

LETTER FROM EPA NEW ENGLAND

March 2008

There are 1.5 million new homes built in the United States every year and over 107 million existing homes. The environmental impact of these homes equals or exceeds the impacts of commercial buildings. Taken as a whole, buildings in the US have the following impacts:

- 39% of the total energy use
- 12% of the total water consumption
- 68% of total electricity consumption
- 38% of the carbon dioxide

While there has been an emphasis on greening commercial buildings, fewer resources have been available for the homeowner who wants to build or renovate their residence. With that in mind, we wrote this Guide to Residential Green Building in 2006 and have now updated the Guide with more resources, especially on energy.

This Guide will help you find information and resources ranging from roofing, siding, and paint to storm water management and indoor air quality. It is designed to allow readers to pick and choose a variety of topics that will help to reduce the environmental impacts of the built environment.

Additionally, we encourage you to look at EPA New England's Green Building web site (www.epa.gov/region1/greenbuildings), where you will find this Guide as well as other information including a description of EPA's green building projects.

We at EPA New England strive to give citizens useful information and resources and we hope that the use of green building techniques contained in this Guide, from energy-efficiency to recycling of construction and demolition debris, will help make all of us environmental stewards in our home projects.

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INTRODUCTION TO RESIDENTIAL GREEN BUILDING IN NEW ENGLAND

Buildings and the Environment

In 2004, buildings accounted for nearly 40% of total U.S. energy consumption. Residential buildings accounted for 54.6% of that total. U.S. buildings are responsible for 38.1% of the nation's carbon dioxide emissions, 20.8% of which is emitted from the residential sector. Building occupants use 12.2% of the total water consumed in the U.S. per day, 74.4% of which is used for residential needs. Building-related construction and demolition debris totals approximately 136 million tons per year, 43% of which is generated from residential sources. (Facts from: www.epa.gov/greenbuilding/pubs/gbstats.pdf)

Green Buildings and How They Are Certified

Green building design and construction practices address: sustainable site planning, safeguarding water and water efficiency, energy efficiency, conservation of materials and resources, and indoor environmental quality (US Green Building Council). By addressing these criteria in an environmentally sensitive manner it is possible to significantly reduce or eliminate the negative environmental impact of buildings. There are several ways to denote a building's "greenness." Green Buildings are certified through independent third party systems (see the Green Home Standard and Certification Programs section for more detailed information).

Why Build Green Homes?

The "built" environment has a vast impact on the natural environment, human health, and the economy. By adopting green building strategies, we can maximize both economic and environmental performance. Green construction methods can be integrated into buildings at any stage, from design and construction, to renovation and deconstruction. However, the most significant benefits can be obtained if those involved in the design and construction of the building work together from the earliest stages of a building project.

Saving Homeowners Money and Creating Business Opportunities

Although green homes usually cost more to build, green homes have lower operating costs. By minimizing energy and water use, green homes have reduced operating costs. They also create, expand, and shape markets for green products and services by increasing demand for these products. Improved indoor environmental quality can cut costs by improving health. Green homes can also reduce costs to society that would otherwise have to be borne for raw material extraction and manufacturing, energy development and distribution, and pollution cleanup.

Providing Residents with Better Indoor Air and Higher Quality of Life

Because green homes can have better air and water quality, include more natural light, and reduce the presence of harmful chemicals, they can enhance occupant comfort and health and improve the overall quality of life for their residents.

Producing Less Air and Water Pollution

Homes can be built to consume less energy, be water-efficient, have increased indoor air quality, and constructed with reused and recycled content materials. Energy efficiency is closely tied to reduced water and air pollution, while reused construction materials conserve raw materials, natural resources, and reduce waste streams. Green homes that include stormwater management and native landscaping enhance and protect local biodiversity.

About the Guide

This Guide is set up in paragraph form; it is not meant to be exhaustive on the topics, but will give the reader resources to find more information. Readers will find each resource option indented with a title followed by either a Web site or search terms and a description of the resource or product. References are provided at the end of the Guide such as Green Building Organizations and Resources – both national and regional, Certification Programs, Online Tools and Advisors, as well as Acronyms and Definitions, and green building examples. While EPA cannot promote or endorse specific companies, services, or products, we can and have described the options currently available and described on the world wide web. To facilitate your searching for specific products or companies, the Guide has been organized in alphabetical order and we have included helpful search terms that can be used for internet research. The Guide does, however, endorse EPA and other federal programs such as ENERGY STAR for Homes and Indoor Air Quality for New or Existing Homes. Please refer to the Indoor Environment section of this Guide for more information on these specific programs.

The Guide presents environmentally preferable options, but readers should think about cost life-cycle considerations such as the durability of products, the length of time before replacement is required, and the environmental impact of the transportation of products, which includes distance from manufacturer, when selecting materials to purchase for their home. The Guide gives a range of product options and does not distinguish cost as a factor. Although some environmental construction materials and products mentioned in this Guide have a higher up-front cost, they may have lower operating costs or last longer. Some are more expensive because of the environmental considerations, and it is up to the reader to decide whether or not to consider this as a factor when making choices for their home. Payback on these products varies. Product life-cycle, as discussed above, durability, and potential savings will determine the length of time needed for complete payback.

It is important that readers of the Guide understand that there are always trade-offs to be made. While one product, material, or technology may be green in one way, it may be lacking in another. None of the products or strategies discussed here are silver bullets, but many can be components in an overall thoughtful and integrated approach to home construction and renovation.

The Guide is current as of its publication and some references may have changed after publication. Readers are encouraged to do further research on specific topics of their interest to be sure they have the most up-to-date information. This is the first update of the guide and we expect to periodically update the Guide, and encourage readers to submit appropriate updates as technology and information become more widely available.

Purpose of this Guide

The purpose of the Residential Green Building Guide for New England is to provide a resource to homeowners and contractors in the New England area who are interested in constructing and/or renovating their homes to be more environmentally friendly. It is intended as a primer and cannot answer all questions, but describes the resources that we are aware of. The Guide contains listings for information on green construction and renovation, where and how to find green products, and serves those in Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island, and Vermont. This Guide features organizations that are governmental or not-for-profit organizations or corporations. The Guide focuses solely on construction and renovation products and does not discuss maintenance or operation of products and references described herein.

The non-EPA Web sites provided in this Guide contain additional information that may be useful or interesting and are being provided consistent with the Guide's intended purpose. However, EPA cannot attest to the accuracy of information provided by these non-EPA Web sites. Providing references to non-EPA Web sites does not constitute an endorsement by EPA or any of its employees of the sponsors of the site or the information or products presented on the site. Also, be aware that the privacy protection provided on the EPA.gov domain may not be available on non-EPA Web sites.

SITE CONSIDERATIONS

When choosing a location to build your home there are some factors homeowners should consider before purchasing a property. Sites that are close to jobs, schools, shops, and services will reduce the amount of time that homeowners have to spend in their cars, which has environmental as well as social benefits. Lots that are in compact, walkable neighborhoods are also easier to service with transit and infrastructure, such as sewer and water. Visit www.epa.gov/smartgrowth for more information on Smart Growth locations, practices and benefits. Once a property has been selected, there are ways to site your home on the lot that minimize environmental impacts, and also homeowner costs. Below, some site considerations are outlined. Also, visit www.epa.gov/owow/nps/lidnatl.pdf for more information on Low Impact Development.

Location

Homeowners can proactively minimize their home's impact on the natural environment when they choose an appropriate location to build. Buyers can consider the following factors when they seek to purchase the land to construct a new home.

Endangered or Threatened Habitat/Species: Homes should not be sited where endangered species or threatened habitat is located. Habitat issues are particularly important to large home builders and subdivisions, individual homeowners do not need to be as concerned. If you suspect that there is or might be endangered or threatened habitat/species on your property, contact your state and local municipality for more information.

In addition, homes should be sited in a manner that minimizes fragmentation of natural habitat on the property. If the site is wooded, for example, place the home closer to the road, cutting only those trees that are necessary will preserve some of the habitat benefits of the site, and also provide energy-saving shading in the summer months.

Connecticut – CT's Endangered Species (<http://www.ct.gov/dep/cwp/view.asp?a=2702&q=323482>)

Massachusetts – Rare Plants and Animals (<http://www.mass.gov/dep/>)

Maine – Endangered Species Program (http://www.maine.gov/ifw/wildlife/species/endangered_species/)

Rhode Island – RI Natural Heritage Program (www.dem.ri.gov/programs/bpoladm/plandev/heritage/)

Vermont – Wildlife Programs (www.anr.state.vt.us/fw/fwhome/wildlife_nongame.cfm)

Flood lines: Homeowners should avoid constructing their homes at elevations lower than 5 feet above the 100-year flood plain to avoid flooding. To find flood maps

in your area, contact the Federal Emergency Management Agency (FEMA) Map Assistance Center at 1-877-FEMA-MAP to find the local “Map Repository” or order maps from their Web site (www.fema.gov/plan/prevent/fhm/hm_main.shtml).

Infrastructure: When possible, it is recommended that new homes be constructed where connection to local infrastructure (sewer, water, etc.) is possible or already present.

Legacy Landscaping: If building on a lot that has existing trees and shrubbery, talk to the architect and/or construction company about which trees might be kept. This is an easy way to increase property value and shade the home in the summer, improving energy efficiency.

Previous use: When possible, homeowners should consider constructing new homes on previously used land. By leaving virgin lands untouched, impact on the environment is minimized. Home sites with higher development densities often require less transportation and already have local infrastructure.

Transportation: Green builders recommend siting new homes in close proximity to public transportation, jobs, retail, and services. By doing so, residents will reduce their need to travel, and will reduce traffic thus minimizing air pollution.

Wetlands: In general it is recommended that homes not be built within 100 feet of any wetland. Vernal pools, which are wetlands that provide critical breeding habitat for frogs, salamanders and many other species, need even greater protection. These aquatic habitats and their adjacent upland buffers are vital to ecosystem function, biological diversity, and storm water management. If your home is in Connecticut or Massachusetts, contact your local municipality to learn more about wetland statutes in your area. If your home is in Maine, New Hampshire, Rhode Island, or Vermont, check with your state to find out about state-run wetland programs.

Size

Smaller homes consume fewer resources during construction and operation. Constructing a home to suit your needs without adding additional unused rooms will reduce the effect your home has on the environment.

Footprint: Your home’s footprint is the total area of land that it covers. Instead of clearing much of a site, consider siting and constructing your home in a way that minimizes impacts on natural vegetation and allows for wildlife corridors to connect with neighboring properties. Homes with smaller footprints also have less impervious land cover, such as paving and roofing, which reduces overall stormwater runoff.

Energy Efficiency: Smaller homes have less surface area from which they can lose heat to the outside. In smaller homes, the distance heat must travel from the furnace to rooms is minimized and there is less overall space to heat and cool, which reduces heat loss from ducts. To maximize energy efficiency in any size home, see the Heating and Cooling section of this guide for more information.

Solar gain

The orientation of your home can maximize solar gain – whether active or passive. Although two theories on this topic are presented here, proper orientation ultimately depends on geography and the direction of prevailing winds. When making this decision, check with your contractor for a professional opinion. For more information on natural shading see the Landscaping section. For more information on window placement and daylighting see the Lighting section.

North-South: To maximize active solar gain through photovoltaic panels, the long axis of your home should be aligned north-to-south. East and west facing windows should be covered using natural shade and awnings in the summer to reduce unwanted heat gain.

East-West: Some professionals recommend situating the home east-to-west in order to maximize passive solar gain in the winter. However, in the summer months, these southern windows will require significant shading to keep out excess light and heat.

REUSE

EPA urges consumers to “Reduce, Reuse, and Recycle.” When the opportunity exists, it is environmentally preferable for products to be reused, and only disposed once their usable life has concluded. Using the resources here, consumers can learn how to reduce construction and demolition debris, donate their own goods and materials for reuse, as well as where they can find reused goods and materials for use in their homes.

Construction and Demolition

Construction and Demolition (C&D) debris accounts for more than one-third of all residential and commercial solid waste generated in Massachusetts and similar amounts in the other New England states. C&D debris and waste reduction plans are typically set up before construction begins. Please use the resources listed here to find further information on debris reduction for your project. For interior upgrades, let the architect know that reuse is a priority. Many designers can update an interior look using an approach that keeps the fundamental structure intact, minimizing waste. For updates on a shoestring budget, visit your local reuse outlet to consider reusing ‘retro’ fixtures and other materials.

Building Materials Resource Center

Web site: www.bostonbmrc.org

Description: The BMRC takes in residential construction/demolition reusables, including over-runs such as vanities, sinks, and tiles. Materials are available for sale to the general public.

EPA Construction and Demolition

Web site: <http://www.epa.gov/region1/solidwaste/cnd/>

Description: This Web site offers a description of construction and demolition debris as well as state-by-state links to construction and demolition reuse and recycling opportunities.

Lifecycle Building Design

Search Term: Lifecycle building design, designing to reduce waste

Description: Construction and demolition debris can be reduced by designing buildings to take their full lifecycle into consideration. Houses should be designed to anticipate and facilitate future changes and eventual disassembly to reuse and recycle materials. This can dramatically reduce renovation costs and time as well as save resource. Examples of lifecycle building include movable walls, centralized wiring and data cables, and nail-free paneling.

