance.org](http://www.rainforest-alliance.org) has compiled a “SmartGuide,” listing companies who offer FSC certified building materials. You can find this PDF at <http://www.rainforest-alliance.org/programs/forestry/smartwood/find-certified-products.cfm> or by searching “SmartGuide” from the Rainforest Alliance main page.

For reclaimed flooring, see our list of sources for salvaged building materials in NY at the end of this guide. Some companies listed there, like Pioneer Mill Works [www.pioneermillworks.com](http://www.pioneermillworks.com) in Farmington, NY, create ready-to-install flooring from salvaged wood.

**Bamboo** is a fast-growing, attractive, durable and moderately priced alternative to hardwood. Bamboo looks similar to hardwood and is now becoming available at regular home improvement stores, like Home Depot.

As bamboo becomes more and more popular as a green building material, it is imperative that consumers continue to evaluate whether or not it actually is the greenest choice for their application. There have been reports that sweatshop labor is used in some bamboo manufacturing facilities. Before opting for bamboo, consider social justice issues, the distance it was shipped, pesticide use, and whether the plantation was created by destroying intact ecosystems or displacing communities. Many providers do ensure that their bamboo is harvested sustainably, but there may still be greener, more locally produced options. Some bamboo flooring products are also manufactured using formaldehyde-based adhesives which can compromise indoor air quality. Formaldehyde content will vary from brand to brand.

*Availability:* Bamboo is now available at most large building and flooring stores.

Teregren Bamboo [www.teragren.com](http://www.teragren.com), available through many retailers, uses fair trade, sustainably harvested bamboo. 800-929-6333

Green Floors [www.greenfloors.com](http://www.greenfloors.com) offers bamboo flooring with no formaldehyde. 703-352-8300

**Stone** for floors is often available from building materials salvage yards. If you plan to procure new stone from a supplier, buying from a local source is obviously more desirable than exporting it internationally with high energy costs. Stone is very durable, and as long as it is sealed with VOC free products and doesn't emit radon, it has excellent indoor air quality characteristics. Stone also has thermal mass, making it a great choice for under floor radiant heating systems, or in homes incorporating passive solar design.

*Availability:* Stone flooring is widely available. As a starting point, see our list of Salvaged building material sources at the end of this guide.

Vermont Natural Stoneworks [www.vermontstone.com](http://www.vermontstone.com), located in Granville, NY, has locally quarried slate flooring. 518-642-2460

**Ceramic and Glass Tile** floors can be made from ceramic or recycled glass which use resources wisely, look nice, and are easy to clean. Glass tiles are manufactured in a similar manner to conventional products except that energy consumption for the processing of raw materials can be eliminated if they contain 100% recycled glass. Energy consumption through production is still greater than some other materials used for flooring and wall-covering. Glass tiles, whether conventional or green, release no emissions into the indoor environment and are among the best-tolerated by people with chemical sensitivities or chronic respiratory ailments. Clay or glass tile, like stone, also absorbs heat and can store solar energy during the day to keep the house comfortable at night.

Brick pavers are thin tiles of real clay that look like aged brick. They are as easy to install and maintain as traditional tile. Brick and tile flooring are usually comparable in price. Tiles can also be made from recycled metal.

*Availability:* Various tiles are available at large building and flooring stores. While they aren't located in NY, some companies that specialize in sustainable tile flooring, listed below, may already distribute to a supplier near you.

Eco Friendly Flooring (Madison, WI) offers recycled glass, metal, and ceramic tiles in addition to other flooring options. [www.ecofriendlyflooring.com](http://www.ecofriendlyflooring.com) 866-250-3273

Sandhill Industries (Boise, ID) has 100% recycled glass tiles. [www.sandhillind.com](http://www.sandhillind.com) 208-345-6508

**Concrete** is not really a green material due to its high embodied energy manufacturing process which contributes to green house gases. However, concrete floors are often considered a greener choice because they last a lifetime and, because the sub-flooring is finished to become the actual floor, they help avoid another material's manufacturing pollution, transportation costs and construction waste.

During renovations, old flooring can be pulled up and the concrete sub flooring can be transformed into a beautiful, durable, stand-alone floor. Concrete floors are an especially good fit for under floor radiant heating systems.

Finishing materials can often include toxic processes, however. Harsh chemical treatments can create a variety of colors and textures, or patterns to mimic natural surfaces like marble. Concrete can be scored to create a tile-like appearance, or treated with safer sealants and waxes to avoid toxic finishing processes.

*Availability:* Concrete floors are already an option for homes with a poured concrete foundation. Go to the Concrete Network [www.concretenetwork.com](http://www.concretenetwork.com) for information on finishing processes, and to find a local contractor in your area.

### ➤ RESILIENT FLOORING

There are a handful of resilient, natural alternatives to vinyl (PVC) flooring, including linoleum, cork, and rubber – all of which come in a wide array of colors.

**Linoleum** is an environmentally friendly,

biodegradable, safe flooring option made from natural linseed oil. However, many people confuse it with PVC, or vinyl – which is neither safe nor good for the environment. Some tile and sheet PVC is actually referred to as linoleum, so choose carefully. Actual linoleum floors are toxic-free and easy to clean, preventing buildup of contaminants and allergens.

*Availability:* Many large manufacturers produce linoleum, including Armstrong and Forbo, which has created a linoleum product called “Marmoleum.” Green Floors also has a great selection of linoleum flooring. [www.greenfloors.com](http://www.greenfloors.com) 703-352-8300

**Cork** floors are made from a rapidly renewable source and compromise indoor air quality. Other benefits of cork floors include its durability, cushiony feel, thermal quality and its sound and vibration reduction which make it an ideal material for recording studios or other places where sound reduction is important. Like bamboo, cork is harvested without killing the tree, which will continue to grow and produce.

*Availability:* Globus Cork is NY based cork company which is a member of the USGBC and is GreenSpec listed. [www.corkfloor.com](http://www.corkfloor.com) 718-742-7264

**Rubber** flooring, which has been widely available as commercial flooring systems and for athletic surfaces, can be environmentally friendly when made from recycled tires. Rubber is durable, easy to clean and can withstand a kitchen's high-volume traffic. Also, like cork, a rubber floor's natural “give” is easy on the feet and back. Rubber is comparable in cost to linoleum flooring.

*Availability:* EcoSurfaces recycled rubber flooring is manufactured by Gerbert Limited (Lancaster, PA). [www.gerbertltd.com/rubberflooring.htm](http://www.gerbertltd.com/rubberflooring.htm) 717-299-5035

Green Floors has rubber tire tiles. [www.greenfloors.com](http://www.greenfloors.com) 703-352-8300

### ➤ CARPET & RUGS

Many people view carpets as comfortable additions to their home, but don't realize the amount of material that gets trapped in them – carpets

are a sink for dirt, allergens, and pathogens, so people who are concerned about asthma triggers should avoid wall-to-wall carpet. Most experts recommend using area rugs that can be removed and washed periodically over wall-to-wall carpets.

Wall-to-wall carpet installation also usually involves VOC's that can continue to sacrifice indoor air quality for months or even years to come. When having wall-to-wall carpet installed, use mechanical attachments or VOC-free adhesives. Perfluorooctanoic Acid (PFOA) is a compound used in carpet stain protectors as well as some adhesives. These compounds linger in the environment and accumulate in the food chain and are used in a range of consumer products including Teflon and all-weather clothing.

Before choosing wall-to-wall carpet, keep in mind that many carpets don't last longer than 10 years and that the waste almost always ends up in a landfill. Carpet America Recovery Effort (CARE) [www.carpetrecovery.org](http://www.carpetrecovery.org) aims to dramatically increase the recycling and re-use of carpet in the US. They've estimated that 5 billion pounds of carpet was sent to the landfill in 2003 and that since 2002, when they started, they have been able to help recover approximately 500 million pounds of old carpet for use in products like composite lumber (both decking and sheets), roofing shingles, railroad ties, automotive parts, and many other things.

When buying rugs or carpets, be mindful of sources that exploit child labor and unfair working conditions. Hand-woven rugs are often created in South Asia, where labor restrictions regarding workers' rights and child labor are less strict than they are in the US. The RugMark Foundation [www.rugmark.org](http://www.rugmark.org) closely monitors the production of hand-woven rugs and issues their label only to those who comply. When buying an imported rug, buy one that has been certified by RugMark to ensure that it was created by adult artisans and is child-labor free.

**PVC-free carpets** are produced with materials including synthetic latex, polyolefin, urethane, and polyurethane backing as an alterna-

tive to vinyl. Many also include recycled content backing. PVC-free does not mean that other toxins are not present, however, and does not take into account other environmental problems with these processes, such as energy intensive manufacturing of synthetic materials. Some companies, including Interface Inc, are considering **sustainability produced flooring** as a whole.

*Availability:* Interface Inc. focuses on sustainability with Mission Zero: A program to ensure that every creative, manufacturing and building decision they make will move them closer to their goal of eliminating any negative impact their flooring and fabric companies may have on the environment by the year 2020. See their website for more, including their sustainability report: [www.interfaceinc.com](http://www.interfaceinc.com) 770-437-6800

Alternatives to PVC for residential use are widely available. Shaw phased out PVC in its carpeting by 2005 and can be found through many carpet suppliers. [www.shawfloors.com](http://www.shawfloors.com) 800-441-7429

**Recycled-content carpeting** is made from recycled PET derived primarily from post-consumer plastic soft drink containers. These carpets keep plastics out of the landfill, but may not address allergy concerns.

*Availability:* GreenFloors offers recycled PET carpet [www.greenfloors.com](http://www.greenfloors.com) 703-352-8300

**Jute, Hemp, Sisal, and Wool** are among many natural carpet options with minimal treatment that are becoming popular. Natural carpets use renewable resources and offer long lasting, healthy and nice looking floor coverings. Prices vary – but many are close to conventional carpet choices.

*Availability:* Natural fiber carpets and carpet pads are widely available through many suppliers and internet stores, including but not limited to Eco by Design [www.ecobydesign.com](http://www.ecobydesign.com), Environmental Home Center [www.environmentalhomecenter.com](http://www.environmentalhomecenter.com) and Green Floors [www.greenfloors.com](http://www.greenfloors.com).