The Forest Products Laboratory – Directory of Wood-Framed Building Deconstruction and Reused Building Materials Companies, 2005

Web site: www.fpl.fs.fed.us/documnts/fplgtr/fpl_gtr150.pdf

Description: This directory lists companies involved in wood-framed building deconstruction and dismantling and reused building materials. It emphasizes companies that use, resell, or remanufacture salvaged wood. Consumers can use the directory to find salvaged wood for architectural items and flooring, construction and framing, or to find deconstruction services.

greenGoat Home-to-Home Program

Web site: www.greengoat.org

Description: This non-profit organization can coordinate donation of gently used building materials, fixtures, and appliances to needy families and deliver a tax benefit to the donating homeowner. They can also provide a list of environmentally responsible building materials and finishes for the construction phase of renovation as well as other resources for all areas of green building. The web site lists project tips within the case studies linked to the greenGoat home page.

FreeCycle

Web site: www.freecycle.org

Description: A grassroots non-profit movement of people who give and get materials, including building materials, for free in their own towns. Each local group is moderated by a local volunteer and membership is free.

Lifecycle Building

Web site: <http://www.lifecyclebuilding.org/index.php>

Description: This site provides case studies and the latest ideas on designing buildings and components and systems for adaptability and disassembly. The project is a partnership of the U.S. EPA, American Institute of Architects and the Building Reuse Association.

MA Department of Environmental Protection (DEP) – Recycling: Construction and Demolition

Web site: <http://www.mass.gov/dep/recycle/reduce/managing.htm>

Description: This site maintained by Massachusetts DEP provides readers with sample construction and demolition waste plans, cost calculations, and bid specifications. The site also gives information on how to prepare for waste reduction, making your construction and demolition project successful, and case studies from local projects. Readers will also find links to additional references and specific information on materials that require special handling like asbestos, pressure treated wood, and wood with lead paint.

The ReCONNstruction Center

Web site: www.reconnstructioncenter.org/index.html

Description: The ReCONNstruction Center salvages building materials for resale

and reuse. They supply low cost building materials to homeowners, landlords, non-profits, schools, building contractors, etc.

Deconstruction

Some building materials reuse center or demolition contractors offer deconstruction, the careful removal of materials for reuse, as an alternative to demolition. Deconstruction has the advantage of maximizing reuse and recycling of unwanted buildings. Deconstruction services can be included in bid specifications, either as a replacement for demolition or to be performed before the building is demolished mechanically. See the resources below to find a service provider in your area.

Donations/Reused Goods and Materials

Reused goods and materials are available throughout New England in local reuse shops or through reuse vendors. The resources listed below will help homeowners find reused materials for their projects as well as offer information on donation locations where homeowners can take their previously used goods and materials for resale.

Architectural Salvage

Search Terms: architectural salvage New England

Description: At architectural salvage centers and antique shops throughout New England, homeowners can find home furnishings such as doors, tiles, flooring, bathroom and light fixtures, furniture, or structural materials to fit their needs, budget, or home style.

Building Materials Reuse Association (BMRA)

Web site: www.ubma.org

Description: BMRA is a non-profit, membership organization that represents companies and organizations involved in the acquisition and/or redistribution of used building materials. From their Web site, readers can find links to other reuse directories as well as information about BMRA.

The Forest Products Laboratory – Directory of Wood-Framed Building Deconstruction and Reused Building Materials Companies, 2005

Web site: www.fpl.fs.fed.us/documnts/fplgtr/fpl_gtr150.pdf

Description: This directory lists companies involved in wood-framed building deconstruction and dismantling and reused building materials. It emphasizes companies that use, resell, or remanufacture salvaged wood. Consumers can use the directory to find salvaged wood for architectural items and flooring, construction and framing, or to find deconstruction services.

Northeast Recycling Council (NERC) – End Users, Manufacturers, and Suppliers

Web site: http://www.nerc.org/documents/market_resources_recycling_industries_2008.pdf

Description: This Web site lists end users, manufacturers, and suppliers of recycled and used goods. Readers can use the information found here to acquire reused construction or renovation materials.

ReCycle North

Web site: <http://recyclenorth.org>

Description: Consumers can learn more about the services offered by ReCycle North of Burlington, VT. This organization offers job skill training programs, poverty relief through household donations, a home goods reuse store, a building materials center, deconstruction services, and in-home repairs.

ReDo

Web site: <http://www.redo.org/SearchRedo.aspx>

Description: This directory lists reuse centers in each of the US states as well as DC, Guam, Puerto Rico, and the US Virgin Islands.

ReNew Building Material & Salvage, Inc

Web site: www.renewsalvage.org

Description: Located in Brattleboro, VT, this non-profit organization accepts new, used, and salvage building materials, appliances, and lumber. Donations are tax-deductible. ReNew also offers deconstruction services.

Restore Home Improvement Center

Web site: www.restoreonline.org

Description: Consumers can learn more about the services offered by the ReStore Home Improvement Center, a non-profit organization in Springfield, MA. This organization offers deconstruction services and a retail store for low-cost surplus and used building materials. Their links page lists similar operations throughout New England and a guide to C&D recycling markets for western Massachusetts.

Reuse Centers

Search Terms: reuse center New England

Description: Materials found at reuse centers are often over-stock from contractors and other home improvement stores or are refurbished materials from deconstructed area homes. Check your local directory or the mentioned web directories for information on reuse centers in your area.

EXTERIOR BUILDING MATERIALS

The exterior of a home is in direct contact with the natural world – from the earth beneath its foundation to the sun and precipitation that strike its roof and walls. When looking to minimize a home’s impact on the environment, one should give consideration to the materials used to construct its exterior and guard it from the elements. The resources cited below give information about environmentally-preferred materials and techniques for the construction and renovation of a home’s exterior. Many of these materials can be found in reuse centers throughout New England. Please visit the **Reuse** section of this guide for more information on salvaged materials.

Color

The exterior color of a house can affect the home’s overall heat retention. Using a lighter color with a higher albedo, or the ability to reflect light, reduces the heat-island effect, a phenomenon where homes and other buildings absorb the sun’s light leading to an “island” of increased heat. Although this is more of an issue in warm climates, it can minimize the energy needed to cool a home during the heat of the summer. For information about eco-friendly paints and stains, please see the **Coatings** section.

Decking

Untreated natural wood can rot and become infested with pests, but pressure-treated lumber can be harmful to the environment and your family. Certain species of wood are naturally rot-resistant, such as mahogany and cedar. Cost effective alternatives to wood exist and should be considered for all outdoor wood uses. Use the resources below to find decking material for your home.

Chromated Copper Arsenic (CCA) treated lumber is used where pressure treating and pest management is necessary. It has been banned from use in most residential settings since December 31, 2003. By choosing species like Forest Stewardship Council (FSC) certified redwood and cedar that are naturally durable and pest resistant, or non-wood alternatives, you’ll minimize the need for chemically treated lumber. More information on CCA lumber is provided in this section.

Composite Wood

Search Terms: composite wood, engineered wood, composite lumber, engineered lumber

Description: Ideal for decking and railings, composite wood looks like real wood. Made out of reclaimed sawdust and plastic, these products are durable, can withstand New England climates, and are environmentally responsible. Although some products are made with problematic chemicals such as formaldehyde, a carcinogen,

other non-toxic options are available. The plastic stabilizes the boards while sawdust protects the plastic from UV radiation. It is guaranteed not to warp, crack, or splinter and is pest resistant.

2007 Composite Panels Buyers & Specifiers Guide

Web site: <http://www.pbmdf.com/Index.asp?bid=1084>

Description: This resource describes various types of composite wood, their uses, and how they are made. The council lists composite products that are certified as Environmentally Preferable Products (EPP). Sales information is listed at the end as well. At the Council's homepage, readers can also find a members list, council publications, and other information.

EPA Pesticides – Chromated Copper Arsenate (CCA)

Web site: www.epa.gov/oppad001/reregistration/cca/index.htm

Description: From this page, consumers can find general information about pressure treated wood, some alternatives to CCA, the risks of using treated products, and consumer safety reports. Because CCA treated wood is treated with inorganic arsenic, a human toxin, it is important to only use it where pesticide protection is necessary.

Healthy Buildings Network – A Guide to Plastic Lumber

Web site: www.healthybuilding.net/pdf/gtpl/guide_to_plastic_lumber.pdf

Description: This document ranks plastic lumber from “Very Environmentally Preferable” to “Not Environmentally Preferable: AVOID.” It also uses rating criteria based on materials used, recycled content, end-of-life recyclability, and structural lumber to evaluate different types of plastic lumber. Readers should consult this guide before using plastic lumber in or around their home.

Foundation

Before pouring a foundation, homeowners can explore the use of eco-friendly options, such as concrete with recycled flyash content. They can also minimize health concerns by ensuring that their foundation is laid with drainage and radon-resistant features. Talk to your contractor about reusable forms, another way to conserve waste.

Energy and Environmental Building Association (EEBA) – Foundations

Web site: www.eeba.org/resources/consumer/new/foundations.htm

Description: The links promoted by EEBA give general foundation information, tips on how to avoid mold and moisture, and insulation technologies.

Flyash

The use of flyash, a coal-fired power plant waste product, in concrete diverts waste from disposal while saving virgin materials from the production lines. Using 15 to 50% flyash in cement can increase the strength, water resistance, and durability of the concrete. For more information on the use of flyash in concrete, visit EPA's Coal Combustion Products Partnership (C2P2) Web site (www.epa.gov/epaoswer/osw/conserves/c2p2).

A Sourcebook for Green and Sustainable Building – Flyash Concrete

Web site: www.greenbuilder.com/sourcebook/Flyash.html

Description: This Web site describes the history and uses of flyash—from the origin of flyash to how it is beneficial to the environment and how the public feels about its use. At the bottom of the page, contractors and suppliers from throughout the country are listed.

Drainage

Proper drainage of home foundations is vital to the prevention of mold, mildew, rot, and foundation decay. To achieve effective rainwater drainage, an integrated moisture control strategy is required, including management of water drainage from the roof, exterior walls, and foundation. Good details on how to do this in various climates and construction types are available in the EEBA guides (www.eeba.org/resources). In addition, the EPA ENERGY STAR Indoor Air Package specifications include comprehensive guidance for water management and are available on the internet at:

<http://www.energystar.gov> KEY WORD= Indoor Air Package Specifications

Many contractors use damp proofing techniques to reduce moisture from entering the home. Damp proofing can be effective when applied as part of an integrated moisture control strategy. Furthermore, in very wet environments, waterproofing may be required. However, waterproofing is considered unnecessary and too expensive for most home sites. Refer to the Indoor Air section of this guide for more information on mold prevention.

Rubber or cement-based Damp Proofing

Search Terms: damp proofing

Description: These products protect your foundations from water invasion by applying negative hydrostatic pressure to the outer foundation walls. Because they are made from rubber or cement, they do not leach harmful chemicals into the soil and ground water.

Radon Resistance

In New England, radon resistance is an important consideration during the foundation phase of a construction project. Please see the **Indoor Air** section of this guide for more information.

Roofing

There are many environmental issues to consider when replacing or constructing a new roof including: energy efficiency, heat island reduction, stormwater runoff, use of recycled content materials, mold and moisture prevention, and durability. Use the information and resources below to choose the right materials for your home.

Energy and Environmental Building Association (EEBA) - Roofs

Web site: www.eeba.org/resources/professional/new/roofs.htm

Description: EEBA offers links to information about roof construction, insulation, and the use of radiant barriers to reduce heat loss and air conditioning loads.

Environmental Design + Construction – Recycled Roofing

Web site: www.edcmag.com

Description: This article discusses the various types of recycled roofing offered to the consumer. Although lacking sales and contractor information, it gives good background information on the various recycled roofing options such as those made from recycled plastic, rubber, and fiber.

Clay

Search Terms: clay roofing, clay tiles

Description: Clay tiles are a good choice in cold climates because they do not absorb water easily. Clay is also durable, and fire-resistant, but it is heavy. Rafters may need reinforcement before the tiles can be installed.

Concrete Tiles

Search Terms: concrete roof tiles, concrete roofing

Description: Concrete roof tiles get harder with age and often require little maintenance. They are durable, fire-resistant, and pose no human health effects. The tiles are heavy and may require rafter reinforcement.

Green Roof

Search Terms: green roof, vegetated roof, living roof

Description: Ideal in any climate, green, or vegetated, roofs bring nature from the ground to the rooftop. They retain storm water, reduce heat island effect, and mitigate air pollution. Green roofs can be heavy because of their components (insulation, soil, vegetation, etc.) and require structural reinforcements to support the

increased load. Green roofs have been used on residential buildings in Germany and other European countries for over 5 decades.

Metal

Search Terms: metal roofing, metal roof tiles

Description: Metal roofing works well in cold climates because snow tends to slide off reducing the development of ice dams. These roofs cannot hold much heat and therefore radiate less into the attic space. They are fireproof, lightweight, and long-lasting.

Photovoltaic (PV) Shingles

Search Terms: photovoltaic shingles

Description: These shingles can be used in combination with slate or asphalt shingles to bring energy generation capability to roofs with access to sunlight. Massachusetts Audubon Society's Boston Nature Center in Boston, successfully incorporated PV shingles into their roofing system. More information about the building can be found at http://www.massaudubon.org/Nature_Connection/Sanctuaries/Boston/green/. For more information on photovoltaics see the **Energy Resources** section.

Recycled Plastic/Rubber

Search Terms: recycled plastic roofing, recycled plastic roof tiles

Description: Plastic or rubber shingles can be made from recycled tires or plastic and they are recyclable at the end of their life. Long-term ultra violet (UV) effects are unknown, but these tiles are sound- and hail-proof.

Recycled Asphalt Shingles

Search Terms: recycled asphalt roof shingles, recycled asphalt roofing

Description: By using recycled materials in their production, these shingles reduce the use of raw materials and keep used shingles from entering the waste stream. They have similar UV and durability properties to conventional asphalt shingles.

Slate

Search Terms: slate roofing, slate roof tiles New England

Description: Slate roofs are durable and fire-resistant, and the tiles can be reused or reclaimed. This material is heavy and may require rafter reinforcement.

Siding Options

The materials used on the exterior of the home—wood, siding, aluminum, brick, etc.—can all have an effect on the environment. The information and resources below are provided to help sort through the options you have for your home.

Certified Wood

For the homeowner that does not want to use reclaimed wood and wants the look and feel of real wood, certified wood proves an option. Certifying organizations, such as the Forest Stewardship Council and others, certify companies and forest managers for investing in environmentally sound management and harvesting practices. This wood is available in New England.

Chromated Copper Arsenic (CCA)-treated lumber is used where pressure treating and pest management is necessary. It has been banned from use in most residential settings since December 31, 2003. By choosing species like Forest Stewardship Council (FSC)-certified Redwood and Cedar that are naturally durable and pest resistant, or non-wood alternatives, you'll minimize the need for chemically treated lumber. More information on CCA lumber is provided in this section.

Forest Stewardship Council (FSC) – Certificate Holder Database

Web site: www.fscus.org/certified_companies/?num=20

Description: The chain of custody (COC) database on this site lists processing and trade companies that handle, label, and advertise certified products and includes New England sources.

Forest Stewardship Council (FSC) – Designing and Building with FSC

Web site: www.fscus.org/green_building/designing_building.php

Description: This guide was designed by FSC in partnership with Forest Products Solutions for architects and other building professionals. It offers readers a single source to learn about, specify, build, and account for the use of FSC-certified products. It is available for download at the Web site listed here.

Rainforest Alliance – SmartWood Program

Web site: www.rainforest-alliance.org/programs/forestry/

Description: The SmartWood Program is accredited by the Forest Stewardship Council, and was established in 1993. From their Web site, consumers can find certified products and companies around the globe as well as certified reused, reclaimed, recycled, and salvaged wood products.

EPA Pesticides – Chromated Copper Arsenate (CCA)

Web site: www.epa.gov/oppad001/reregistration/cca/index.htm

Description: From this page, consumers can find general information about pressure treated wood, some alternatives to CCA, the risks of using treated products, and consumer safety reports. Because CCA-treated wood is treated with inorganic arsenic, a human toxin, it is important to only use it where pesticide protection is necessary.

Wood Alternatives

There are many wood siding alternatives for the home. The information and resources below have been provided to help you make the right siding choices for your home.

Brick and Stone

Search Terms: brick exteriors, brick siding, stone exteriors

Description: Brick and stone exteriors offer fire resistance and can be found locally in the northeast thus reducing environmental impacts of transportation. Molded cementitious stone, a less expensive alternative, offers similar benefits without the need for quarrying natural stone. See the Reuse section of this guide for information on reclaimed stone.

Fiber Cement Siding

Search Terms: fiber cement siding

Description: Fiber cement siding is made from cement, sand, cellulose, silica, and other additives. The finished product is durable, flame, weather, pest, and rot resistant. It can be painted any color, but can be heavy to install.

Metal Siding

Search Terms: metal siding, aluminum siding, steel siding

Description: Steel or aluminum siding offer increased energy efficiency, fire resistance, and protection in colder climates.

Papercrete

Search Terms: papercrete, fibrous cement

Description: Made with Portland cement, sand, and recycled paper or cardboard, this substance looks like stucco or clapboard wood siding. It won't twist, warp, burn, or melt and holds paint well and resists pests. It can be found as siding planks or in brick form.

Stucco

Search Terms: stucco, stucco exteriors

Description: Genuine stucco is effective in wet areas – the cement mixture absorbs water, but it dries easily leaving the main structure dry. Stucco needs a heavy and solid support structure to give it strength.

INTERIOR BUILDING MATERIALS

While a home's exterior materials interact directly with the natural environment, interior materials are in direct contact with home dwellers. The resources below explore sources and alternatives to conventional interior building materials. Many of these materials can be found in reuse centers throughout New England. Please visit the Reuse section of this guide for more information on salvaged materials.

Floors

For those who enjoy the look of hardwood, eco-friendly options include cork and bamboo—two fast growing materials that can be made to look like traditional hardwood floors. Reclaimed wood is another option available in New England. Recycled glass, rubber, natural linoleum, and stone are materials that homeowners can also look into. Use the following links to find the kind of flooring that is right for you.

Carpet

For more information on carpets, please see **Carpet** in the **Furnishings** section of this guide.

Hardwood

Hardwood has been the leader in flooring for centuries because of its look, feel, and durability. While the use of wood flooring is still common, it has come under scrutiny because of harvesting practices and deforestation. There are many wood or wood-like options available for eco-conscious homeowners. Use the information below to learn more.

Cork

Search Terms: cork floors

Description: Harvested from the bark of a cork oak tree, cork floors are naturally insulative and resist mold, mildew, rot, and insects. Typically, cork floors have a vinyl or water-based coating that makes them easy to clean. They are also often sold in tile form so that homeowners can install them easily.

Bamboo

Search Terms: bamboo floors

Description: Bamboo floors look almost exactly like traditional hardwood, yet are harder and more durable. Bamboo is a fast growing grass that is golden in color but also come in other shades. These floors are often sold as pre-finished planks and can be installed like conventional hardwood floors. Some bamboo flooring is manufactured with adhesives that contain formaldehyde resin, which can off-gas and cause indoor air quality problems. If you are considering bamboo flooring, ask the manufacturer about Volatile Organic Compounds (VOCs) and formaldehyde emissions.

Forest Stewardship Council (FSC) – Certificate Holder Database

Web site: www.fscus.org/certified_companies/?num=20

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Rainforest Alliance – SmartWood Program

Web site: www.rainforest-alliance.org/programs/forestry/smartwood/

Description: The SmartWood Program is accredited by the Forest Stewardship Council, and was established in 1993. From their Web site, consumers can find certified products and companies around the globe as well as certified reused, reclaimed, recycled, and salvaged wood products.

Reclaimed Wood

Search Terms: reclaimed wood, reused wood

Description: In New England, there are a number of local resale shops where consumers can purchase vintage and reclaimed wood for flooring and other housing needs. See the **Reuse** section of this guide for more information on reclaimed and reused wood.

Natural Linoleum

Search terms: natural linoleum, marmoleum

Description: Made with natural raw materials such as linseed oil, pine resins, and cork, natural linoleum is durable and environmentally benign throughout its life –little to no scraps are left from production, it has a long life-span, and theoretically it could be composted after use.

Green Resource Center – Natural Linoleum

Web site: <http://www.greenresourcecenter.org/MaterialSheetsWord/NaturalLinoleum.pdf>

Description: Although written for citizens of the state of California, this Web site gives consumers background information about using natural linoleum in the home.

Recycled Glass

Search Terms: recycled glass flooring

Description: Recycled glass can be found in the form of tiles, mosaics, and terrazzo. Usually made from 100% post-consumer waste, recycled glass surfaces save glass from going to disposal.

Recycled Rubber

Search Terms: residential recycled rubber floors, residential rubber floors, recycled tire flooring

Description: Made from recycled tire rubber, these floors are extremely durable, fire, weather, and sound proof. The tiles or sheets are produced through low-energy and emissions procedures making them a green alternative to traditional rubber floors.

Stone

Search Terms: eco-friendly stone floors, stone flooring, reclaimed stone

Description: Natural stone can be extremely durable and environmentally friendly. Tile options include limestone, slate, and sandstone. When looking into stone flooring, ask about sealants. Many stone products need to be sealed, and the chemicals can be detrimental to indoor air quality. (see section on Indoor Air Quality) Reclaimed stone floors can be found locally and are another environmentally preferable flooring option. See the **Reuse** section for information on reclaimed stone.

COATINGS

Coatings are used throughout the house—paints, stains, varnishes, wallpapers, etc. Using the resources below, you can find environmentally-preferable coatings for your home.

Paints and Primers

Paints and primers contain volatile organic compounds (VOCs)—some of which can be toxic, are flammable, and may contain heavy metals that are toxic to humans, animals, and the environment. When using these products, it is important for handlers to always read the labels and conform to safety and disposal guidelines. The tools/links listed below provide both the environmental concerns and environmentally-friendly options for both inside and outside your home.

Paint Consumers should be aware of the following:

- **Reuse** Cans of reused paints and primers can sometimes be found at local reuse centers. See the **Reuse** section of this guide for more information on reused paints in your area.
- **Quantities** Your paint retailer can help calculate the amount of paint necessary for a project. Leftovers should be disposed of properly, and occasionally reuse centers will accept leftover paints.

Latex/Water-based Paint

Description: Latex and water-based paints have a water base while alkyd paints have an oil base. In general, water-based paints produce less VOCs than solvent-based paints (alkyd), but may produce them over a longer period of time. Note that latex paints are not made with natural rubber – the term “latex” is a misnomer and therefore will not aggravate consumers with latex allergies. Latex paint is readily available; visit your local hardware store or anywhere where paint can be purchased for this product.

Lead-Based Paint

Lead is a highly toxic metal that was used for many years in products found in and around the home—including paint. Exposure to deteriorating lead-based paint, lead-contaminated dust (particularly from renovations), and lead-contaminated residential soil may cause a range of health effects for young children such as behavioral problems, learning disabilities, seizures, and death. Children under 6 and pregnant women are especially susceptible to lead risks. If you're planning to renovate your pre-1978 home, take necessary precautions before you or your contractor begin working. For more information on lead-safe renovation, please visit: www.epa.gov/region1/eco/ne_lead/keep_it_clean.html#lrt.

If you're planning to buy a pre-1978 home, be aware that the seller must disclose to you all information he/she has about the property related to lead-based paint, so as a buyer, you are aware of your lead risks prior to sale. As a buyer, you also will have an opportunity to pay for a risk assessor or lead inspector to assess/inspect the property for lead risks prior to your buying.

For more information on the Federal Lead Disclosure Rule, please visit www.epa.gov/region1/enforcement/leadpaint/index.html.

Paint Calculators

Search Terms: paint calculator

Description: Because paint can't always be disposed of easily, it is better to not over-buy. Before you purchase paint for a home project, get a paint quantity estimate by referring to an online paint calculator or discussing your needs with a painting professional at your local paint shop – this will not only save you from storing unused paints, but it will save money as well.

Paint Disposal

Web site: www.earth911.org

Description: If you have excess paint, Earth 911 can help you find a disposal location. You can search by zip code to find organizations that collect paints and other hazardous wastes in your area.

Volatile Organic Compounds (VOC)

VOCs are organic (carbon containing) chemicals that evaporate readily at room temperature. Some associate them with strong odors, but they may not have an odor. Regardless, exposure to some VOCs can be harmful to human health and may cause eye, nose, and throat irritation, headaches, and nausea. Chronic exposure to these chemicals has been linked to cancer, liver and kidney damage, and can harm the central nervous system (Source: www.epa.gov/iaq/homes/hip-painting.html). By making informed coating choices, consumers can avoid or reduce their exposure to VOCs.

Consumers can avoid or reduce their exposure to VOCs by using good practices while applying coatings to interior spaces. Good practices include:

- Ventilation of indoor spaces to remove any VOCs to the outside;
- Application of coatings before installation of materials that may absorb or trap the VOCs and emit them at a later time (such as carpet, padding, fabric wall covering, acoustic tiles, and upholstered furniture);
- Reading and following all instructions to reduce the risk of exposure to chemicals;
- Consideration of when people (workers or occupants) will be in the home; and
- Evaluation of the coating that you choose.

For more information see **Healthy Indoor Painting Practices (EPA and Consumer Product Safety Council, 2000)** at <http://www.cpsc.gov/CPSPUB/PUBS/456.pdf> and **Painting and IAQ – Addressing Indoor Environmental Concerns During Remodeling** (<http://www.epa.gov/iaq/homes/hip-front.html>).

The National Paint and Coatings Association

Web site: http://www.paint.org/con_info/brochures.cfm

Description: This non-profit organization works with law makers and paint manufacturers. For consumers, their Web site has painting information—FAQ sheets, how-to brochures, information on latex, leftover, and lead paints.

Wallpaper

Traditional wallpaper is often made with synthetic non-permeable substances. Alternatives made from natural fibers such as wood pulp, cotton, silk, etc. are available for purchase and may reduce health and environmental concerns. Consumers can also look for low-VOC wallpaper adhesives to further enhance indoor air quality. Some wallpapers have been linked to mold issues. For more information on wallpaper and mold, see the Indoor Environment section.

Dextrine/Starch-based Wallpaper Adhesives

Search Terms: starch based adhesives

Description: These adhesives are made from roots of tubers such as maize, potatoes, wheat, rice, and tapioca. They are often cold or hot water soluble. Although used for envelope sealing, they can also be used for hanging wallpaper.