Bloomsburg Carpet Industries, Inc (NY, NY) produces natural wool carpets. [www.bloomsburgcarpet.com](http://www.bloomsburgcarpet.com) 212-688-7447

## Safer Adhesives for Floors

AFM Enterprises makes a non-toxic, water-based, 3-in-1 Safecoat Adhesive, along with many other low- and no-VOC products. [www.afmsafecoat.com](http://www.afmsafecoat.com) 619-239-0321

Auro USA provides All Purpose Flooring Adhesive, Natural Latex Adhesive made with milk and Organic Household Contact Glue. [www.aurousa.com](http://www.aurousa.com) 888-302-9352

DAP Inc. DAP Weldwood Adhesives are low-VOC, latex-based, non-flammable adhesives for installing carpets and tiles. [www.dap.com](http://www.dap.com) 888-DAP-TIPS

Franklin International makes Titebond Solvent-Free Construction Adhesive and green building adhesives that clean up with water. [www.titebond.com](http://www.titebond.com) 800-347-4583

PL Adhesives & Sealants offers “PL Premium” construction adhesive and other VOC compliant adhesives. [www.stickwithpl.com](http://www.stickwithpl.com) 612-496-6000

Sinan Co. produces water-based “Auro” brand natural adhesive, along with many other natural paints and stains. [www.sinanco.com](http://www.sinanco.com) 530-753-3104

For more information about carpets and rugs, indoor air quality and testing, go to The Carpet and Rug Institute at [www.carpet-rug.org](http://www.carpet-rug.org).

### Other Ideas

**Earthen Floors** are growing in popularity because they’re healthy, extremely low impact, look beautiful and can even allow people to feel closer to nature. All in all, earthen floors virtually eliminate the waste, pollution, and energy necessary to manufacture a floor. They also have thermal benefits: because of the high density and low thermal conductivity of earthen floors, they capture and retain heat acting as a passive solar device.

Earthen floors are installed by spreading a special mud mixture including sand, lime, and sometimes straw or paper pulp evenly until its a few inches thick. After drying, the floor is then coated with linseed oil or beeswax. Natural pigments can be added for coloration, or tiles can be imbedded in section of the floor for decoration.

With its leathery look and feel, an earthen floor also eliminates construction waste and is easily repaired. Although they are durable when

well installed, they don’t tolerate weight on small points, like high heeled shoes, or pointy chair legs. While few local contractors are experienced in earthen flooring, there are plenty of people moving toward this “new” flooring technique.

For an informative article on earthen floors, see <http://www.networkearth.org/naturalbuilding/floor.html>.

### Resources for Floors

- Healthy Building Network’s PVC free materials list [www.healthybuilding.net/pvc/PVCFreeAlts.html](http://www.healthybuilding.net/pvc/PVCFreeAlts.html)
- RugMark [www.rugmark.org](http://www.rugmark.org) is an international nonprofit organization devoted to helping children by ending child labor in the handmade carpet industry in South Asia.
- Jonathan Kalmuss-Katz. “Eco-Friendly Flooring” from *Co-op America: Economic Action for a Just Planet* [www.coopamerica.org](http://www.coopamerica.org)
- Carpet America Recovery Effort (CARE) [www.carpetrecovery.org](http://www.carpetrecovery.org) has more information about how to help keep carpets out of landfills.

For more green flooring companies and suppliers, search within Green Home Guide at [www.greenhomeguide.com](http://www.greenhomeguide.com).

## WALLS: CONSTRUCTION & COVERING

**Y**OUR WALLS SURROUND YOU when you're at home, making it important that they be both as aesthetically pleasing and as safe as possible.

Most walls in conventional homes are made from gypsum, otherwise known as dry-wall. Alternative wall and home construction materials, including adobe, straw bale and plaster, and cordwood are described briefly on page 29. After we've constructed our walls, it is often what we add next that can help or hurt our indoor air.

### What to Avoid

Wallpaper with PVC is a big one to watch out for. Many residential and commercial wall coverings are made in part or entirely from films of PVC, or vinyl. Some wall papers are in fact paper, but many are also coated with PVC to make them more durable. Others are just PVC with a paper backing. The problems with PVC in wall coverings go beyond the previously discussed problems with production and disposal of the PVC highlighted on page 10. Because PVC is not a breathable material, moisture that gets trapped behind the "paper" can promote toxic mold growth in your home, which really does a number on your indoor air. See page 19 for more on mold remediation.

PVC disguised as paper also off-gasses fumes from the plasticizers that make it flexible. These added chemicals, called phthalates, are suspected to trigger asthma attacks in some people, and have been linked to reproductive harm. Fortunately, there are many alternatives to vinyl wall paper.

### Greener Possibilities

Low- or no-VOC paint is one of the simplest things you can do to finish your indoor walls. See our Paints and Stains section on page 73 for more about these options and availability.

**Wallpaper alternatives** made from sustainable materials like linen, sisal, hemp and cotton can be fun, creative, and give your walls

the design you're looking for. Industrial jute sacking can be bought in rolls and can make durable wall coverings as well. PVC-free wallpaper is also available from some suppliers. Also, be sure to use low or no-VOC adhesives.

*Availability:* There are many suppliers and options for do-it-yourself decorating.

Mod Green Pod creates designer, organic cotton fabrics and PVC-free wallpapers [www.modgreenpod.com](http://www.modgreenpod.com) 617-670-2000

Building for Health and Living Green both carry natural wall covering materials such as sisal, natural cork, and homespun fabrics. [www.buildingforhealth.com](http://www.buildingforhealth.com), [www.livinggreen.com](http://www.livinggreen.com)

**Tinted natural plaster** can provide both color and texture to an interior room, and can be a fun project.

*Availability:* Building for Health Natural Building Supplies, a Colorado based web-store with warehouses around the country, carries natural plaster colors and tools. [www.buildingforhealth.com](http://www.buildingforhealth.com)

Bettencourt Green building supplies carries American Clay ([www.americanclay.com](http://www.americanclay.com)). [www.bettencourtwood.com](http://www.bettencourtwood.com) 800-883-7005

**Wood and bamboo** also make great wall covering options, as long as they are harvested sustainably and finished with low- or no-VOC products. Tongue-in-Groove boarding makes a warm and permanent decorative finish, needing only an occasional coat of linseed oil or beeswax.

*Availability:* Ply-boo wall covering is available from [www.bettencourtwood.com](http://www.bettencourtwood.com) 800-883-7005

Locate FSC certified wood wall coverings using the Rainforest Alliance's resource list by searching "SmartGuide," from their main page. [www.rainforest-alliance.org](http://www.rainforest-alliance.org)

### Other Ideas

Other neat ideas for wall coverings include mosaics and recycled glass or ceramic tiles which are popular in bathrooms and kitchens. See the floor section for where to find recycled content tiles. Some alternative wall options can be fairly

## Is Drywall Okay for My Wall?

Drywall, also known as Gypsum board or Sheetrock (the trade name for the product made by U.S. Gypsum company), is the principal material used in the United States for interior building. Gypsum is relatively benign – a natural mineral mined from ancient sea beds often bound together with corn or wheat starch and sandwiched in paper. However, it can have significant environmental impacts because it's used on such a vast scale. The main environmental impacts of gypsum are habitat disruption from mining, energy use and emissions in production and shipment, and solid waste from its disposal.

Another problem with drywall is its propensity to act as a food source for mold in humid or damp conditions. Mold issues are weighing in heavy on the list of current and forecasted health risk concerns in buildings, so drywall manufacturers are modifying gypsum products to address these concerns. Mold-resistant alternatives, such as USG's Humitek, use chemically treated paper to reduce water absorption. Other mold-inhibiting gypsum products eliminate the paper altogether, which can make it dusty to work with. Mold resistant drywall can also be much more expensive, and of course, is not a replacement for sound building practices to help eliminate mold.

One of the major problems with using so much gypsum is all the scrap drywall left over after building projects. The U.S. produces approximately 15 million tons of new drywall per year, and approximately 12% of new construction drywall is wasted during installation. In landfills with wet conditions, scrap gypsum can release hydrogen sulfide gas which has a foul odor and is toxic in high concentrations. If incinerated, drywall can release toxic sulfur dioxide gas. Unused drywall gypsum can be recycled back into new drywall if most of the paper is removed. Some companies are working to decrease the paper content to both improve the fire rating, and to further increase the recycled content.

To cut down on the scrap drywall your project will generate, aim to construct standard-sized walls and flat ceilings and order custom-sized sheets for non-standard applications. For some building projects – usually commercial buildings – it makes more sense to find reusable substitutes, like demountable partitions.

While sometimes scrap drywall has been added to soil to improve water retention in high clay soil, this is not a recommended outlet for homeowners as there may be contaminants and it is not helpful to all soils. Luckily there are some potential markets for gypsum waste, including cement and stucco production, water treatment, manure, soil and water treatment, and as a material to mark athletic fields.

After reducing the amount of drywall waste your project generates, some possibilities to save it from the landfill include finding a recycling center that will accept it, placing drywall scraps in the interior wall cavities during new construction to eliminate disposal and transportation costs, and if there are large pieces, donating them to your local chapter of Habitat for Humanity. Go to [www.earth911.org](http://www.earth911.org) to find a recycling center near you.

Source: California Integrated Waste Management Board <http://www.ciwmb.ca.gov/ConDemo/Wallboard/EcologyAction> [http://www.ecoact.org/Programs/Green\\_Building/green\\_Materials/gypsum.htm](http://www.ecoact.org/Programs/Green_Building/green_Materials/gypsum.htm)

labor intensive and can therefore more expensive, but if you are redoing a room interior yourself, then all you need is time and some in-

structions. Look for Do-It-Yourself books at the local library or bookstore for creative ideas and how to implement them in your home.