Natural Fiber Wallpaper

Search Terms: natural fiber wallpaper, natural fiber wallcoverings

Description: Natural fiber wall coverings are often made from wood pulp and other recycled and reclaimed materials such as gypsum, latex, and cellulose or cotton and silk. These wallpapers/wallcoverings pose no health threats and are environmentally friendly.

HEATING AND COOLING

According to the US Department of Energy, heating and cooling account for about 56% of the energy use in a typical U.S. home, making it the largest energy expense for most homes. Updating and periodic maintenance of heating and cooling equipment can save homeowners money and energy. Additionally, appropriate insulation, windows, and thermostats are other methods to decrease your energy consumption. For more information regarding alternative energy sources, please see the Energy Resources section.

US Department of Energy – Energy Savers

Web site: www.eere.energy.gov/consumer/tips/heating_cooling.html

Description: This site describes the heating and cooling components (ducts, heat pumps, solar heating, fireplaces, gas and oil heating systems, air conditioners, and thermostats) and has links to tips that will improve the efficiency of each element.

US Department of Energy – Your Home’s Energy Use

Web site: <http://www.energystar.gov> KEY WORD=Improve Your Home’s Energy Use

Description: The purpose of this Web site is to allow homeowners to determine which part of their home uses the most energy. This Web site also offers suggestions as to how you can improve the efficiency of different aspects of your home.

Equipment

Well-maintained thermostats, water heaters, and HVAC systems are all vital to the energy-efficiency of a home. Below, each is outlined with resources homeowners can use to upgrade or maintain their equipment for long-lasting performance.

Heating, Ventilating, and Air Conditioning (HVAC) Systems

In cold regions, like New England, heating your home can account for up to two-thirds of your utility bill. Efficient HVAC upgrades are often possible, but can be costly. HVAC systems also have a very important impact on indoor environmental quality and are necessary to maintain fresh air and exhaust indoor pollutants. Using the HVAC system resources described here, homeowners can choose the appropriate system for their home and family.

Some tips to remember when choosing an HVAC System:

- Bigger is not always better;
- Locating your furnace in the center of your home reduces duct runs which improves efficiency;
- Efficient ventilation systems reduce moisture buildup while allowing fresh-air to enter the home.

Energy and Environmental Building Association (EEBA) – General HVAC**Web site:** www.eeba.org/resources/consumer/existing/hvac_general.htm**Description:** The links promoted by EEBA give information about energy-efficient home heating and cooling strategies, maintenance checklists, system selection, and more.**ENERGY STAR – Duct Sealing****Web site:** <http://www.energystar.gov> KEY WORD=Duct Sealing**Description:** Duct sealing and maintenance is as important as maintenance of the furnace itself. Without well-sealed ducts and maintained ducts, heated and cooled air cannot make it from the furnace into the rooms of the house. At this Web site, readers can find fact sheets and other important duct information.**PATH – Energy Efficient Rehab Advisor (HVAC Systems)****Web site:** <http://rehabadvisor.pathnet.org/sp.asp?id=9731>**Description:** This Web site, maintained by A Public-Private Partnership for Advancing Housing Technology (PATH), provides links to resources and home energy-saving tips. PATH focuses on all aspects of green housing—browse the entire page for information that goes beyond HVAC systems.**Heating**

Heating homes during New England winters can be quite costly. Most homes are equipped with gas or oil furnaces or boilers that generate heat for the entire home by burning fuel. Some homes have electric heat, which produces heat directly from electricity, but can be inefficient and expensive. Wood is a reliable source of heat and is less expensive than oil and gas, but can exhaust unsafe emissions. To reduce cost and conserve resources, homeowners should consider elements before choosing a heater for their home.

- **Size** A system that is too large will only work at peak efficiency part of the time. Choose a properly sized furnace/boiler that will effectively heat your home without wasting energy and money by having your contractor perform a Manual “J” heat loss analysis.
- **Fuel** There are several conventional and alternative fuel options for homeowners (see Energy Resources section). If possible, choose a renewable fuel option like geothermal energy, or wood pellets to heat your home.
- **Efficiency** Heating systems that are more efficient will save both money and environmental resources.
- **Durability** Choose a heating system with a long life-span.

ENERGY STAR – Heat and Cool Smartly

Web site: www.energystar.gov/index.cfm?c=heat_cool.pr_hvac

Description: Readers will find information about HVAC systems. By choosing the appropriate link on the left, consumers can find further information about particular heating and cooling systems.

US DOE – Energy Efficient Gas Heating for Homes

Web site: http://www1.eere.energy.gov/consumer/tips/heating_cooling.html

Description: This fact sheet gives consumers information on adding new gas heating in their home. The information is applicable to retrofits and new construction. This Web site discusses the different types of gas heat, their benefits, as well as maintenance issues, installation, and cost issues.

US DOE – Heat Pump Fact Sheets

Web site: www.eere.energy.gov/consumer/tips/home_energy.html

Description: Consumers will find links to fact sheets with information about heat pumps. By choosing particular fact sheets, readers will find a wealth of information about heat pumps for the home.

US DOE – Information Resources: Comparing Heating Fuels

Web site: http://apps1.eere.energy.gov/consumer/your_home/space_heating_cooling/index.cfm/mytopic=12330?print

Description: There is a vast difference among traditional heating fuels such as electricity, gas, kerosene, propane, oil, and wood. At this DOE Web site, readers can find information about each source, its efficiency (BTU value), and its heating value.

Ventilating

Ventilation is extremely important to achieve good indoor air quality. Ventilation systems bring in and circulate fresh air and exhaust stale or polluted air, reducing moisture buildup which can lead to mold (see the **Indoor Air** section) and removing odors or pollutants generated from indoor sources. Most older homes have no ventilation system installed and rely on “natural ventilation” (i.e. open windows and doors) and/or air infiltration through unintended leaks in the exterior shell of the home.

Homeowners should discuss with their contractors or HVAC professionals how the construction project will be in compliance with professional ventilation standards for your home. The ASHRAE 62.2-2004 standard can be found at <http://resourcecenter.ashrae.org/store/ashrae/newstore.cgi?itemid=23117&view=item&page=1&loginid=22212778&priority=none&words=ventilation%2>

062.2%20standard&method=and& and is available for purchase. It states that Ventilation and Acceptable Indoor Air Quality in Low-Rise Residential Buildings (including homes) requires controlled mechanical ventilation, since infiltration and natural ventilation are unreliable and inconsistent methods for achieving adequate fresh air ventilation. The most basic approach to meeting the ventilation requirement is through continuous, low-level operation of bathroom and/or kitchen fans—referred to as “exhaust only” ventilation. If designed and installed properly, exhaust only ventilation can be very effective in the New England climate. “Balanced ventilation” is more advanced and supplies fresh air through intakes while it exhausts humid, polluted air from kitchen and bathroom fans. “Central ventilation,” the most advanced form of ventilation, exhausts old air while taking in fresh outdoor air through a balanced central ventilation system, either integrated into the HVAC system or through an independently ducted standalone ventilation system. Some central ventilation systems also include heat recovery or energy recovery, which can save energy while supplying a continuous flow of fresh outside air.

Air Conditioning

Air conditioning does more than just cool the air. It also removes moisture and humidity from the inside air. Rocky Mountain Institute estimates that during summer months, 50% of all energy used in the US is for air conditioning purposes. There are three types of conventional air conditioners: room units, central air conditioners, and electric heat pumps.

During construction or renovation, homeowners should consider incorporating the following to reduce the need for air conditioners in the home:

- Natural shade (see the **Landscaping** section);
- Natural ventilation;
- Thermal mass; and
- Fans.

But, if air conditioning is needed, there are some energy efficient options for you to choose from:

ENERGY STAR – Central Air Conditioning

Web site: www.energystar.gov/index.cfm?c=cac.pr_central_ac

Description: ENERGY STAR certified central air conditioning units are 25% more efficient than conventional products. At this site, readers will find links to the Consortium of Energy Efficiency (CEE) and American Refrigeration Institute’s database where ENERGY STAR certified central AC units are listed.

ENERGY STAR – Room Air Conditioning

Web site: www.energystar.gov/index.cfm?c=roomac.pr_room_ac

Description: This Web site discusses energy efficient room air conditioners and their estimated annual savings when compared to conventional units. By using the “Find a Store” link on the right consumers will be able to locate these air conditioners in their area. ENERGY STAR also provides a link to tools that ensure you are using an AC unit that is properly sized (http://www.energystar.gov/index.cfm?c=roomac.pr_properly_sized) .

Thermostats

By regulating your thermostat closely or installing programmable setting thermostats, homeowners can drastically reduce their heating and cooling costs with little effort. Thermostats come in many varieties, but consumers should avoid purchasing those containing mercury because of the chemical’s toxicity to the environment and human health. As many states are banning the sale of mercury products, mercury-free alternatives have become available and readers should consider these products when planning to purchase a new thermostat for their home.

ENERGY STAR – Programmable Thermostats

Web site: www.energystar.gov/index.cfm?c=thermostats.pr_thermostats

Description: Programmable thermostats and savings associated with these thermostats are described. Using the “Find a Store” link to the right, consumers can find out where they can purchase ENERGY STAR products in their area.

US Department of Energy – Information Resources

Web site: <http://www1.eere.energy.gov/consumer/tips/thermostats.html>

Description: This site starts with the basics and discusses general thermostat operation, automatic thermostat operation, and programmable thermostats. Consumers can use this site to learn more about the various types of programmable thermostats—such as electromechanical, digital, hybrid, occupancy, and light sensing—and how to choose the right one for their home.

Zoning

Search Terms: thermostat zoning, home zoning

Description: By zoning your home, you can group rooms that have similar heating and cooling needs and link each group to a single thermostat. If used in conjunction with programmable thermostats, a zoning system will automatically adjust room temperatures based upon occupancy and activity levels.

Water Heaters

Water heating accounts for up to 13% of your utility bill and is the third largest energy expense in the home after 1) heating and cooling (44%) and 2) lighting, cooking, and other appliances (33%). Homeowners can reduce their water heating bills by using these four easy tips:

- Use less hot water;
- Turn down the Water Heater Thermostat;
- Insulate your Water Heater, hot, and cold water pipes;
- Upgrade your Water Heater (see below),
- Install a programmable timer on your Water Heater.

Also, by installing low-flow shower heads and faucets (see the **Plumbing** section), consumers can minimize hot water usage in the home.

Energy and Environmental Building Association (EEBA) – Water Heating

Web site: www.eeba.org/resources/consumer/new/water_heating.htm

Description: The links promoted by EEBA give information about energy-efficient home water heating strategies and high-performance home water heating.

Heat Pump Water Heaters

Search Terms: heat pump water heaters

Description: When electricity is the only source of energy, heat pumps are the most economical water heating system. They pump heat from air into water and often have backup systems for when demand outruns supply. Pumps use one-third to one-half as much electricity as a conventional electric water heater.

Indirect Fired Hot Water Heater

Search Terms: combined water heaters, combined water and heat

Description: In indirect hot water and heat systems, water is heated as a separate zone off of the furnace or boiler. There is no burner on the water heater, and the system reuses heat waste from the furnace or boiler to heat water for tap use. The hot water is stored in an insulated storage tank and always ready for use—keeping the boiler from having to turn on frequently.

Programmable Timers for Water Heaters

Search Term: water heater timers

Description: If you have an electric water heater, you can save an additional of energy by installing a timer that turns it off at night when you don't use hot water and/or during your utility's peak demand times.

Solar Hot Water

Search Terms: solar hot water, solar water heating

Description: Solar water heaters use the sun's energy to heat water by passing water through solar collectors. The hot water is stored in a tank similar to that of conventional systems. Solar water heaters can be used in all climates, but back-up systems are often recommended, if not required by your building code.

Storage Water Heaters

Search Terms: storage water heaters

Description: Storage water heaters have a ready supply of hot water at all times, but when hot water is not being used heat is lost through the walls of the tank. These losses can account for 10-20% of household annual water heating costs. More efficient models are available, such as those that have higher levels of insulation around the tank to reduce standby losses.

Tankless Water Heaters

Search Terms: tankless water heaters

Description: These water heaters heat water only when a hot faucet is open, thus reducing losses during stand-by. Tankless water heaters reduce energy consumption by 20-30% and often have longer life-spans than storage water heater models.

US Department of Energy – Water Heating

Web site: www.eere.energy.gov/consumer/your_home/water_heating

Description: Here, consumers can find additional tips on how to reduce hot water usage in the home and save money on water heating bills as well as learn about solar water heaters. DOE provides a link to additional information on residential water heating.

Insulation

Insulation lessens heat transfer through walls, ceilings, and floors. The “R-value” associated with insulation refers to its effectiveness in blocking the transfer of heat—the higher the R-value, the more effective the insulation. Traditionally, homeowners have used conventional fiberglass as insulation, but more environmentally-friendly options are now available. Use the resources below to determine what type of insulation and R-value is right for your home and your construction/renovation project.

Cellulose Insulation

Search Terms: cellulose insulation

Description: Cellulose insulation is made from recycled newspapers and is often treated with borate for added fire and pest proofing. It can be applied as insulation

almost anywhere in the home, but it shouldn't be installed in wet months and should be tested for moisture before installing drywall.