## FINISHING: PAINTS & STAINS

**O**F ALL OF THE LOW-TOXIC materials one could choose, low-toxic paints and coatings are an important and easy selection to make. Standard paint contains solvents called volatile organic compounds (VOCs) which are released into the air as the paint dries, giving off fumes that compromise both indoor and outdoor air quality. Some VOCs in paint include benzene, xylene, propane, butane, paraffins, toluene, and styrene. While the long-term affects of these VOCs on human health are not yet understood, there are increasing incidences of asthma and other allergic reactions in all people, especially children. Even less is known about the effects of exposures (long or short-term) to various mixtures of these substances.

Lower VOC paints replace these solvents with non-toxic synthetic binders which preserve both indoor and outdoor air quality and reduce the incidence health effects from VOC fumes. Many of the first VOC-free paints were not popular because they were only available in pastels, dried much quicker, and were easier to scuff up. Now, most manufacturers produce at least one variety of low- or no-VOC paint and they are increasingly durable, colorful, and cost effective.

There are many benefits to using paints with little or no VOCs:

- Reduced ozone depleting and smog forming chemicals, with less potential to impact landfills and groundwater.
- Water-based means these paints are easy to clean-up and disposal is greatly simplified.
- Reduced toxins during application benefit all and allow you to occupy the home sooner.
- Safer paints are cost competitive with proven performance compared to conventional paints.

When looking for an environmentally friendly paint, it's important to look for low-VOC paints, but also to make sure any VOCs present are nontoxic and non-reactive. Green-

Seal certification is a good guarantee of a relatively non-toxic paint.

Paints and Stains can be classified in three main categories: Natural, no-VOC and Low VOC. Natural paints are made with linseed and other plant oils and resins, plant dyes and essential oils; natural minerals including clay, talcum, and chalk, natural latex, bees wax, and milk casein. They can also be hued with mineral pigments. These paints take slightly longer to dry, but smell much nicer!

No-VOC paints only have VOC's in the range of 5 grams per liter or less. Even "Zero-VOC" paints may still use colorants, biocides and fungicides with some VOC's and will emit an odor until they are dry. In low-VOC products, the amount of VOCs varies, and is listed on the paint can or Material Safety Data Sheets (MSDS). To be able to compare the VOC levels of coatings, the EPA has developed Reference Test Method 24 which measures VOC level of a coating in grams per liter of total coating without water. To meet EPA standards for "low-VOC", paints and stains cannot have more than 200 grams per liter of VOCs, and varnishes must not contain VOCs in excess of 300 grams per liter. Look for paints with the Green Seal Standard, as they are certified to be lower than 50 grams **per liter**.

Keep in mind also that the VOC content of a paint is often stated as the content for a base paint. Pigments added by the retailer to create the color you desire can add VOC's and other potentially harmful substances. As a rule, dark and bright colored pigments are both higher in VOC content than light colored pigments.

### Natural Paints & Stains

These paints are naturally VOC free – made with natural plant oils, milk proteins, and minerals.

**Auro**—full line of solvent-free, water-based natural paints and primers, finishes, stains and adhesives [www.aurousa.com](http://www.aurousa.com) 888-302-9352

**Anna Sova**—natural paints from milk ca-

sein and food grade ingredients as well as other healthy home products [www.annasova.com](http://www.annasova.com) 877-326-7682

**EcoDesign's BioShield**—a line of natural paints and finishes [www.bioshieldpaint.com](http://www.bioshieldpaint.com) 800-621-2591

**Green Planet Paints**—natural clay based interior paints made with soy resin and Mayan clay pigments [www.greenplanetpaints.com](http://www.greenplanetpaints.com) 520-394-2571

**Silacote**—paint from natural mineral compounds especially for use on masonry, concrete and wallboard both interior and exterior [www.silacote.com](http://www.silacote.com) 800-766-3157

**The Real Milk Paint Company**—colorful, non-toxic paint with milk protein, lime, clay and earth pigments [www.realmilkpaint.com](http://www.realmilkpaint.com) 800-339-9748

**Weather-Bos**—natural stains, finishes and paints [www.weatherbos.com](http://www.weatherbos.com) 800-664-3978

### No- & Low-VOC Paints & Stains

Most major paint companies now manufacture at least one line of low-VOC paint. Some companies listed below were founded on principles of safe products and environmental stewardship, while others are larger paint manufacturers whose safer paint lines are listed to make them easier to find.

**AFM Safecoat**—zero-VOC interior paints and primers [www.afmsafecoat.com](http://www.afmsafecoat.com) 800-239-0321

**American Pride**—zero-VOC interior latex and acrylic enamel paints [www.americanpridepaint.com](http://www.americanpridepaint.com) 601-264-0442

**Benjamin Moore**—Pristine EcoSpec, Aura, Impervo 314 (low-VOC) [www.benjaminmoore.com](http://www.benjaminmoore.com) [www.myaurapaints.com](http://www.myaurapaints.com)

**Best Paint Company**—zero-VOC Interior paints, primers, finishes, and Low-VOC Exterior paints and primers. [www.bestpaintco.com](http://www.bestpaintco.com) 206-783-9938

**Cloverdale Paints**—Horizon and Ecologic interior and exterior paints (low-VOC) [www.cloverdalepaint.com](http://www.cloverdalepaint.com) 604-596-6261

**Devoe**—Wonder Pure line (low-VOC) [www.devoepaint.com](http://www.devoepaint.com)

**ICI**—Lifemaster 2000 interior and Decra-Shield exterior (Zero-VOC) [www.icipaintstores.com](http://www.icipaintstores.com) 800-984-5444

**Kelly-Moore**—1505 Enviro-Cote line (Zero-VOC) [www.kellymoore.com](http://www.kellymoore.com) 916 921-0165

**Cohalan Company's Keim Mineral Silicate Paint**—[www.keimmineralsystems.com](http://www.keimmineralsystems.com) 302-684-3299

**MAB Paints**—Enviro-Pure Interior line (Zero-VOC) [www.mabpaints.com](http://www.mabpaints.com) 800-MAB-1899

**Miller Paint Co.**—Acro and Super Acro Acrylic interior line (Low-VOC) [www.millerpaint.com](http://www.millerpaint.com) 503-255-0190

**Olympic Paint and Stain**—Olympic Premium interior line (Zero-VOC) [www.olympic.com](http://www.olympic.com) 800-441-9695

**Sherwin Williams**—Green Sure: Harmony line (no-VOC interior) [www.sherwin.com](http://www.sherwin.com)

**Vista Paint**—Carefree Earth Coat, Aurora Bond, etc interior and exterior (low-VOC) [www.vistapaint.com](http://www.vistapaint.com) 714-680-3800

**Yolo Colorhouse**—no-VOC interior paints, Green Seal certified [www.yolocolorhouse.com](http://www.yolocolorhouse.com) 503-0493-8275

### Natural, No- & Low-VOC Sealers & Finishes

**AFM Safecoat**—zero-VOC stains, sealers and clear finishes [www.afmsafecoat.com](http://www.afmsafecoat.com) 800-239-0321

**Auro**—full line of solvent-free, water-based natural paints and primers, finishes, stains and adhesives [www.aurousa.com](http://www.aurousa.com) 888-302-9352

**Best Paint Company**—zero-VOC varnish replacement and glazing products. [www.bestpaintco.com](http://www.bestpaintco.com) 206-783-9938

**EcoDesign's BioShield**—natural stains and finishes for furniture and flooring [www.bioshieldpaint.com](http://www.bioshieldpaint.com) 800-621-2591

**Eco-House Inc.**—natural wood finishing products for woodworkers and artists [www.eco-house.com](http://www.eco-house.com) 877-ECO-HOUSE

**Weather-Bos**—natural stains and finishes for all applications, including waterproofing exterior wood [www.weatherbos.com](http://www.weatherbos.com) 800-664-3978

**Vermont Natural Coatings**—toxic-free stains for floors and furniture [www.vermontnaturalcoatings.com](http://www.vermontnaturalcoatings.com) 802-472-8500

Resources for

### Paints & Stains

- Clean Air Counts, an Illinois based organization working to reduce ozone depleting emissions <http://www.cleanaircounts.org/lowvocpaints.shtml>
- EarthEasy [http://www.eartheasy.com/live\\_nontoxic\\_paints.htm](http://www.eartheasy.com/live_nontoxic_paints.htm)
- Sustainable Building Sourcebook, Chapter: Health and Safety, Paints and Primers. [www.austinenergy.com](http://www.austinenergy.com)
- Oikos <http://oikos.com/products>

## HEATING, VENTILATION, & COOLING

**H**EATING, VENTILATION, AND air conditioning, or HVAC, accounts for 40% to 60% of the energy used in U.S. commercial and residential buildings. A home must strike a balance between an energy-efficient house, which is often tightly sealed to prevent cold drafts, and good indoor air quality, which relies on frequent air exchanges. In older, drafty homes, air exchange happens by accident. Newer homes have a greater emphasis on having the exterior tightly sealed, so we need to be more thoughtful. Air trapped inside the house can lead to prolonged exposure to pollutants and allergens, especially if the home was built without actively eliminating toxic exposures from formaldehyde and other VOC's.

The energy efficiency of a house depends on a combination of factors, such as how tightly

sealed and well insulated a house is; the efficiency of windows; and the efficiency of heater and all the electrical appliances. The simplest thing you can do to cut cooling costs and save energy is to install ceiling fans, and/or to install a whole house fan that draws air through the entire building. When planning a new home or renovating, a combination of proper insulation, energy-efficient windows and doors, daylighting, shading, and seasonal natural ventilation can keep homes cool in the summer and warm in the winter. See page 24 for more on siting and designing your home to capitalize on these natural ways to save energy.

No matter what kind of heating, ventilation, and air-conditioning system you have in your house, you can save money and increase your comfort by properly maintaining and upgrading your equipment. But remember, an energy-

### Big Stores React to Green Demand

In Spring 2007, Home Depot announced Eco Options, a new program to label more than 2,500 environmentally friendly products including compact fluorescent lightbulbs, cellulose insulation, front-load washing machines, and certified sustainable forestry products. The Eco Options label was "tested" in Canada in 2004 where consumer demand for greener products proved that it made sense to launch the brand in the U.S. Eco Options products meet one or more of the following green goals: sustainable forestry, energy efficiency, healthy home, clean air, or water conservation. By 2009, Home Depot expects the Eco Options brand to grow to 6,000 products.

Home Depot is also working to reduce its own environmental impact. The company has signed an agreement with The Conservation Fund to offset all carbon emissions created by the company's Atlanta headquarters and a portion of emissions created by employees traveling on business. As part of the Conservation Fund's Go Zero Program, Home Depot will fund the planting of thousands of trees across metropolitan Atlanta. Home Depot is also replacing the incandescent bulbs in its lighting department displays with CFL bulbs to save energy.

efficient furnace alone will not have as great an impact on your energy bills as using the whole-house approach. By combining proper equipment maintenance and upgrades with appropriate insulation, air sealing, and thermostat settings, you can cut your energy use for heating and cooling, and reduce fossil fuel emissions from 20% to 50%.

When choosing a conventional heating, ventilation, and air conditioning (HVAC) system, look for one that is Energy Star-rated, which guarantees that it is at least 15% more efficient than the average system on the market.

If you are replacing your heating system, consider those which use the same furnace for heating hot water on demand and provide hot water for baseboard heaters. This can save costs

on hot water heating (no tank to keep warm all the time) and reduce fuel costs for heating.

### Traditional Technology

**Forced-air gas furnaces**, which draw cool air from the home and supply warm filtered air to each room, heat the majority of American single-family homes. Their efficiencies vary, but some new furnaces are among the most efficient heating systems available.

Forced air systems can be a problem when they push air through dusty vents, blowing around pet dander and other allergens. Other heating systems, like radiant floor heating, are much healthier for those with asthma or allergies because the less air that's forced, the less dust and sinus irritation you'll usually encounter.

Problems with forced air systems can also occur when interior doors are shut. Supply registers will pressurize some rooms, while areas equipped with return registers are depressurized. This pressure imbalance increases the likelihood of air leakage and heat loss throughout the building shell. Transfer grills, jump ducts, or door undercuts may be used to mitigate these problems, especially when a central return is used.

**Air conditioners** can use a lot of energy to run – especially older models. There are many ways to build and design your home to provide cooling with less energy use.

### Greener Possibilities

Heat Recovery Ventilators warm fresh air on the way in, benefiting indoor air quality and reducing heat loss. Geothermal heat pumps can use the solar heat collected by the earth to heat and cool your home. Hydronic radiant floor heating gently warms rooms without forced air systems that transport dust and allergens. The installation of a heating or cooling system is a decision that will affect a homeowner's comfort – and pocketbook – for years to come.

#### ► HEAT RECOVERY VENTILATOR

Few home heating and cooling systems mechanically bring fresh air into the house. An air exchanger ensures an adequate supply of fresh

### What is SEER?

As of January 2006, the US Dept. of Energy requires manufacturers of air conditioners and heat pumps to produce equipment with a seasonal energy efficiency rating, or SEER, of at least 13. SEER is to air conditioning what combustion fuel efficiency (CFE) is to furnaces and boilers and similarly, the higher the SEER value, the more energy efficient it is. Prior to this new rule, the minimum efficiency standard for AC equipment was 10 SEER. The increase to 13 SEER is projected to reduce energy bills for homeowners who use these ACs over the old ones by up to 30%.

To determine which SEER is best for your home, consult your local utility company to help you determine the approximate portion of your bill devoted to cooling and provide this information to a cooling contractor who can help you decide. Be sure to look for Energy Star and to check with your local utility company for rebates for equipment upgrades. Keep in mind that while some more efficient systems cost more up front, they can pay for themselves in a few years. Of course, homeowners who rely on natural ventilation, passive solar design and energy efficient ceiling fans to cool their homes will save the most!

For more information on the new SEER rating for AC systems, go to [http://www.eere.energy.gov/consumer/news\\_detail.cfm/news\\_id=9566](http://www.eere.energy.gov/consumer/news_detail.cfm/news_id=9566)

air indoors. The most effective option is a Heat Recovery Ventilator (HRV), a small energy efficient fan with a heat exchanger and air filter placed in the attic to both bring in fresh air and pull out stale air. The heat exchanger transfers heat from the warmer flow to the cooler flow, which can save heating costs in winter. The air filter removes allergens and particulates on the way in.

To choose the proper size and flow for your HRV, you will need a blower door test to estimate the natural ventilation. This test, conducted by a professional energy auditor, uses a powerful fan mounted into the frame of an exterior door. The fan pulls air out of the house, lowering the air pressure inside to help locate leaks. If you've renovated an older home, you may not have been able to tighten it up to the point where you will need auxiliary ventilation. In a new home, you will have some natural air flow, but the HRV will supply the additional ventilation you need to maintain proper indoor air quality.

### ➤ GEOTHERMAL HEAT PUMPS

One option to think about is a geothermal heat pump (GHP), which is one of the most cost-effective and longest-lasting heating and cooling systems on the market. Plus, GHPs provide free hot water as a byproduct of air conditioning for the household in the summer. Also known as ground source heat pumps and geo exchange systems, GHPs provide many benefits to the homeowner in both new and retrofit situations.

According to the Environmental Protection Agency (EPA), these systems are the most energy efficient, environmentally clean, and cost-effective space conditioning systems. A GHP system moves the heat from the earth (or a groundwater source) into the home in the winter, and pulls the heat from the house and discharges it into the ground in the summer.

In even the coldest climates, geothermal heat pumps offer cost savings, durability, low maintenance, and year-round comfort, but they aren't cost-effective for homes that don't need cooling systems. Homes that have been built to

maximize natural cooling through shading and natural ventilation will save more energy and money on their own!

Compared with other heating and cooling systems, geothermal heat pump systems have few maintenance requirements. The components in the living space are easily accessible, which increases convenience and helps ensure that the upkeep is done on a timely basis. The underground piping used in the system often has a 25- to 50-year warranty and the GHP's themselves typically last 20 years or more.

While air source heat pumps are also common, they are more useful in places without a cold winter. In the Northeast, ground source (geothermal) heat pumps are usually the better option because they work well in any climate. Ground source heat pumps also require slightly less maintenance, and last longer than air source heat pumps.

On average, a geothermal heat pump system costs about \$2,500 per ton of capacity, or roughly \$7,500 for a 3-ton unit (typical residential size). In comparison, other systems would cost about \$4,000 with air conditioning. But the energy cost savings from the GHP will easily exceed that amount over the course of its lifetime. On a retrofit, the GHP's high efficiency typically means much lower utility bills, allowing the investment to be recouped in two to ten years. In addition, some electric utilities have financing packages that make the purchase of a GHP system even less expensive. Other utilities are providing special electric rates for homes with GHP systems installed. According to the EPA, geothermal heat pumps can reduce energy consumption – and corresponding emissions – up to 44% compared to air-source heat pumps and up to 72% compared to electric resistance HVAC systems.

When looking for a contractor, find someone who specializes in the type of heat pump system you've chosen and who is certified by the International Ground Source Heat Pump Association (IGSHPA). Ask plenty of questions and get several cost estimates to decide if it will be a good long term investment for your home.

More information on heat pumps can be found at the US Dept of Energy's Energy Efficiency and Renewable Energy website [www.eere.energy.gov](http://www.eere.energy.gov).

### ► RADIANT FLOOR HEATING

Floor heating works with pipes imbedded in the floor, pumped with heated air, electricity, or heated water. While this type of heating usually still relies on fossil fuels, it is great option for those who suffer from allergies, since dust and allergens aren't forced through ducts. Also, since no heat is lost through ducts, it is more efficient.

Hydronic systems, using heated water, are the most popular and cost-effective radiant heating systems for homes. Hydronic (liquid-based) systems use little electricity, a benefit for homes off the power grid or in areas with high

electricity prices. The hydronic systems can also be heated with a wide variety of energy sources, including standard gas- or oil-fired boilers, wood-fired boilers, solar water heaters, or some combination of these.

To be most efficient, and to make use of the large thermal mass of concrete, "wet installations" are recommended. Wet installations mean that the tubing is laid out and concrete (the slab) is poured over it. In "dry installations," the tubing is sandwiched between two layers of plywood or attached under the floor.

Resources for

### Heating, Cooling & Ventilation

- US Dept of Energy's Energy Efficiency and Renewable Energy [www.eere.energy.gov](http://www.eere.energy.gov)

## Seal Your Heating & Cooling Ducts!

Ducts that move air to-and-from a forced air furnace, central air conditioner, or heat pump are often big energy wasters. Duct leakage allows substantial heat loss, especially when ducts are located in unconditioned crawl spaces, attics, or attached garages.

Sealing and insulating ducts can improve the efficiency of your heating and cooling system by as much as 20 percent. Unfortunately, many duct systems are not insulated properly. Ducts that leak heated air into unheated spaces can add hundreds of dollars a year to your heating and cooling bills. Insulating ducts that are in unconditioned spaces is usually very cost effective. If you are buying a new duct system, consider one that comes with insulation already installed.

Sealing your ducts to prevent leaks is even more important if the ducts are located in an unconditioned area such as an attic or vented crawl space. If the supply ducts are leaking, heated or cooled air can be forced out unsealed joints and lost. In addition, unconditioned air can also be drawn into return ducts through unsealed joints. In the summer, hot attic air can be drawn in, increasing the load on the air conditioner. In the winter, your furnace will have to work longer to keep your house comfortable. Either way, your energy losses cost you money.

Here are a few simple tips to help with minor duct repairs.

- Check your ducts for air leaks. First look for sections that should be joined but have separated and then look for obvious holes.
- If you use duct tape to repair and seal your ducts, look for tape with the Underwriters Laboratories logo to avoid tape that degrades, cracks, and loses its bond with age.
- Remember that insulating ducts in the basement will make the basement colder. Consider insulating both ducts and the basement.
- If your basement has been converted to a living area, install both supply and return registers in the basement rooms.
- Be sure a well-sealed vapor barrier exists on the outside of the insulation on cooling ducts to prevent moisture buildup.
- Get a professional to help you insulate and repair all ducts.