Cotton

Search Terms: cotton insulation

Description: Cotton insulation is typically made from recycled cotton and other natural fibers that would otherwise be disposed. It is often treated for fire-resistance, but lacks toxic and carcinogenic chemicals found in conventional insulation. Cotton batts are similar in energy efficiency and ease of installation to traditional fiberglass insulation.

Recycled Content, Formaldehyde-free Fiberglass

Search Terms: recycled fiberglass insulation

Description: This fiberglass insulation consists of recycled materials. While it provides similar insulation properties to conventional fiberglass, the recycled content version can add LEED Energy & Atmosphere or Materials & Resources credits to your construction project.

Spray-foam

Search Terms: spray-foam insulation

Description: This insulation is growing in popularity because of its ability to block all creases and crevices during expansion, but, it should be installed by a professional. Be sure to avoid CFC (chlorofluorocarbon) and HCFC (hydrochlorofluorocarbon) versions because of their ozone depleting characteristics.

US Department of Energy's Insulation Fact Sheet

Web site: www.ornl.gov/sci/roofs+walls/insulation/ins_01.html

Description: This Web site discusses insulation basics. Under the link "R-value Recommendations" (www.ornl.gov/sci/roofs+walls/insulation/ins_16.html), homeowners can find out what level of insulation is necessary in their home based upon their zip code and furnace type.

US EPA Comprehensive Procurement Guidelines – Building Insulation

Web site: www.epa.gov/cpg/products/building.htm

Description: At this EPA site, readers can find information on environmentally responsible insulation as well as manufacturers and suppliers. Use these resources to make insulation choices for your home.

Windows

In New England, windows not only add to the aesthetics of a home, they also account for heat gain in the summer and heat loss in the winter. By choosing the right windows for your home and climate, homeowners can save on cooling and heating

costs. The resources below provide readers with energy saving tips and information on the latest window technologies.

Energy and Environmental Building Association (EEBA) – Windows and Doors

Web site: www.eeba.org/resources/consumer/new/wndows_doors.htm

Description: The links promoted by EEBA give general information regarding windows and doors, window selection, window terminology, and high-performance windows.

ENERGY STAR – Residential Windows, Doors, and Skylights

Web site: www.energystar.gov/index.cfm?c=windows_doors.pr_windows

Description: At this ENERGY STAR Web site, homeowners can find basic information about window replacement and window technology. Homeowners can learn everything they need to know about how to purchase efficient windows by using the “Buy with Confidence” link (www.energystar.gov/index.cfm?c=windows_doors.pr_ind_tested).

ENERGY STAR – U-Factor for the Northeast

Web site: www.energystar.gov/index.cfm?c=windows_doors.pr_crit_windows

Description: This Web site outlines the ENERGY STAR criteria for windows, doors, and skylights in different areas of the country. In the Northeast, windows should be “mostly heating” and have a U-Factor (a measure of the rate of heat transfer ranging from 0.25 – 1.25; the lower the U-Factor, the better the window insulates) less than or equal to 0.35.

US Department of Energy – Energy Savers

Web site: <http://www1.eere.energy.gov/consumer/tips/>

Description: At this Web site, homeowners will find window tips for cold climates such as installing storm windows, closing drapes and curtains at night, and maximizing solar gain during the day. Information on window technologies and links to purchase new windows are also provided here.

Window Treatment

Search Terms: awnings, shutters, insulated drapes

Description: There are different types of window treatments that can help maximize the efficiency of your home. Installing awnings on south- and west-facing windows will help in the summer to block out the strong sun, thus reducing need for air conditioning. In winter months insulated drapes can help to keep heat from escaping through the windows.

For information on **Daylighting**, please see the **Lighting** section of this guide.

Window Technologies

There are several new as well as old window technologies that help save energy. The resources below will help you choose the right window options for your home.

Double-Paned Windows

Search Terms: double-paned windows

Description: Typically, the more panes your windows have, the better they will be at insulating your home. Replacing single-paned windows with double-paned windows throughout the home can save up to 15% on heating costs and add to the value of your home.

Gas-Filled Windows

Search Terms: argon-filled windows, krypton-filled windows, gas-filled windows

Description: The space between panes in multi-paned windows can be filled with inert and safe gases such as argon or krypton which slows heat transport from the inside to the outside. When gas is added to these windows, their insulation qualities are increased.

Historic Window Repair

Search Terms: historic window repair, historic window rehabilitation

Description: Homeowners with historic or old double-hung sash windows might consider window refurbishment and rehabilitation instead of replacement. Using the search terms above, you can find information on window repair in your area.

Low-Emissivity (Low-E) Windows

Search Terms: Low-E Glazing, Low-E Windows, Low-Emissivity Glazing, Low-Emissivity Windows

Description: Low-E windows have a glazed metal or plastic coating that reduces heat transfer and lowers the window's U-Factor. Low-E windows typically cost 10-15% more than conventional windows, but can reduce energy loss by 30-50%.

Superwindows

Search Terms: superwindows

Description: Superwindows have plastic sheets suspended between panes in multi-paned windows making them triple or quadruple glazed windows and reducing the U-Factor to 0.15-0.30. They also minimize UV rays that can fade home furnishings.

LIGHTING

Because home lighting accounts for 5-10% of energy usage, even the simplest renovations that include lighting changes can reap the benefits of energy efficiency. Bulb and appliance choices, lighting and window locations, and light timing devices throughout a home can significantly reduce energy use from 50-75%. There are many options with home lighting and the resources listed below will explore several topics. Please read on to learn more.

Efficiency and Placement

Energy-efficient light bulbs and fixtures have been cited to use up to 2/3 less energy and last 6-10 times longer than conventional bulbs/fixtures. Homeowners that change five light fixtures/bulbs in their home to more efficient options can save up to \$60 in energy costs per year and reduce green house gas emissions from local power sources. Making these changes not only saves you money and time, but reduces air pollution as well.

When renovating or building a new home, it is important to consider location when planning a lighting strategy. Rather than lighting entire rooms, homeowners should think about where work will most likely be done and where artificial light is necessary. By maintaining light in specific areas, homeowners will save energy and money.

ENERGY STAR – Compact Fluorescent Light Bulbs (CFL)

Web site: www.energystar.gov/index.cfm?c=cfls.pr_cfls

Description: When a conventional incandescent 100W light bulb is replaced with a 32W CFL, homeowners can save up to \$30 over the life of the new bulb. This web site discusses CFLs, energy efficiency, and why consumers should make the change.

National Lighting Product Information Program (NLPPIP)

Web site: www.lrc.rpi.edu/programs/nlpip/index.asp

Description: NLPPIP disseminates objective manufacturer-specific information about energy-efficient lighting products. Homeowners can visit their web site and search through publications, an extensive FAQs section, as well as some research information about lighting, energy, and the environment.

Daylighting

Search Terms: daylighting, skylights, solar tubes

Description: Daylighting is simply the use of natural light in place of artificial light bulbs and fixtures. Through skylights and window placement, homeowners can bring enough natural light into a room that the lights need only be used after sundown. Daylighting not only saves energy by reducing bulb usage, it also saves on heating costs in the winter and can benefit human health.

DOE Building Technologies Program: Daylighting

Web site: www1.eere.energy.gov/buildings/printable_versions/windows_technology.html

Description: Information on the daylighting concept and why it is beneficial in many homes. Here readers can also learn about design and installation of daylightlights for their homes.

Light Pollution

Light pollution occurs when outdoor lights meant to illuminate the ground—for walking and driving—is poorly directed resulting in light sent overhead, which causes glare and wastes energy. Additionally, the resulting glare blocks views of the night sky and can adversely affect wildlife. To avoid causing light pollution, outdoor lights should be energy-efficient and well-directed to the ground. Homeowners should limit the use of outdoor lights except when necessary. Some towns in New England have set night light guidelines. Check with your local town or city hall to see if there are set guidelines you should follow.

New England Light Pollution Advisory Group (NELPAG)

Web site: www.cfa.harvard.edu/nelpag/nelpag.html

Description: NELPAG has been providing information about light pollution and its impact on night views since 1995. Through their Web site and meetings, NELPAG strives to spread the word about low-lumen and glare-free outdoor night lighting.

PLUMBING

Clean water is necessary for sustaining human life and a healthy environment. Although 75% of our planet is covered by water, it is not an abundant resource and should be protected. The resources given here provide readers with the information needed to renovate and construct homes that conserve and protect water.

Flow Efficiency

Because only 1% of the earth's water supply is usable for human activity, consideration of your home's water usage is important when planning to renovate or build a new home. Homeowners can consider the following easy upgrades when exploring how to minimize their home's water usage:

- Low flow toilets, sinks, dishwashers, and washing machines; dual flush toilets, waterless urinals;
- Shower head and sink aerators;
- Running only full dishwashers and washing only full loads of laundry.

For more ways to save water in your home, please visit:

<http://www.epa.gov/WaterSense/pubs/res.htm>.

Composting Toilets

Search Terms: composting toilets

Description: Composting toilets often use little to no water. Through a combination of evaporation and natural decomposition, they convert human waste into useful fertilizer. Composting toilets are optimal in areas without septic systems or access to plumbing.

Dual Flush Toilets

Search Terms: dual flush toilet

Description: Dual flush toilets have two different flush options, one for liquid and one for solid waste. The flushes use 0.8 and 1.6 gallons of water respectively. Dual flush toilets save significant amounts of water when compared to traditional toilets that use 2.9 gallons in each flush.

ENERGY STAR – Appliances

Web site: www.energystar.gov/index.cfm?c=appliances.pr_appliances

Description: At this Web site, readers can find links to ENERGYSTAR® certified clothes washers and dishwashers. These appliances not only save on electricity, but they also have reduced water consumption and may be eligible for utility rebates in your area (see “Local Efficiency Programs” in the **Heating and Cooling** section of this guide for more information). Use the links provided to find retailers in your area.

Massachusetts Water Resources Authority (MWRA) – Water-Efficient Appliances and Fixtures

Web site: www.mwra.com/04water/html/lctoilet.htm

Description: This locally sponsored Web site provides information about why readers should consider water-efficient technologies and how they might go about doing it.

Massachusetts Water Resources Authority (MWRA) – The Operation Water-Sense Program

Web site: www.mwra.state.ma.us/04water/html/watsense.htm

Description: Through this program, MWRA communities are eligible to receive free water saver kits including low flow showerheads, faucet aerators, toilet tank dams, and leak detection equipment. Free kits are still available; please use the link to request one for your home.

PATH – Energy Efficient Rehab Advisor (Water)

Web site: www.rehabadvisor.pathnet.org/sp.asp?id=10744

Description: This Web site, maintained by A Public-Private Partnership for Advancing Housing Technology (PATH), provides links to resources and home water saving tips.

Waterless Urinals

Search Terms: waterless urinals

Description: Waterless urinals do not use water at all, leading to an overall 100% water savings. They require little maintenance and are comparable in cost to conventional urinals.

Piping

Although a drinking water source may be clean, residents need to consider the age and quality of infrastructure bringing water to their tap. Through corrosion and leaching, lead and other contaminants can find their way into drinking water. The resources listed below give renovation and construction suggestions that can minimize this risk.

Greenpeace – PVC Alternatives database

Web site: <http://www.greenpeace.org/usa/news/how-to-find-and-avoid-toxic-vi>

Description: Building on the PVC-free Sydney Olympics, Greenpeace hosts a database providing PVC-free information to homeowners throughout the world.

US EPA – Lead in Drinking Water

Web site: www.epa.gov/safewater/lead/index.html

Description: Sponsored by EPA, this Web site focuses on giving the reader as much information as possible about lead and drinking water. Here, fact sheets tell why lead might be a problem and how it can be reduced. There are links to regulatory information and local drinking water quality reports.

FURNISHINGS

There are many furnishing options when constructing or renovating your home. New and reused furnishings, as well as those constructed from reused, sustainable, and/or durable materials are available to consumers. The resources listed here suggest 'green' furnishing options that homeowners can consider.

Carpet

Carpet

Search Terms: environmental carpet, environmental rugs

Description: Consumers can consider choosing carpets made from natural materials like wool and cotton or those made with recycled content. Note that carpet dyes, glues, fire retardants, and backing materials can be made with chemicals that often off-gas (release fumes).

Carpet and Rug Institute (CRI) – Green Label Plus

Web site: http://www.carpet-rug.com/drill_down_2.cfm?page=8&sub=3

Description: The Carpet and Rug Institute's Green Label Plus is built upon their original Green Label and is used on carpets and rugs that meet low emissions, indoor air quality criteria. This label can be found on carpets in a showroom, and many of the "labeled" carpets are listed on this Web site.

Carpet Pads

Search Terms: environmental carpet pads

Description: Conventional carpet padding is often made with plastic or synthetic rubber and contains petroleum products. At end use, these pads are not recycled and are not biodegradable. Consumers can consider carpet pads with recycled content, minimal petroleum content, or low-VOC emissions.

Carpet and Rug Institute (CRI) – Green Label Plus

Web site: <http://www.carpet-rug.org/about-cri/cri-signature-programs/green-label-plus-adhesive.cfm>

Description: The Carpet and Rug Institute also labels carpet pads. On this Web site, consumers can find "labeled" products that have been tested for and meet CRI's criteria.

Recycled Furnishing Materials

When furnishing a renovation or newly constructed home, look for products that are made with recycled or refurbished materials, free from harmful and toxic chemicals, and those that will not require quick replacement. By choosing environmentally-preferable products, homeowners reduce the amount of waste to be disposed and can keep their family free from toxins.