## APPLIANCES

**I**F YOU LIVE IN A TYPICAL U.S. home, the appliances in your home are responsible for about 20% of your energy bills. Refrigerators, freezers, clothes washers, dryers, dishwashers, and ranges and ovens are the primary energy-using appliances in most households. While salvaging is usually a good thing, it doesn't help to hang onto inefficient monster appliances from the past – you may keep them out of a landfill, but will waste plenty of energy. Save money and help the environment by taking steps to save energy while using your appliances, and by replacing old, inefficient appliances with modern, efficient ones.

Look for the Energy Star label to help you identify energy-efficient appliances. Promoted by Department of Energy and the U.S. Environmental Protection Agency, the Energy Star is only awarded to appliances that significantly exceed the minimum national efficiency standards. See <http://www.energystar.gov> [www.energystar.gov](http://www.energystar.gov) for more information on Energy Star ratings and a list of energy-efficient appliances.

In the United States, all refrigerators, freezers, clothes washers, and dishwashers are sold with yellow EnergyGuide labels to indicate their energy efficiency. These labels provide an estimated annual operating cost for the appliance, and also indicate the cost of operating the models with the highest annual operating cost and the lowest annual operating cost. By comparing a model's annual operating cost with the operating cost of the most efficient model, you can compare their efficiencies.

Keep in mind that there can be a significant difference in appliance energy consumption. EnergyGuide labels are present on all major appliances to help you select the most efficient models. These labels compare the *model* bearing the label with other similar models. However, this information does not indicate whether one has selected the most efficient *appliance type*. Check overall energy consumption as well. A larger refrigerator could have lower energy consumption than a smaller one. The most efficient *appliance* will have certain features that should guide the purchaser to selecting the most efficient *model* with those features.

For example, clothes washers that are *front loading* horizontal axis machines are 50 percent more efficient, both in water and energy use, than *top loaders* with a vertical axis. When selecting a front-loading machine, identify the features that create the most efficient energy consumption, such as variable temperature settings, rinse cycles, and load sizes.

Similarly, refrigerators have different efficiencies according to features such as defrosting characteristics (manual, partial automatic, automatic), compartment locations, and size. Manual defrost with bottom freezer will outperform top freezer models with automatic defrost, for example.

Many dishwashers offer special features that improve energy efficiency. Booster heaters and no-heat drying are two helpful features. It is also important to know how much water the different models require and select those that can clean with the least amount of water.

## LIGHTING

**S**PECIFYING A HIGH QUALITY energy efficient lighting system that utilizes both natural sources, like day lighting, and electric sources is the key to a comfortable living environment. When looking for environmentally friendly

lighting, it's important to consider energy efficiency as well as aesthetics – since lighting can influence the health and mood of home occupants.

Some lamp types are more efficient in converting energy into visible light than others.

The efficacy of a lamp, measured in lumens per watt, refers to the number of lumens leaving the lamp compared to the number of watts required by the lamp and ballast. Sources with higher efficiency require less electrical energy to light a space.

### What to Avoid

**Incandescent lamps** are one of the oldest and least energy-efficient electric lighting technologies available. Whenever feasible, you should seek alternatives to incandescent lamps. With recent advances in “warmer” compact fluorescent lamps that can pay for themselves in a few months, the continued use of standard incandescent lamps is difficult to justify.

**Dimmer Switches** contain mercury and are also inefficient for incandescent lights, using practically the same amount of electricity to make a bulb dimmer. A more efficient way to vary lighting is to have different circuits; for example in a dining room, one for the central focus on the table and another for the perimeter of the room.

### Greener Possibilities

**Compact Fluorescent Lamps (CFLs)** are energy-efficient, long lasting substitutes for incandescent lamps. Newer CFLs give a warm, inviting light instead of the “cool white” light of older fluorescents, making them ideal to replace incandescents. Although initially more expensive, these lights pay for themselves quickly since they use only about 1/3 the energy of traditional light bulbs.

They are available in many configurations and wattages, and can be purchased with lamp and ballast as an all-in-one piece or two separate components. The advantage of separate lamps and ballasts results from the difference in life expectancy of the two components. CFL lamp life is usually rated around 10,000 hours and ballast life is typically 20,000 hours. Thus, when the lamp burns out it can be replaced

without having to replace the ballast as well. Several retrofit adapters are available for convenient retrofit in existing incandescent sockets.

Traditional fluorescent lamps are the most commonly used commercial light source in North America because they’re energy efficient and have a long operating life. These are great options for workshops and garages.

One major drawback to CFLs is that they contain mercury. Many agree that this is small compared to the mercury saved from reducing electricity use, since mercury emissions released from coal burning power plants are a major cause of mercury in our environment. However, even small amounts of mercury are harmful, and these lights need to be handled carefully and recycled properly so that mercury gas isn’t released in your home. Cleaner technologies, such as LEDs, continue to be developed.

**LED lights**, which stand for Light Emitting Diode, are extremely durable and long lasting – with a lifespan of up to ten times that of CFLs. They are also very energy efficient which makes them great for use with solar power systems. LEDs are still relatively expensive and although technology is improving quickly, they are more suited for “point” lights and are usually not ideal for lighting large spaces. LEDs do not contain mercury, but aren’t yet available in warmer colors.

**Solar Lights** are great for outdoor locations that don’t require a lot of light. They collect energy from the sun during the day store it in a battery used to light up walkways and gardens during the night. Solar lights are widely available and usually use LED bulbs because they last much longer than other types.

**Daylighting**, using controlled natural light to illuminate rooms, is an important lighting alternative – especially if members of your household are at home during the day. See page 25 for more on how to design to eliminate or drastically reduce the need for electric lights during the day.

## FIXTURES

**W**ATER EFFICIENT FIXTURES, such as toilets, showers and sinks can help save lots of water and energy.

### Greener Possibilities

#### ► SHOWERS AND FAUCETS

You can make a simple improvement in water conservation by replacing older showerheads and faucets with **“low-flow” heads or aerators** that maintain pressure while reducing flow, measured in gallons-per-minute (GPM). They work by mixing air into the water stream to keep a steady pressure. Most modern faucets are threaded (just inside the nozzle tip) to accept aerators. If you already have aerators on your faucets, check the GPM, imprinted on the side of the device. Shower heads should be 2.5 or lower, and faucets should be 2.75 or lower. Aerators are easy to find, inexpensive and sim-

ple to install – and they can save up to 50% of your water usage, paying for themselves in just a few months.

*Availability:* Low-flow shower heads and faucet aerators are widely available at most hardware or plumbing supply stores.

Some Online sources for low-flow faucet aerators and shower heads include NRG Savers, LLC [www.nrgsavers.com](http://www.nrgsavers.com) and Creative Energy Technologies [www.cetsolar.com](http://www.cetsolar.com)

#### ► TOILETS

These toilet alternatives can help reduce water and sewage expenses if you use municipal water, and conserve groundwater if you use a well.

**Dual flush toilets** have two separate buttons – one for a full flush with 1.6 gallons, and another half flush at .8 gallons. Older, traditional toilets use 2.9 gallons in a single flush, so

### Water Savings Tips

Aside from taking shorter showers and turning off the faucet while you brush your teeth and shave, here are a few other tips to help you reduce home water usage:

- Fix the leaks. The best way to spot common yet costly water leaks: read your water meter, wait two hours without using any water, and read the meter again. The difference can show you how much, if any, is leaking.
- Add aerators to your faucets and showerheads, and update your toilet.
- Don't waste water by flushing other stuff down the toilet – like used tissues, or leftover food scraps.
- Keep a bottle of drinking water in the fridge so you aren't always letting the water run waiting for it to get cold enough.
- Use Energy Star appliances. Energy Star rated dishwashers and washing machines save energy and water – but remember to only use them for full loads.
- Insulate your pipes. This is not only going to save you energy, but it helps hot water reach the shower or faucet sooner wasting less water while you wait for it to get hot. It has been estimated that the water lost while waiting for hot water to reach a tap adds up to an average of 10,000 gallons per year per household.
- Add heat exchangers. In new construction, heat-exchangers can transfer heat from grey water (e.g., showers, sinks, washers) to incoming cold water, reducing hot water demand by as much as 50%.
- Consider roof rainwater collection and/or using grey water. It can be useful for uses such as yard watering, car washing, and toilet flushing.
- Use a broom, rather than a hose, to clean pine needles or leaves off the driveway.

even if you don't go for a dual flush, updating to a newer toilet that uses 1.6 for all flushes will save water. Full and half flush technology can reduce water usage by up to 67%. While early low-flush models were problematic for many homeowners, newer low-flush options use wider pipes and more air-pressure to be effective.

*Availability:* Kohler [www.us.kohler.com](http://www.us.kohler.com), Gerber [www.gerberonline.com](http://www.gerberonline.com), and Caroma, [www.caromausa.com](http://www.caromausa.com)

**Composting Toilets** are waterless – completely eliminating water use from flushing. The waste product, once composted, can be used as a fertilizer in your garden.

The thought of composting human waste is

uncomfortable for many people and there are often misconceptions that the process must be smelly or unsanitary. In fact, composting toilets are clean and can be pretty high tech – ranging from relatively simple twin chamber designs to sophisticated systems with rotating chambers, temperature and moisture probes and electronic control systems. Composting toilets are relatively expensive, but are worth it to the growing number of people who have found that they're effective and clean biological converters of waste that can save money and energy.

*Availability:* Envirolet [www.envirolet.com](http://www.envirolet.com), Sun-Mar [www.sun-mar.com](http://www.sun-mar.com) and Biolet [www.biolet.com](http://www.biolet.com) are some manufacturers.

## KITCHEN COUNTERS & CABINETS

**M**UCH LIKE THE CHOICES you make when picking out flooring and siding for your home, the materials you choose to build your kitchen or other workspaces

should consider lifecycle costs and toxicity.

When you plan your kitchen, remember to make it as easy as possible for you to compost and recycle. Building a pull-out receptacle for both trash as well as bins for cans and bottles

### PROFILE



#### A Composting Toilet: The Perfect Solution for an Off-the-grid Home

Linda Ochs, Waterloo, NY

Back in the 70's, most people gave less thought to their sewer systems than how their garbage magically disappeared from their curbside. I was one of those people who placed a brick in the toilet tank to save clean water from becoming "black water" in the process of sewage disposal.