Things to look for when purchasing furnishings for your home:

- **Chemical Free** These products generally have lower-VOC emissions, and are not made with or require adhesives that contain formaldehyde and other carcinogens that may cause harm to homeowners and their families.
- **Durability** The need to replace is reduced when consumers purchase products that hold up to normal wear and tear. This keeps materials out of the waste stream and reduces production of new products that use virgin materials.
- **Locally-Made** Furnishings that are made locally not only support the local economy, but expend lower pollution because they tend to use local materials and minimize pollution caused by shipping (of raw materials and of product-to-market).
- **Recycled Content** By purchasing products that have recycled content or are refurbished, consumers reduce strain on the waste stream and put materials to use when they are still viable.
- **Recyclability** If the item is easy to disassemble, it will be easier to recycle when its useful life is done. Furniture that is owner-assembled or made of a single material has a higher rate of recycling potential.

Vermont Sustainable Jobs Fund – Vermont Wood Products Resource Manual

Web site: <http://www.vsjf.org/resources/documents/Pages1-38.pdf>

Description: This publication is a collaboration of the Vermont Sustainable Jobs Fund and Vermont Wood Manufacturers Association. It provides information on sustainable furniture dealers and other wood products companies in Vermont.

INDOOR ENVIRONMENT

Because the average American spends up to 90% of their time indoors, the green building community has put significant emphasis on greening indoor environments—specifically cleaning the air we breathe. Asthma, a serious life-threatening respiratory disease affecting over 20 million Americans, is triggered by indoor allergens and can be controlled once triggers are recognized. While the information presented below does not cover every indoor air issue, it provides readers with information and tools to gain further understanding of many indoor air quality issues. Visit www.epa.gov/region1/healthyhomes and www.epa.gov/iaq/homes for additional information on indoor air quality issues.

Please visit www.epa.gov/asthma/programs.html to learn more about EPA's national asthma program and how to limit exposure to indoor asthma triggers.

Indoor Air Quality for New Homes

EPA has also developed specifications to recognize homes equipped with a comprehensive set of indoor air quality (IAQ) measures. Homes that comply with these specifications can use the “Indoor Air Package” as a complementary label to ENERGY STAR for Homes. Visit www.energystar.gov/homes to view the draft specifications.

These IAQ specifications address moisture control, pest control, radon, HVAC and ventilation, combustion systems, and building materials.

Indoor Air Quality for Existing Homes

For existing homes, a number of actions can be taken to improve IAQ. Visit the following links to find more information:

- **Home Improvements with ENERGY STAR** (www.energystar.gov/index.cfm?c=home_improvement.hm_improvement_index)
- **Remodeling for Indoor Air Quality** (www.epa.gov/iaq/homes/hip-front.html)

Mold

Indoor mold is most often found on bathroom tile, basement walls, areas around windows where moisture condenses, and near leaky sinks. Uncontrolled humidity or water leaks lead to mold growth, particularly in hot, humid climates. During renovations or construction, there are steps homeowners can take to reduce the risk of mold—use the resources below to learn more about what you can do to minimize the chance of mold growth in your home.

To reduce mold in your home:

- clean up all spills within 48 hours;
- insulate cold water pipes;
- install fans in kitchens and bathrooms.

For more moisture and mold control tips, please visit www.epa.gov/iaq/molds/moldresources.html

Asthma Regional Council of New England – READ THIS before you Design, Build, or Renovate

Web site: www.asthmaregionalcouncil.org/about/documents/READTHIS6.07.04.pdf

Description: This document covers a variety of construction and renovation topics, including pest management and moisture control and gives homeowners tips on how to reduce the impact of home pollutants on persons with asthma.

Energy and Environmental Building Association (EEBA) – Mold Issues

Web site: www.eeba.org/resources/consumer/mold.htm

Description: Homeowners can find links to everything they need to know about mold—why it grows, where it grows, how it spreads, and how it can be prevented. A homeowners’ guide is posted as well as guides for renovation, building, moving, etc.

ENERGY STAR – Dehumidifiers

Web site: www.energystar.gov/index.cfm?c=dehumid.pr_dehumidifiers

Description: Consumers can find information to determine if a dehumidifier is needed in their home as well as dehumidifier basics, placement, and options. There are also links to ENERGY STAR certified product retailers.

ENERGY STAR – Home Improvement

Web site: http://www.energystar.gov/index.cfm?c=home_improvement.hm_improvement_index

Description: From ENERGY STAR’s Home Improvement page, you can diagnose household problems ranging from mold, mildew, and musty odors to damp basements. The links on this page inform homeowners how to reduce moisture and avoid mold growth in the home.

US EPA Indoor Air – Mold

Web site: www.epa.gov/mold

Description: This EPA Web site outlines the causes of mold growth, ways to avoid mold, and links for further information. This site is a good background read and should be used as a starting point from which more in depth information can be found.

Radon

Radon is a radioactive, colorless, odorless gas occurring naturally in rock, soil, and well water. Radon is the second leading cause of lung cancer in the United States and is linked to approximately 21,000 lung cancer deaths in the United States per year. Homeowners are typically exposed to radon through gas diffusing through the foundations of their homes. Because granite is prevalent in New England, homeowners in this region should be particularly concerned with radon resistant construction.

There are easy and inexpensive techniques that reduce exposure to radon, whether constructing a new home or reducing the level of radon in an existing home. To find out how to detect and fix radon for your home, visit www.epa.gov/radon/radontest.html for more information.

CT Dept. of Public Health – Radon-Resistant Construction

Web site: <http://www.ct.gov/dph/cwp/view.asp?a=3140&q=387610>

Description: This site gives state-specific radon reducing construction tips. More on the CT radon program can be found at <http://www.ct.gov/dph/cwp/view.asp?a=3140&q=387598>

Energy and Environmental Building Association (EEBA) – Radon Issues

Web site: www.eeba.org/resources/consumer/radon.htm

Description: Here, like other EEBA resources, consumers can find links to further information, fact sheets, construction guides, and radon exposure zones.

Local Radon Contacts

Web site: www.epa.gov/region01/eco/radon/more.html

Description: Here readers can find EPA New England, EPA national, state, and tribal contact information.

National Radon Hotline

1-800-SOS-RADON

1-800-767-7236

National Radon Proficiency Program (NRPP)

Web site: www.radongas.org

Description: NRPP is a nationally-recognized certification program for radon professionals. From this site consumers can find a checklist for radon testing and how to find a radon professional. Other radon links are available as well.

US EPA Radon in New England

Web site: www.epa.gov/region01/eco/radon

Description: At this EPA site readers can find extensive information about radon in their homes. There are links to radon contacts, radon publications, radon testing, and more. By following the Radon Publications link, readers will be able to download a number of EPA radon publications including A Citizens Guide to Radon, Building Radon Out: A Step-by-Step Guide on how to Build Radon-Resistant Homes, and a Radon Guide for Tenants.

US EPA Radon Resistant New Construction (RRNC)

Web site: www.epa.gov/radon/construc.html

Description: This EPA site focuses on why homeowners should build radon-resistant construction and how to do so. There are links, diagrams, and contact information that consumers will find helpful during construction or renovation of their home.

For information on VOCs and Lead-Based Paint, please refer to the **Coatings** section.

Other Air Quality Resources

Healthy Indoor Air for America's Homes

Web site: www.montana.edu/wwwcxair/

Description: Sponsored by a partnership between EPA, Montana State University, and USDA, this Web site covers many indoor air issues.

US EPA – Healthy Homes

Web site: <http://www.epa.gov/region1/healthyhomes/pdfs/healthyhomes.pdf>

Description: Specific to New England, this page covers many topics household health. Please visit for more in-depth information to keep your family and home healthier.

US EPA Indoor Air Quality

Web site: www.epa.gov/iaq

Description: This is EPA's main indoor air quality page. From this site, users can find links to many IAQ topics, some of which are not specifically covered in this guide.

LANDSCAPING

New Englanders seeking to incorporate ‘green’ aspects into their home can easily find landscaping techniques that will reduce the effect of their home on the natural environment. Whether renovating, constructing, or just fixing up your yard, this topic is applicable to almost every homeowner. Some things to try when landscaping are:

- minimizing the use of pesticides and other chemicals – they run off into rivers, lakes, and streams;
- reducing paved areas – impervious surfaces lead to stormwater run off;
- reducing lawn size—large lawns require a lot of irrigation and can contribute to stormwater runoff;
- using native vegetation – prevents the landscape from contributing to the invasive plant problem that is prominent in New England’s natural areas.

Native Species

Search term: New England native species

Description: Native plants are those that have evolved over time in a specific region. They have adapted to the climate as well as to the insects and animal species of that region. Such adaptations allow native plants to grow without chemical inputs from pesticides and fertilizers. They conserve water because they have adapted to the specific region’s rainfall patterns and they provide habitat for a variety of native species.

Please refer to the links below to find more green landscaping techniques that are right for your home.

New England Wild Flower Society – Native Plant Nurseries

Web site: <http://www.newfs.org/visit/native-plant-nurseries>

Description: New Englanders can purchase native species at this site for use in their gardens and find other local nurseries.

US EPA – Green Landscaping with Native Plants

Web site: www.epa.gov/greenacres/index.html#Benefits

Description: This document was created by EPA Region 5—the Great Lakes Region, but it is applicable to green landscaping anywhere. It discusses the history of the landscape and how homeowners can use sustainable techniques to achieve natural landscapes for their homes. Woodlands, prairies, wetlands, invasive species, and wildlife are all topics covered here.

US EPA – Green Landscaping (Region 3)

Web site: www.epa.gov/reg3esd1/garden/index.htm

Description: This Web site was written for US EPA Region 3 (Delaware, DC, Maryland, Pennsylvania, Virginia, West Virginia), but the information presented is ap-

plicable to New England. Here, readers can find out what green landscaping is, why they should do it, how they might start, and links to more information.

US EPA – Healthy Homes Guide

Web site: <http://www.epa.gov/region1/healthyhomes/pdfs/healthyhomes.pdf>

Description: This brochure offers ways to make your home a healthy place. It includes information on indoor and outdoor air quality, pesticides, toxic household products, mold, tobacco smoke, radon, drinking water contaminants and making your home “green”.

Integrated Pest Management (IPM)

Search Terms: integrated pest management

Description: Integrated Pest Management, as defined by EPA, is the coordinated use of pest and environmental information with available pest control methods to prevent unacceptable levels of pest damage by the most economical means and with the least possible hazard to people, property, and the environment. For more information on controlling pests on your property, use the resources below and speak to your landscaper for their professional opinion.

A Homeowners Guide to Environmentally Sound Lawncare

Web site: www.massnrc.org/ipm/schools-daycare/ipm-tools-resources/homeowners-guide.html

Description: This publication, written by Massachusetts Department of Agricultural Resources, discusses environmentally responsible lawn care without the use of pesticides and herbicides.

US EPA – Pesticides and Food: What “Integrated Pest Management” Means

Web site: www.epa.gov/pesticides/food/ipm.htm

Description: By using trapping devices and regularly inspecting your plants, you can keep pest damage to a minimum in your garden without spraying harmful chemicals. This site leads readers to additional information and discusses the basics of IPM.

Asthma Regional Council of New England – READ THIS before you Design, Build, or Renovate

Web site: www.asthmaregionalcouncil.org/about/documents/READTHIS6.07.04.pdf

Description: Though this document covers more construction and renovation topics than just pest management, readers can find good pest guidance on page 46. Construction and landscaping strategies that minimize pest entry into the home such as keeping bushes away from the home, minimizing points of entry, reducing moisture, and many more are discussed.

Irrigation

Irrigation, although important when plants are first becoming established in the garden, can be reduced when landscapes are planned to include native species. For example, if the site is sunny and dry, choose plants that are adapted to that environment instead of trying to fight nature- this means your plants will thrive with little maintenance-reducing stress on the local water supply and the environment. It is important, however, to give plants a good start in life, so water them deeply during dry spells during the first year or two. In later years, there may be other occasions when you need to irrigate. During dry spells, be sure to check with your municipality or local government to see if there are any water bans before you irrigate. If you need to irrigate, please use the following tips:

- position sprinklers so that they only water vegetation and not driveways, sidewalks, and the street;
- skip watering on weeks where there has been rain;
- don't water your lawn in the summer- it will "green up" again in the fall;
- use rain barrels to collect water for irrigation;
- water lawns and gardens in the morning to reduce evaporation;
- water slowly to avoid run-off;
- water plants deeply, to encourage strong root growth in the subsurface zone.

MA Water Resources Authority (MWRA) – Garden and Landscaping Water Conservation Tips

Web site: www.mwra.state.ma.us/04water/html/gardening.htm

Description: This locally-sponsored Web site provides information about proper irrigation, water conservation, and landscaping in New England. Readers can find tips on finding the right automatic sprinkler, flower care, rain barrels, and garden design as well.

Rain Barrels

Search Terms: rain barrels, rain catchment

Description: Rain water is naturally soft and does not contain minerals, chlorine, fluoride, and other chemicals. Plants tend to respond well to watering with this water. By collecting rain, homeowners can save money on water used for irrigation. Systems range from simple, such as plain buckets, to advanced with cisterns, pumps, and flow controls. If the catch bucket you use does not have a lid, consider mosquito control methods, such as adding goldfish to eat mosquito larvae. The fish will need an air pump to get oxygen, but provide a "low tech" way to minimize spread of mosquito-borne disease. Be careful that they don't make their way into the watering can!

Water Saving Tips for your Lawn and Garden

Web site: <http://www.cmhc-schl.gc.ca/en/co/maho/la/index.cfm>

Description: Although written for Canada, these tips can be applied to lawns and gardens in New England. This Web site offers basic information about lawn and garden irrigation—when to water, how to water—as well as some more advanced suggestions including rain barrels and tips on aeration. Visit this site for all your irrigation needs.

Natural Shade

By providing your home with well-located natural shade, homeowners can save up to 30% on air conditioning costs and 20-50% of the energy used to heat a home. Also, the USDA Forest Service estimates that healthy, mature trees well-planted on a house lot can add an average of 10% to the property value.

USDA Forest Service – Northeastern Area

Web site: www.na.fs.fed.us/resources/homeowners.shtm

Description: The USDA Forest Service works to educate the public and maintain healthy forests across the country. Readers will find how to select, buy, and care for trees on residential property.

Specialized Techniques

Advanced gardeners might try applying Greenscapes, organic gardening techniques, or Xeriscaping to their property. The information below will guide homeowners in their landscaping decisions.

Greenscapes

Search Terms: greenscapes

Description: Greenscape ideas are typically used on commercial property and large scale landscaping, but the techniques offer homeowners some ideas for environmentally-responsible landscaping. Using Greenscapes ideas such as purchasing hoses, tubing, trickle irrigation systems, and lawn edging made from recovered plastic and old tires, New England homeowners can landscape large yards with minimal environmental impact. Visit www.epa.gov/epaoswer/non-hw/green/index.htm for more information on **Greenscapes**.

The Massachusetts Bay Estuary Association – Greenscapes Reference Guidebook

Web site: <http://www.greenscapes.org/page-134.html>

Description: This guidebook from Massachusetts Bay Estuary Association gives readers information about greenscaping. Sections entitled “What are Greenscapes?” and “How Do I Greenscape?” are followed by information on mowing, fertilizing, plants, and watering.

US EPA – “Greenscaping” Your Lawn and Garden

Web site: www.epa.gov/epaoswer/non-hw/green/pubs/home-gs.pdf

Description: This general guidance on Greenscaping discusses why it’s beneficial to the environment and how homeowners can incorporate it into their yards. Composting is also discussed.

Organic Gardening

Organic Gardening

Search Terms: organic gardening, green gardening

Description: Organic gardening is the practice of maintaining a garden (food or plants) or lawn without the use of pesticides and herbicides. By using alternative maintenance practices, homeowners can successfully garden while reducing their exposure to potentially harmful chemicals.

Organic Lawn Care

Web site: www.ct.gov/dep/cwp/view.asp?a=2708&q=382644&depNav_GID=1763

Description: Connecticut Department of Environmental Protection offers a fact sheet about organic lawn care. This Web site explains the basics of organic lawn care and also provides resources for further information.

Organic Lawn Care FAQ

Web site: <http://faq.gardenweb.com/faq/lists/organic/2004020829016580.html>

Description: This Web site focuses on organic lawn care. Information on organic and natural fertilizers, composting, and pest and weed management can be found here.

Organic Lawn Care Guide

Web site: <http://lawncareadvisor.com/lawncare/lawncareguide/>

Description: This Web site gives basic information on how to maintain your lawn organically. Information on fertilizer, watering, weeding, mowing, pests, and pH can be found here.

Xeriscaping

Xeriscaping

Search Terms: xeriscaping, xeriscapes

Description: Xeriscaping is a general term that refers to landscaping techniques known for water conservation and environmental protection. Using specific designs and planning, plant choice, and irrigation/maintenance techniques, homeowners can apply xeriscaping to their property.

Water-Efficient Landscaping: Preventing Pollution and Using Resources Wisely

Web site: http://www.epa.gov/OW-OWM.html/water-efficiency/docs/water-efficient_landscaping_508.pdf

Description: This EPA guide outlines why water-efficient landscaping is so important and how homeowners might apply this technique to their own property. Please visit to learn more about how proper planning, irrigation, and maintenance can help your property become water-efficient.

Xeriscaping – Establishing a Waste Efficient Landscape

Web site: www.ciwmb.ca.gov/organics/Xeriscaping/

Description: This resource was prepared by the State of California and has some xeriscaping basics—what it is and why homeowners should consider it—as well as information on landscape design, plant choice, soil preparation, and irrigation systems.

NOTES

STORMWATER MANAGEMENT

Runoff from land and impervious areas such as paved streets, driveways, and rooftops during rainfall and snow events often contains pollutants that could adversely affect water quality. In New England, stormwater is controlled by permits that are distributed at the municipal level. Homeowners can manage stormwater on their property by minimizing paved areas, capturing rainwater, and consciously preventing stormwater contamination during construction. Visit http://cfpub.epa.gov/npdes/home.cfm?program_id=6 for information on EPA's stormwater program.

Green Infrastructure

Search Term: Green Infrastructure

Description: Green infrastructure represents a new approach to stormwater management that is cost-effective, sustainable, and environmentally friendly. Green infrastructure captures, cleanses and reduces stormwater runoff using plants, soils and microbes. On the local scale, green infrastructure consists of site-specific management practices (such as rain gardens, porous pavements, and green roofs) that are designed to maintain natural hydrologic functions by absorbing and infiltrating precipitation where it falls. For more information about green infrastructure visit http://cfpub.epa.gov/npdes/home.cfm?program_id=298

Low Impact Development Center

Web site: www.lowimpactdevelopment.org

Description: The Low Impact Development Center is a non-profit organization that provides resources to homeowners and organizations interested in low impact development. The Web site offers a "Builders Guide to Low Impact Development" at http://www.lowimpactdevelopment.org/lid%20articles/Builder_LID.pdf.

The North South Rivers Watershed Association (NSRWA) - Ways to Protect Your Watershed

Web site: www.nsrwa.org/Page.58.html

Description: This list from the Massachusetts NSRWA gives homeowners simple ways they can protect their watershed from stormwater pollution. Ideas include greenscaping (see the Landscaping section of this guide), wash your car over the lawn, pick up after your pets, and do not pour hazardous waste down the sink or storm drains.

Erosion and Sediment Control

Erosion and sedimentation are harmful to the environment and can disturb local wildlife habitats. During construction, the land is disturbed and often there are piles of dirt, steep slopes, and natural habitats that need protection. The resources found below discuss the harms of erosion and sedimentation while giving homeowners management strategies for use during construction and renovation.

Kentucky Erosion Prevention and Sediment Control Field Guide

Web site: www.tetrattech-ffx.com/wstraining/pdf/esc_guide.pdf

Description: This erosion and sediment control guide is from Kentucky, but is applicable in New England.

US EPA – Does Your Site Need a Stormwater Permit?

Web site: www.epa.gov/region1/npdes/stormwater/index.html

Description: This Web site outlines the NPDES (National Pollution Discharge Elimination System) permitting system and alerts homeowners when their contractor may need to get a storm water permit from EPA or the state.

US EPA – Innovative Uses of Compost

Web site: www.epa.gov/osw/conserves/rrr/composting/pubs/bioremed.pdf

Description: This document discusses the use of compost during and after construction for erosion control, turf remediation, and landscaping. Compost can be generated from the trees and brush on site during the clearing, stumping, or grubbing processes.

US EPA – Stormwater and the Construction Industry

Web site: www.epa.gov/npdes/pubs/posterside1.pdf

Description: This document, written by EPA, shows some methods you can discuss with your contractor about how to control stormwater and erosion during construction.

Surface Water Management

When surface water is appropriately managed, pollution from stormwater can be greatly reduced. Through minimizing impervious surfaces and incorporating rain gardens and collection systems, homeowners can control surface water on their property.

Builder's Guide to Low Impact Development

Web site: www.lowimpactdevelopment.org/publications.htm

Description: This short pamphlet focuses on stormwater management and low impact development. Although it describes larger developments, the information on stormwater management is specifically applicable to homeowners.

Rivers in Massachusetts

Web site: <http://www.mass.gov/dfwele/river/watershed>

Description: This Web site lists an index of the watershed associations in Massachusetts. The homeowner or builder's local watershed association is usually interested in stormwater management and can give advice on landscaping, infiltration and other practical management techniques.

University of New Hampshire (UNH) Center for Stormwater Technology Evaluation and Verification

Web site: www.unh.edu/erg/cstev/fact_sheets/index.htm

Description: The UNH Center for Stormwater Technology Evaluation and Verification is testing a variety of storm water handling methods – some of which are appropriate for residential use under cold climate conditions.

US EPA – Solution to Pollution

Web site: www.epa.gov/npdes/pubs/solution_to_pollution.pdf

Description: This brochure discusses stormwater pollution and why healthy household habits can beneficially affect the natural environment. Look here for information on vehicles and garages, lawns and gardens, home repair and improvement, pet care, swimming pools and spas, and septic system use and maintenance.

US EPA – Ten Things you can do to Prevent Stormwater Runoff Pollution

Web site: www.epa.gov/npdes/pubs/nps_month_bookmark.pdf

Description: Here homeowners can find 10 easy ways to reduce stormwater pollution.

Pavement

Paved and other impervious surfaces, such as roofs, do not permit precipitation to drain into the ground. By minimizing these surfaces by landscaping or other methods, homeowners reduce the impact of stormwater pollution.

Nonpoint Education for Municipal Officials (NEMO) – Porous Pavement

Web site: <http://www.nemo.uconn.edu/tools.htm>

Description: This Web site focuses on alternatives to paved surfaces in construction. Here, readers will find information on pervious construction materials like pavers and pavement for roofs and driveways.

Recycled Tire Paving

Search Terms: tire sidewalks, recycled tire paving

Description: This paving material can be made from 100% recycled rubber. It is gaining popularity in the US and is being used predominantly for sidewalks. This pavement is porous, durable, can withstand tree root growth, and does not become slippery when wet. It is available for residential uses as well.

Toolbase Services

Web site: <http://www.toolbase.org/index.aspx>

Description: Here readers can find porous alternatives to traditional pavement patterns and materials. Materials, methods, and installation for these materials are given.

Rain Gardens

Rain gardens look like traditional gardens, but usually consist of deep-rooted native plant species and have a bowl-shaped dip in the center. They are used to absorb and filter rain as it runs off paved and other impervious surfaces on a home's landscape. Because they are typically planted with native species, they require little maintenance once they are set up.

Neponset River Watershed Association

Web site: <http://www.neponset.org/raingarden.htm>

Description: The Neponset River Watershed Association created a demonstration rain garden. On this Web site they list the local plants that were used as well as the basics of creating a rain garden. The organization has also worked on similar Low Impact Development strategies for mitigating stormwater runoff in Massachusetts.

Rain Gardens of West Michigan

Web site: www.raingardens.org/Index.php

Description: Rain gardens work by capturing rain water before it runs down the street into the storm drain. This Web site gives information on why and how to construct rain gardens for the home.

University of Maine's "Adding a Rain Garden to Your Landscape" Guide

Website: <http://www.umext.maine.edu/onlinepubs/PDFpubs/2702.pdf>

Description: This how-to guide outlines the process of installing and maintaining a rain garden on your property.

Water Collection Systems

By collecting rain in a basin and either releasing it slowly to recharge groundwater or saving it for future irrigation and other non-potable needs, homeowners can reduce pressure on municipal water supplies and minimize stormwater runoff. The resources listed here give homeowners information about the water collection systems available.

Charles River Watershed Association (CRWA) – SmartStorm Rainwater Recovery System

Web site: www.crwa.org

Description: This system, developed by CWRA, is a large partially buried rain barrel able to capture rainwater off rooftops and store it for irrigation and non-potable uses. Its incorporation into New England households will reduce pressure on drinking water sources and pollution from stormwater runoff.

ENERGY RESOURCES

Alternative Fuels for HVAC and Electricity

The following fuel source alternatives to natural gas, oil, and conventional electricity have become more common because of their reduced effect on the environment and human health. Some alternatives are more easily adapted for use in new homes and renovations than others. Use the resources below to determine if an alternative fuel source is right for you.

Biodiesel

Search Terms: biodiesel, biofuel, bioheat

Description: Biodiesel is made from domestic renewable resources and when used in low concentrations can be mixed with traditional diesel fuel to power vehicles or heat homes. Sources of biofuels include vegetable oils, in New England, it can be blended with traditional No. 2 heating oil at 10-20% concentrations and used to heat homes. Consumers looking to mix biodiesel with traditional heating oil should ensure that their furnace/boiler can accommodate the mixture before use.

Fuel Pellets

Search Terms: fuel pellet, wood pellet, corn pellets, biomass

Description: Fuel pellets are typically made from sawdust and ground wood chips that would normally be a waste product and be disposed. Pellets can be stored easily and conveniently and burn readily with high heat output and very low emissions. Alternative types of pellets include corn pellets, switchgrass pellets and multi-fuel pellets. Total heating costs may be less than the cost of electric heat, but competitive with average costs of other fuels.