Browsing through a bookstore one day during my lunch hour, I spied a book entitled "Say Goodbye to the Flush Toilet." This book was the first I'd seen that discussed such matters with actual solutions for dealing with this issue – and it really got me thinking about water issues.

When I built my own small home, I had no funds for such amenities as a flush toilet system that would require so many gallons of water to dispose of such a small amount of waste. I built an outhouse from recycled lumber and other materials, and this served our needs until I learned about composting toilets. I purchased mine from Sun Mar in 1996. I liked that fact that I could get one that didn't use water or electricity, which would save my off-the-grid solar electricity for other things. There are several different models to choose from. The non-electric model – which is fine for a couple but may not meet the needs of a whole family, has a vent pipe running up the back and out the roof to allow air ventilation for odor and moisture control.

Clean water issues will continue to become more of a concern, especially in the southwest part of our country, and composting toilets are one step toward alleviating these concerns.

will make it easy to separate your recycling.

Countertops need to be installed on top of a substrate. Make sure this is made from FSC-certified plywood, wheatboard, or formaldehyde-free fiber board.

Of course, remember to look for low- or zero- VOC paints, stains or sealers to treat your counters and cabinets.

### What to Avoid

Many “quick to install” kitchens mean cabinets, counters and shelving made with **processed wood containing formaldehyde** which can off gas.

While highly durable and growing in popularity, **concrete** is generally not a green option for counters since it’s so energy intensive and polluting to produce. In addition, the recycled aggregate used to make concrete “greener” is a by-product from power plant scrubbers – meaning that heavy metals like mercury are often present in it, and may leach out. See the section on foundations on page 45 for more on concrete.

### Greener Possibilities

#### > CABINETS

For cabinets, look for **FCS certified wood** or **processed fiberboard** made with non-toxic products.

*Availability:* *Breath Easy*™ makes cabinetry for indoor air quality. [www.breathesycabinetry.com](http://www.breathesycabinetry.com) 631-727-7721

## FURNITURE

### What to avoid

**S**AFE AND GREEN FURNITURE choices can be found if you follow many of the same rules as non-toxic building supplies: avoiding PVC, buying wood products that have been harvested sustainably, avoiding products made from processed wood that can off-gas formaldehyde, and staying away from stain treatments and finishing treatments with VOCs.

### > COUNTERTOPS

Countertops can be made with many of the same materials discussed in the flooring section on page 66. Some widely available options include **FSC certified wood, locally quarried stone, bamboo, and ceramic or recycled glass tiles**. Many materials will need a sealer to protect against staining, so be sure to look for a low-VOC sealer.

**Paper or Glass Composite** countertops can be made from recycled paper, wood pulp, recycled glass or crushed stone. There are a growing number of suppliers making sustainable composite counters from recycled materials, including broken porcelain fixtures like tubs and toilets which would otherwise go to a landfill. These materials are very durable and don’t off gas.

*Availability:* PaperStone [www.paperstoneproducts.com](http://www.paperstoneproducts.com) makes durable counters with 100% post-consumer recycled paper. In NY, PaperStone products are currently available through Bettencourt Green Building Supplies in Brooklyn, NY [www.bettencourtwood.com](http://www.bettencourtwood.com) 718-218-6737 and **Green Courage** in Cold Spring, NY. [www.greencourage.com](http://www.greencourage.com) 845-255-8731

Richlite sustainable paper products, including countertops, are available from several dealers across the state. [www.richlite.com](http://www.richlite.com) 888-383-5533

IceStone durable surfaces are made in Brooklyn, NY from 75% recycled glass and concrete. [www.icestone.biz](http://www.icestone.biz) 718-624-4900

A toxic threat to be on the lookout for with stuffed furniture are brominated flame retardants. These are neurotoxic chemicals commonly found in foam cushions, electronics like TV’s and computers, and office furniture.

### Greener Possibilities

There are a growing number of furniture manufacturers that make environmentally and people friendly products.

## What are Brominated Flame Retardants?

Brominated flame retardants known as PBDEs (polybrominated diphenyl ethers) are used in a broad array of products, including cars, electronics, and furniture. They are also among many chemicals known as persistent bioaccumulative toxins (PBTs), meaning they last in the environment and build up in people's bodies over a lifetime. In minute doses, brominated fire retardants impair attention, learning, memory and behavior in laboratory animals.

The EPA has recently banned two types of PBDE's, penta and octa, which were taken off the market at the end of 2004. This has increased the pressure to ban the third most widely used type, deca. While manufacturers claim that deca isn't harmful to human health, European studies have shown that in the environment deca rapidly breaks down to penta and octa, the two most harmful and readily absorbed forms of the chemicals. Deca is detected widely in our environment, especially in household dust where children are continually exposed. This is the subject of an Environmental Working Group report entitled "In The Dust: Toxic Fire Retardants in American Homes" which can be found at [www.ewg.org](http://www.ewg.org).

Some manufacturers who use deca are already shifting to effective phosphorus-based flame retardants. For example, in May, 2007, Apple released a statement that it will cut off use of BFRs as well as polyvinyl chloride (PVC) by 2008. In April 2007, Washington became the first state in the nation to pass a bill banning deca. The bill prohibits the use of deca in mattresses beginning in 2008 and will outlaw the manufacture and sale of deca-containing TVs, computers and residential upholstered furniture in 2011. Maine, New York, Massachusetts, California, Michigan, and Illinois are all considering deca bans as well. For more information on BFRs, Environmental Working Group ([www.ewg.org](http://www.ewg.org)) is a great resource for environmental health news.

FSC certified wooden furniture and organic furniture, including sofas, chairs and beds are all available, though they can be much more expensive than conventional options. Organic and toxic-free bedding and pillows are easier to afford if, like many people, expensive organic furniture just isn't in your budget. There are always small steps you can take to eliminate toxins in your home environment.

*Availability:* There are many companies making sustainable and toxic-free furniture.

Life Kind Products makes over 100 organic and naturally safer products including beds, pillow, sofas, chairs, and bedding. [www.lifekind.com](http://www.lifekind.com) 800-284-4983

Vivavi makes modern style eco-friendly furniture & furnishings. [www.vivavi.com](http://www.vivavi.com) 866-848-2840

Vermont Woods Studios makes wooden furniture from sustainable sources. [www.vermontwoods.com](http://www.vermontwoods.com) 888-390-5571

## Green Cleaning

Of all the ways to go green, changing cleaning products is one of the easiest and is directly cost-efficient. There is a myriad of products available and one can make good cleansers using safe, non-toxic ingredients from around the house like baking soda, white vinegar and water.

Cleaning products in the home contain various chemicals that can be harmful to people and eco-system health. Byproducts from the manufacture of these products even further pollute the environment. Chlorine and phosphates are common culprits in the cleaning world, two substances that wreak havoc on the environment, particularly water. Air pollution is normally associated with the emissions from vehicles and the smoke chugging from industrial stacks, but indoor air pollution is a much more immediate threat to your health. Volatile organic compounds (VOCs) are emitted from many household cleaning products at room temperature. Most VOCs have varying adverse affects on humans, and can cause respiratory irritation, headache, nausea, dizziness or fatigue. The severity of the symptoms depends on exposure, concentration, and body mass – affecting children more strongly than adults. With asthma rates on the rise, affecting over 9 million children in the US, cleaning with greener products will continue to become a priority for families and schools.

Toxicity is not the only issue when cleaning green. The packaging craze sweeping across the country has not skipped over the cleaning aisle. Most cleaning products are in bulky boxes or bottles, which are often not made from recycled materials. Instead, the best green products use recycled paper and plastic for their packaging, in addition to being non-toxic and biodegradable. Further compounding the packaging waste, cleaning products are designed to be disposable. Paper towels, one-use dusting cloths, and bleach wipes are intended for one swipe and then the garbage. Going green also means being reusable, and an old cotton t-shirt with a little vinegar is just as effective and much more sustainable. The mantra “reduce, reuse, recycle”, is equally important for practicing green cleaning as any other green efforts.

Thankfully, there is no lack of choice when looking for a green de-greaser, laundry detergent, or dish soap. Seventh Generation, Method, and Simple Green are just three companies that provide a great range of inexpensive products for household cleaning. These companies, and others, make non-toxic, biodegradable cleansers, and Seventh Generation and Method use only recycled content packaging. Further, as mentioned earlier, there are plenty of great recipes for non-toxic, biodegradable cleaners using household ingredients. For example, vinegar diluted with water is a great glass cleaner and salt can double as an abrasive for scouring pots and pans.

The point of cleaning is to stay healthy, so why choose products that may make your family sick, or make a mess of the environment?

For more information about green cleaning and other greener household products:

- Household Products Database [www.householdproducts.nlm.nih.gov](http://www.householdproducts.nlm.nih.gov)
- Inform Inc. has great fact sheets about PBTs, and safer products. Look for the fact sheet “Cleaning for Home Health” [www.informinc.com](http://www.informinc.com)



## SECTION FOUR

# Building Outside



**Your property is part of a larger eco system, and how you choose to manage it is important. Think of your yard as the buffer zone that allows your home to harmonize with the land around it. By landscaping with native plants, you can eliminate the need for using pesticides and household water; by creating decks and playsets with salvaged lumber or FSC certified wood, you can save forests and keep your family safe from arsenic and chromium in pressure treated wood; and by minimizing impervious surfaces like concrete patios and paved driveways, you allow the soil to naturally absorb run off. Read on for helpful tips on how to green your outdoor environment!**

## DECKS, PLAYSETS, & PATIOS

**F**OR DECK AREAS AND SWINGSETS, arsenic treated wood can be replaced with several alternatives. The best alternative for decks is salvaged lumber from previously existing sites and lumber certified sustainable by the Forest Stewardship Council (FSC). For more on FSC certified lumber and where to find it, see page 48. Redwood, cedar and hemlock are good choices because they are naturally decay-resistant. When staining or sealing your outdoor structures, look for water-based, low-VOC options. Some companies that provide these products are listed in the paints and stains section on page 73.

Another option for outdoor building is plastic wood made from high post-consumer recy-

clered plastic which reduces both demand for old growth lumber and landfill waste from plastics. While plastic wood production may be energy intensive, advantages of plastic wood include that it conserves trees, utilizes recycled plastic, does not need to be sealed, is easily cleaned and is resistant to moisture, rot, bacteria growth and graffiti. For more on plastic lumber, and which options are most environmentally preferable, see page 50.

Patios can be constructed from a number of recycled materials, including recycled tiles, salvaged bricks, and stone from a local quarry. For ideas for salvaged building supplies in NY, see our list at the end of this guide.

### Outside Living Space

Looking for more living space? Outside living spaces can become seasonal extensions of your home. They have many benefits, ranging from lower stress and more family time, to more attention and care given to the natural world.

Outdoor garden rooms are not new ideas – the ancient Greeks and Romans often shaped their homes around statues, fountains and flowers. Before you transform part of your lawn, figure out what you want from your garden room: a quiet sitting area to unwind after a hectic day? More space to cook and dine? A formal area for parties and weddings? A place for sports? An office or a writers' retreat? Maintaining backyard garden rooms and pathways can also be a fulfilling hobby, and a venue to teach children about nature and botany.

## DRIVEWAYS & PATHWAYS

Gravel driveways are usually “greener” simply because they contain less embodied energy, meaning they take much less energy to produce and finish than asphalt and concrete. Gravel is easy to locally procure in NYS, and is less expensive. While gravel driveways allow water to seep into the ground more than paved surfaces, over time they will pack down and prevent water infiltration.

Using pervious materials for at least one-third of all driveways, walkways and patios is important so that water runoff doesn’t compromise soil: the faster water begins to travel, the

more it will erode and compact nearby soil. A designed grass-pave system can maintain grass health and reduce driveway compaction over time. Another option is pervious paving – a lighter colored concrete paving with voids in the mix that allow water to soak through.

Avoid soil erosion from run-off by limiting development on steep slopes and by aligning paths and driveways with the natural topography. On steep slopes or stone retaining walls, small out-pockets and planters or vines can also help to absorb water and reduce run-off.

## WATER RETENTION

Channeling rainwater through gutters and downspouts into an above ground cistern can keep water runoff from overloading storm drains, while providing a free source of water for lawns and gardens, making you less dependent on treated drinkable water when caring for your yard.

Rainwater collection can be as simple as collecting run-off in a small barrel for later use.

More complicated systems are needed when homes are designed to always use grey water for certain uses. The term “grey water” is used to describe non-drinkable water which doesn’t contain harmful contaminants or pathogens and is therefore useful for things we usually use potable water for, like watering our gardens and flushing toilets.

## LANDSCAPING & GARDENING

Landscaping provides you a way to integrate your own living environment with the natural environment. Remember that your property is part of a larger eco-system. By paying attention to water usage, native species, and the trends of the natural eco-system where you live, your landscaping can be beautiful and low-impact.

If you’re building a new home, preserve the top soil for later use and make sure to dig up and replant perennials, trees or native ground covers that you’ll want when the project is complete.

Recycle or salvage your land-clearing waste from building by using tree trimmings as mulch. Restore or enhance vegetation cleared during development.

When you site your home, you should choose a site and design that allows tree overhang and other shading to optimize solar resources and natural temperature control. Planting hedges and trees with careful consideration can allow for energy savings when they grow larger a few years down the road. For more on siting to aid passive solar gain and day lighting, see page 25.

### Mowing

Did you know that a single gas powered push mower may emit as much pollution in an hour as 11 cars? According to Green Grass Cutters, an environmentally friendly lawn mowing company based in Virginia, operating a typical gasoline mower with a four-cycle engine produces

as much PAHs (polycyclic aromatic hydrocarbons) as driving a modern car about 95 miles. Other sources claim this can be as high as 3,400 miles! PAHs are one type of pollutant emitted by lawn mowers that are classified as probable carcinogens by the Center for Disease Control. An Environmental Protection Agency study found that approximately nine percent of some types of air pollutants nationwide come from lawn and garden equipment. All this pollution is often most harmful to the person doing the mowing, whose lungs get the first crack at breathing concentrated doses of these PAHs while they work.

First, shrink down that lawn by planting trees, shrubs or gardens. Then, get a mechan-

ical push mower which can also give you a great workout! Cleaner electric mowers are a less polluting option too. The Neuton from Country Home Products ([www.drpower.com](http://www.drpower.com)), is a battery-powered mower (no cord!) that's lightweight, relatively quiet, costs about \$399, and has a one-hour battery charge perfect for small lawns. An optional replacement battery doubles the mowing time.

### **Xeriscaping**

Designing sustainable landscapes can decrease maintenance - watering, mowing, and fertilizing and pesticide application, while conserving water, improving soil and increasing biodiversity. For many people, this means reevaluating

## **Composting**

Home composting is one of the best ways that you can reduce your families' trash impact, help your organic garden grow, and make earthworms happy. Most people don't see food waste thrown in the trash as an environmental hazard because they know that it's biodegradable. Approximately 25% of our waste stream is composed nearly equally of food scraps and lawn debris, according to the Environmental Protection Agency. These are the very materials that, once in the landfills, produce ozone-damaging methane, a greenhouse gas more potent than carbon dioxide. Methane gas also causes landfill fires that produce dioxin and other pollution. Many people rely on garbage disposals to get rid of food waste - but they require a great deal of water to work well. Food waste eliminated with a garbage disposal can account for as much as 50% of home wastewater solids - increasing water treatment costs, or requiring septic tanks to be pumped more frequently.

With hardly any work, these organic materials can instead be turned into rich, life-supporting compost. Because it is a great source of nutrients, use of compost significantly reduces or eliminates the need for fertilizer. Compost improves soil texture and its ability to hold onto moisture, thus protecting against drought. Compost also helps control erosion and weed growth, and acts as a protective barrier against toxins in the soil. No matter where you live, you can help reduce the emission of damaging greenhouse gases by composting.

The composting heap should be about a cubic yard set slightly into the earth to allow both water drainage and easy access to earthworms. There are numerous types of ready-made containers on the market. Commercial bins made from black recycled plastic are successful for keeping out animals, but tying four wooden pallets together upright, a circle of heavy gauge wire fencing, or simply a pit in the ground are also successful designs. With your kitchen and garden scraps (without bones, meats, fats and oils) and an equal amount of dead leaves or some other carbon source, your compost pile will reduce your waste stream and help your backyard ecosystem.

If you don't have space for a compost pile, a worm bin is another option. All it takes is a container, moistened bedding and redworms and your food scraps. Worm composting can be done year-round, indoors in schools, offices and homes. There is no odor, and the resulting compost is great for house plants and patio containers as well as gardens.

For more on compost systems and links to other related sites, go to Environmental Protection Agency <http://www.epa.gov/compost/>

## PROFILE



### Greening the Governor's Mansion

Albany, NY

On May 1, 2007, First Lady Silda Wall Spitzer unveiled a plan to transform the Governor's Mansion in Albany into a green building.

Serving as a model for the state, the residential greening initiative helps address global climate change and is part of Governor Eliot Spitzer's broader clean energy plan to decrease the projected demand for electricity 15 percent by 2015 through increased energy efficiency and clean, renewable power production. The "15 by 15" plan, which claims to be

the most aggressive target in the nation, looks to increase the supply of available energy for NY in an environmentally sustainable way.

"Residential buildings are a major contributor to global warming," said First Lady Silda Spitzer, in a press conference to discuss the initiative. "The Executive Mansion is a place of historic significance, which should be properly preserved. Starting today, the mansion will also function as a sustainable building. I am hopeful that this initiative will encourage others to pursue similar efforts with their own homes. Together, every small step can reduce our overall impact on the environment." Silda Spitzer is making green buildings and green affordable housing a top priority.

"Greening the Mansion" will cut its electrical energy consumption by 50% and reduce greenhouse gas emissions by half. Highlights of the plan include:

- **Clean, Renewable Energy.** Solar panels will be installed in three locations throughout the Executive Mansion's property: the parking lot, a building canopy, and the roof of the pool-house. The solar panels in the parking lot will serve as carports, providing shade and eventually enabling electric vehicles to re-charge. Solar panels will also be built as a canopy outside the State Police building. A fuel cell system will be used to power a back-up generator, replacing an existing diesel generator.
- **Energy-Efficient Appliances and Equipment.** Energy efficient appliances will replace several existing appliances. Low-flow showerheads will also be installed to reduce the use of water and many of the existing light bulbs throughout the mansion will be replaced with energy-efficient compact fluorescent bulbs.
- **Ecologically Sound Maintenance Practices.** The mansion is phasing in the use of non-toxic cleaning products, organic pest control, mulching lawnmowers that recycle grass clippings in place, extensive recycling, and composting.
- **Green Equipment.** The mansion staff will begin using hybrid electric vehicles. Electric lawn mowers and lawn maintenance equipment will also be used to reduce gasoline emissions. (Electric equipment can plug into the solar carport for power.)
- **Local and Organic Food Policy.** The mansion now purchases New York-grown, and preferably organic, produce to the greatest extent possible. The mansion will also purchase from a local food co-op, and join a local Community Supported Agriculture (CSA), which allows consumers to buy a share in a farm and receive fresh local organic produce when it is harvested.

The mansion qualifies for the New York Power Authority's pre-existing state program for energy improvements at state facilities, and will apply for additional funding under a New York State Energy Research and Development Authority (NYSERDA) program available to all electricity consumers in the state. The project team does not expect to use any capital funds from the state budget for the project.

Much of the green technology will not only cut energy costs and help the environment, but it will ultimately pay for itself in energy savings. When the project is complete, the plan will be submitted to the U.S. Green Building Council for review and possible LEED certification.

what it means to have a perfect lawn. Those who want to strive for a huge expanse of perfectly green, dandelion-free grass will find themselves battling with herbicides and mowers to keep this in check. A “greener” lawn can sustain itself without chemical inputs and excessive mowing. Consider gardens with perennial plants suitable to the climate and soil, and replacing turf grass and sod with native plants – a practice known as “xeriscaping.”

Xeriscaping focuses on reducing water usage for landscaping by using plants that belong in a place. While it is especially important in places with dry climates where water is a scarce resource, everywhere we can eliminate extra inputs and allow the land that surrounds our homes to flourish on its own is a benefit to the environment. For example, planting native vegetation which may be becoming rare or endangered can preserve the biodiversity of a place by also supporting the insects and birds that feed on these plants.

Resources for

### **Xeriscaping**

Marie Iannotti, Xeriscape Gardening - Planning for a Water Wise Garden, <http://makeover.about.com/od/yardgarden/a/Xeriscaping.htm>

Eartheasy: Xeriscape, [http://www.eartheasy.com/grow\\_xeriscape.htm](http://www.eartheasy.com/grow_xeriscape.htm)

## **Gardening**

Growing your own food organically, or supporting a local organic farm or CSA, are important ways you can live greener, since you’ll be eating healthy food without supporting the chemical inputs and polluting transportation that bring it to the grocery store. An organic garden is also a great way for children to learn about nature and the environment.

When you plan a garden, learn about your soil and make sure that you’re not growing food in soil that has been contaminated by arsenic and chromium treated lumber or older lead paint that has chipped from the home or nearby structure. For more on these issues, see Toxic Problems in Existing Homes, starting on page 13.

Raised garden beds can allow you to plant vegetables closer together in deep soil, and they’re also easier to reach. Create raised beds with salvaged brick, wood or stone. Don’t use chemically treated wood or railroad ties since these are treated with chemicals that can leach contaminants into your soil.

For those people without much outdoor space, there are also plenty of ways to create mini-greenhouses, or even cold frames that can allow you to grow herbs and even vegetables in a small space.

There are plenty of great organic gardening books that will help you plan your garden and give tips on how to grow healthy food without the use of harmful pesticides.



## CONCLUSION

# The World at Home



**T**HROUGHOUT THIS GUIDE, WE presented materials and strategies with a range of upfront costs and a wide array of benefits to show you options and the many considerations that must be factored in before something can be labeled “green.” Whatever level of green building you’re able to incorporate in your home, you’re helping to support a market transformation that helps make healthier building products and techniques mainstream. While some of these strategies can be money saving – like energy saving appliances that will reduce your electric bill – most other benefits, such as reducing greenhouse gas emissions to fight global warming, are much more difficult to put a price tag on. In many cases, the action and the benefits go hand in hand – like supporting sustainable forestry and feeling good about the choice to support it. Similarly, choosing a slightly more expensive flooring option – like real linoleum over PVC – can help protect your family’s health, another immeasurable benefit. We already know that avoiding toxic products usually translates to more demand for safer ones – one effective way to reduce toxic exposures to workers through production and reduce safer product costs over time.

Until recently, people seldom considered the damage to the environment caused by the manufacture and disposal of synthetic materials. Today, many people consider the health risks of materials they bring into their homes and their long-term environmental impacts. It’s critical that despite our busy lives we take the time to

make the big connections between what we buy and use and the vast implications to our future and the future of this planet. Imagine that the choice you made to buy organic food from a local market helped a family continue to provide healthy produce to other families like yours. Imagine that including your children in the green building decision-making process for your home caused them to teach fellow classmates about the importance of avoiding VOCs and reducing landfill waste. And imagine too that the contractor you hired to work on your bathroom went on to recommend aerating faucets and recycled glass tiles to all his future clients.

Environmental consciousness arrived later in the home building sector than in other areas of our lives. But as our guide shows, it’s here today, and is likely to grow. We strongly believe that the health and environmental benefits of green building to you, your family, your community, and our shared ecosystems vastly outweigh the various costs. As we’ve shown, however, green building decisions frequently involve difficult trade-offs. Building green requires a level of attention from the homeowner or remodeler that is perhaps unprecedented. But, as we also hope we’ve shown, green building can be fun for the whole family! It’s a rigorous and challenging learning experience, an opportunity for quality time together, and a project with both short- and long-term payoffs. We trust this guide has been useful to you, and look forward to your suggestions about how to improve the next edition.

## SOURCES FOR RECLAIMED BUILDING MATERIALS IN NEW YORK STATE

### **Antique & Vintage Woods of America, Ltd**

Warehouse, design center and showroom, and woodcraft center, offering a variety of products and salvaged wood varieties.

Pine Plains, New York 12567

518-398-0049

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

### **Barn Shadow Enterprises**

Reclaimed and restored antique barn wood.

Wellsville, NY 14895

585-593-5075

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

### **BarnStormers Woodworks**

Salvaged barnwood flooring, siding, beams, and furniture made from 100% salvaged barnwood.

Saugerties, NY 12477

845-661-7989

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

### **Building Preservation Works, LLC**

Specializing in architectural antiques for restorations, with online showroom.

Homer, NY 13077

607-749-8889

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

### **Build It Green! NYC**

The city's only non-profit, salvaged building materials warehouse.

Queens, NY 11102

718-777-0132

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

### **Craigslist**

Browse this site for free stuff postings in your neighborhood.

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

### **Demolition Depot**

Specializing in vintage fixtures and architectural ornaments.

New York City, 10035

212-860-1138

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

### **Eastern Rensselaer County Community Warehouse**

Non-profit reuse center with home and office furniture and fixtures.

Hoosick Falls, NY 12090

518-686-7540

[www.hoosickfalls.com/community/ERC.htm](http://www.hoosickfalls.com/community/ERC.htm)

### **FreeCycle**

Sign up (free) with your community's online network to post and get postings about free stuff.

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

### **Greenworker Cooperatives – Bronx Building Materials Reuse Center**

A non-profit organization working to create an alternative green economy in the South Bronx. Plans for a building reuse center is in the works for 2007.

Bronx, NY 10474

718-617 7807

[www.greenworker.coop/website\\_j/](http://www.greenworker.coop/website_j/)

### **Habitat for Humanity – ReStore**

Surplus and used building materials and furniture for contractors and homeowners located in cities across the country.

[www.habitat.org/env/restores.aspx](http://www.habitat.org/env/restores.aspx)

### **Historic Home Supply Corp.**

Specializes in architectural salvage.

Troy, NY 12180

518-266-0675

**Hudson Valley Materials Exchange**

Reuse center accepting building materials, industrial scraps and art materials from the business wastestream with onsite waste assessments for potential donors.

New Windsor, NY 12553

845-567-1445

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

**Long Island City Business Development Cooperation**

Industrial waste recycling and prevention program.

Long Island City, NY 11101

718-786-5300 x24

**Materials Resource Center**

A project of the Association for Resource Conservation which obtains scrap and surplus materials from industry.

Ronkonkoma, NY 11779

613-580-7290

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

**Mat-Ex Online Western/Central NY Materials Exchange**

The exchange involves businesses in 21 counties.

585-344-2580 x5464

[www.mat-ex.org](http://www.mat-ex.org)

**New York Salvage/Architiques**

Roofing, flooring, architectural salvage and antiques.

Oneonta, NY 13820

607-432-9890

[www.architiques.net](http://www.architiques.net)

**NY Wa\$teMatch**

Helps clients reduce disposal costs, generate revenue and obtain raw materials for free.

New York, 10007

212-442-5219

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

**Pioneer Millworks**

Produces quality hardwood flooring and siding from salvaged wood.

Farmington, NY 14425

585-924-9970, 800-951-9663

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

**Significant Elements**

A non-profit, architectural salvage warehouse working in conjunction with Tompkins County Solid Waste Management Division.

Ithaca, NY, 14850

607-277-3450

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

**Urban Archaeology**

Specializing in saving historic elements from demolished buildings.

New York, 10013

212-431-4646

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

**Zaborski Emporium**

Architectural salvage and vintage fixtures.

Kingston, NY 12401

914-338-6465

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

## 10 Things to do Today & 10 Things to do When You Build

Whether you're redecorating a room, renovating part of the house, or building a new home, you can make energy choices that are inexpensive in the short term and lead to long term benefits.

The tips listed here range from things you can do right now, like replacing incandescent lights with fluorescent bulbs as they burn out – to long term, large-scale projects, like designing a new, energy efficient home to take advantage of passive solar heat, day lighting, and natural ventilation.

### 10 things to do now:

1. Replace incandescent bulbs with compact fluorescent lights, which use less than half of the electricity, or LEDs which use only one tenth.
2. Lower hot water tank temperatures to 120 degrees Fahrenheit.
3. Adjust thermostat settings to be higher in summer and lower in winter.
4. Close windows and shades during summer days to keep the heat out.
5. Only run clothes washers, driers and dishwashers when the loads are full.
6. Wash clothes in cold water and air-dry them.
7. Turn off lights when you leave a room.
8. Caulk, seal and weather-strip air leaks to cut cooling and heating expenditures.
9. Put TVs, VCRs, stereos, DVD players, microwaves, and other electronic equipment on power strips that can be shut off when not in use.
10. Switch to locally produced, decentralized renewable energy which keep energy dollars circulating in the local economy and reduce green house gas emissions.

### 10 things you can do when building a new home:

1. Orient your home to maximize natural day lighting and passive solar heat.
2. Place windows to provide natural ventilation.
3. Select a light colored "cool roof" to reflect heat and use overhangs to shade.
4. Install Energy Star whole house fans or ceiling fans to reduce or eliminate AC.
5. Install high R-value recycled insulation as well as windows and doors.
6. Select Energy Star appliances and an energy efficient furnace and water heater.
7. Design water efficient landscapes based on native plants and plant deciduous trees to shade the home in summer and allow sunlight in winter.
8. Minimize or eliminate the amount of lawn you need to mow.
9. Install water efficient "dual flush" toilets and low-flow showerheads and faucet aerators.
10. Use efficient, properly maintained heating and cooling systems.





## THE WORLD AT HOME

### A Household Guide to Building Green

**Never have the stakes been clearer or higher: societies must green themselves in the twenty-first century or face some very serious and unpleasant consequences. While the problems of toxic chemicals, climate change and peak oil may seem overwhelming and remote, there are many opportunities for us all to take part in the green overhaul of the built environment. These opportunities begin at home. As this guide shows, homeowners, renters, architects, and contractors can all contribute to the positive changes necessary to bring our society into balance with the natural world. And, as if that good news were not enough: our contributions can also be healthy, economical, innovative, and just plain fun!**

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