Geothermal Energy

Search Terms: geothermal energy, geothermal heat pump

Description: Geothermal energy, or heat from the earth, is a renewable fuel source. Almost everywhere, the upper 10 feet of Earth's surface maintains a nearly constant temperature between 50 and 60°F (10 and 16°C). A geothermal heat pump system consists of pipes buried in the shallow ground near the building, a heat exchanger, and ductwork into the building. In winter, heat from the relatively warmer ground goes through the heat exchanger into the house. In summer, hot air from the house is pulled through the heat exchanger into the relatively cooler ground. Depending on factors such as depth, volume, and water quality, bodies of surface water can be used in geothermal heat pump systems as well. The biggest benefit of GHPs is that they use 25%–50% less electricity than conventional heating or cooling systems. Geology, hydrology and land availability are all important factors to consider when looking into geothermal heat pumps. Although there are no fuel costs, these systems can be expensive to install and are only available to customers with appropriate home sites. Minimal electricity is needed to run the system.

Electricity Options

Hydroelectric Energy

Search Terms: hydroelectric power

Description: Hydroelectric power is derived from the energy in flowing water. If you have water flowing through your property, you may be able to set up a small hydroelectric power station for your home's electricity. If this is not feasible for you, you may be able to purchase electricity from a hydroelectric plant in your area.

Purchasing Green Power

Web site: <http://www.epa.gov/greenpower/buygp/index.htm>

Description: Green power produces electricity with lower emissions and has a superior environmental profile to conventional power generation. Solar, wind, geothermal, biogas, biomass and low-impact hydro generate green power. Renewable Energy Certificates (RECs), also known as green tags, green energy certificates, or tradable renewable certificates, represent the technology and environmental attributes of electricity generated from renewable sources. A certificate can be sold separately from the megawatt hour of delivered electricity it is associated with. This flexibility enables customers to offset a percentage of their annual electricity use with "green" certificates generated elsewhere. Customers do not need to switch from their current electricity supplier to purchase certificates, and they can buy RECs based on any fixed amount of electricity. Revenue from RECs helps develop and expand the renewable energy industry. If you are looking to purchase RECs to support local renewable energy and impact air quality in your area, you should seek out a local renewable energy supplier. If you are looking to reduce carbon dioxide levels on a global scale, there are REC suppliers who sell RECs generated all over the United States. When looking into purchasing renewable energy certificates it is important to know the company's policies. For more information about purchasing Green Power visit <http://www.epa.gov/greenpower/>.

Solar Energy

Search Terms: solar power, solar energy, photovoltaic cells, solar cells, solar hot water

Description: Solar energy is power harvested from the sun and can be used for water heating purposes or to generate electricity. There are several technologies associated with solar power – photovoltaic cells and panels, solar power plants, passive solar heating and daylighting (see the Lighting section), and solar water heating. Photovoltaic (PV) systems convert light into electric voltage. A photovoltaic cell consists of two thin layers of semi-conducting materials, usually silicon, that have been treated with chemical substances. When sunlight strikes PV cells these chemicals react to sunlight, electrons are released and then gathered to create an electrical current. The greater the intensity of the sunlight is, the greater the flow of electricity. The direct current is converted into alternating current to operate household appliances. While solar energy is free and renewable, the cost

of the systems and retrofitting older homes can be costly. For more information about photovoltaic systems visit the Department of Energy's Consumer Guide: "Get Your Power from the Sun" at <http://www.nrel.gov/docs/fy04osti/35297.pdf>. State agencies may also offer incentives for installing renewable energy systems. For more information regarding state and local clean energy programs see www.epa.gov/cleanenergy/stateandlocal/index.htm

Wind Energy

Web site: http://www.eere.energy.gov/windandhydro/windpoweringamerica/pdfs/small_wind/small_wind_guide.pdf

Search Terms: residential wind energy, small wind turbines, residential wind turbine

Description: Wind turbines and wind farms that create energy from the wind are the world's fastest growing renewable energy source. Although many wind projects are large scale commercial wind turbines, there are options for wind power at the residential level. For more information about residential wind power see <http://www1.eere.energy.gov/buildings/residential/wind.html>

Local Energy Efficiency Programs

The programs listed below are for homeowners and tenants in the six New England states. Homeowners can visit these resources to find out more about energy programs in their state as well as tips and fact sheets regarding energy efficiency in the home. These programs also provide information about home energy audits. A home energy audit is an important first step in assessing how much energy your home consumes so that you can evaluate what home energy efficiency measures to take.

Database of State Incentives for Renewables and Efficiency

Web site: <http://www.dsireusa.org/>

Description: DSIRE is a source of information on state, local, utility, and federal incentives that promote renewable energy and energy efficiency. This Web site gives a summary of each incentive, contact information and Web sites to visit for more information.

ENERGY STAR – Home Performance

Web site: <http://www.energystar.gov> KEY WORD=Home Performance

Description: Under this program, contractors participating in the locally-sponsored Home Performance with ENERGY STAR program can help you cost-effectively improve your home's energy efficiency. Contractors will audit a home and recommend improvements (insulation, lighting, heating/cooling equipment, thermostats, windows, etc.) that could save homeowners up to 30% in energy costs/year. This program is not nationwide, so check the listings to find out if Home Performance is available in your area.

ENERGY STAR Rebates

Website: http://www.energystar.gov/index.cfm?fuseaction=rebate.rebate_locator

Description: To encourage customers to buy energy-efficient products, ENERGY STAR partners occasionally sponsor special offers, such as sales tax exemptions or credits, or rebates on qualified products. This Web site allows you to search by your zip code to find special offers or rebates. Also, check with your local utility to see if they offer any incentives.

Northeast Home Energy Rating System Alliance – State Programs

Web site: www.energyratings.org/states.htm

Description: At this Web site, homeowners click on their state and are linked to a page detailing home energy programs in that state. In Massachusetts, for example, readers are brought to the Massachusetts Division of Energy Resources' Home Energy Service page where more links detail energy-saving techniques and programs in that state.

PATH – Energy Efficient Rehab Advisor

Web site: <http://rehabadvisor.pathnet.org>

Description: This Web site could serve as 'one-stop' shopping for green building. Using the green building tools, homeowners can find up-to-date energy advisors and building technology evaluations.

US Department of Energy – Weatherization Assistance Program

Web site: www.eere.energy.gov/weatherization/doe_fact.html

Description: At this Web site, homeowners can find DOE fact sheets about energy efficiency in the home. Topics covered here include home energy audits, insulation, finances, and water heating. Also, at this site, DOE provides links to other useful energy tools such as "Tips for Saving Energy and Money at Home" and "Home Energy Saver." Visit <http://apps1.eere.energy.gov/weatherization/> for more information on the Weatherization Program in the Northeast.

Appliances and Home Electronics

Buying energy-efficient appliances and implementing efficient practices in the home are the easiest ways to save money, energy and the environment.

EnergyGuide Label

Web site: <http://www1.eere.energy.gov/consumer/tips/energyguide.html>

Description: The Federal Trade Commission requires EnergyGuide labels on most home appliances (except for stove ranges and ovens), but not home electronics. EnergyGuide labels provide an estimate of the product's energy consumption or energy efficiency. They also show the highest and lowest energy consumption or efficiency estimates of similar appliance models.

ENERGY STAR Label

Web site: <http://www.energystar.gov/index.cfm?c=home.index>

Description: ENERGY STAR labels appear on appliances and home electronics that meet strict energy efficiency criteria established by the U.S. Department of Energy and U.S. Environmental Protection Agency. The ENERGY STAR labeling program includes most home electronics and appliances except for water heaters, stove ranges, and ovens. ENERGY STAR qualified appliances incorporate advanced technologies that use 10–50% less energy and water than standard models.

Energy Saving Tips

US Department of Energy's Energy Savers Tips on Saving Money and Energy at Home

Web site: http://www1.eere.energy.gov/consumer/tips/pdfs/energy_savers.pdf

Description: This brochure published by the US Department of Energy outlines steps that you can take to reduce energy consumption in your home by helping you look at your energy use through a “whole-house” approach.

In a typical U.S. home, appliances and home electronics are responsible for about 20% of your energy bills. Here are some simple steps you can take to cut down on unnecessary energy use:

- **Use power strips/surge protectors** to shut off electronics when they are not in use. Home electronic products use energy when they are off to power features like clock displays and remote controls. In the average home, 40% of all electricity used to power home electronics is consumed while the products are turned off.
- **Unplug conventional battery chargers** when not in use. Even when not actively charging a product these batteries can draw as much as 5 to 20 times more energy than is actually stored in the battery.
- **Turn off computer monitors** if you aren't going to be using your PC for more than 20 minutes.
- **Turn off the monitor and CPU** if you're not going to use your PC for more than 2 hours.
- **Use auto-switching to sleep mode** or manually turning monitors off. There is a common misconception that screen savers reduce the energy used by computer monitors; they do not.

COMMUNICATIONS

For homeowners interested in green alternatives when renovating or constructing their home, the challenges do not always end once a contractor is hired. Oftentimes, homeowners have a difficult time expressing their interest and recommending products to contractors, who may view the project from a different perspective or have little or no experience with green building methods or products. Below are some resources and tips homeowners can use when finding an architect and/or contractor and discussing green products with their contractor.

Finding an Architect/Contractor

It is important that your architect and contractor understand your wishes and desires. The resources listed below provide directories of certified professionals in your area and tips on how to hire the right contractor for the job. Use these resources when planning your renovation or construction project.

Follow these three steps when finding the architect or contractor that is right for you (adapted from *Green Remodeling: Changing the World One Room at a Time*):

- **Research** Contact your local home builders association (www.nahb.org) and the Better Business Bureau (www.bbb.org) to research your potential contractor.
- **Certifications** Be sure that your contractor that is licensed, bonded, and registered as regulated by the law in your local area.
- **Referrals** Sometimes the best way to find a contractor that will fit your needs is to ask homeowners in your neighborhood that have recently had homes built or renovated. Ask them questions – are they happy with the work? Was the contractor willing to listen?

AIA Architects

Web site: www.aia.org/about_doforyou

Description: At this site, readers can find a database of AIA residential architects who are specifically trained to help homeowners make the most of their budget and space. Many AIA architects are familiar with green construction and are able to help homeowners find the contractor that is right for them.

Boston Society of Architects (BSA) – Architect Directory

Web site: www.architects.org/directories/list_firms.cfm?type=res

Description: At this site, homeowners can find a link to a local architect directory as well as The Residential and Small Commercial Project Handbook. The handbook describes the role of the architect, the design and construction process, budgets, and schedule. The database lists several firms in the Greater Boston area and provides links to other AIA chapters. The BSA also has a Committee on the Environment (COTE). Their Web site (www.architects.org/committees/index.cfm?doc_id=150)

has information on COTE monthly meetings that are open to interested parties and focus on the design, construction, and operation of sustainable buildings.

The City of Seattle – Green Home Remodel: Hiring a Pro

Web site: <http://www.seattle.gov/dpd/GreenBuilding/SingleFamilyResidential/Resources/RemodelingGuides/default.asp>

Description: This guide, published by the City of Seattle outlines tips on hiring and working with design professionals and contractors when working on green remodel projects.

ENERGY STAR Heating and Cooling Contractors

Web site: www.energystar.gov/index.cfm?c=heat_cool.pr_contractors_10tips

Description: At this site, ENERGY STAR offers tips on finding the right heating and cooling contractor. They recommend considering your contractor's certifications, recommendations, estimations, and more before signing a contract.

ENERGY STAR – Home Performance

Web site: www.energystar.gov KEY WORD=Home Performance

Description: Under this program, local contractors will visit your home to assess your energy consumption and recommend improvements that could save homeowners up to 30% in heating costs/year. This program is not available nation-wide, so check the listings to find out if Home Performance is available in your area.

Knowing your Rights

Massachusetts General Statutes

Web site: www.mass.gov/legis/laws/mgl/142a-2.htm

Description: Massachusetts General Laws, Chapter 142A – Regulation of Home Improvement Contractors details all agreements between homeowners and their contractors. Section 2 – Residential Contracting Agreements; Requirements, in particular, is of interest to homeowners. Homeowners in other states should check their local laws for these regulations.

Talking to Your Contractor

Once you have hired the architect/contractor for your project, it is important that you express your wishes to them. At times this can be difficult, especially since environmentally responsible construction has yet to become mainstream. Use the tips below to ensure that your finished product is as green as you imagined (Adapted from *Green Remodeling: Changing the World One Room at a Time*).

GREEN BUILDING RESOURCES

National

The following organizations are involved in green buildings and have information that may be helpful to New Englanders.

Building Science Corporation

Web site: www.buildingscience.com

Description: This Boston-based architecture and building science consulting firm provides free information (as well as publications for purchase) regarding moisture dynamics, mold, indoor air quality for energy efficient and sustainable homes, and climate-specific best practices.

Department of Energy – Weatherization Assistance Program

Web site: www.eere.energy.gov/weatherization

Description: This national program works with low-income families to reduce their energy bills by permanently making their homes more energy efficient. The fact sheets can be used by anyone looking for ways to reduce their home's energy consumption.

ENERGY STAR®

Web site: www.energystar.gov

Description: This site provides residents and businesses with information on energy efficiency, energy-efficient products such as appliances, heating and cooling devices, home electronics, office equipment, and lighting, and guides on installing energy-efficient features in new homes. There is also information about the voluntary label for ENERGY STAR® Qualified New Homes and information about Indoor Air Quality pilot specifications.

Energy and Environment Building Association (EEBA)

Web site: www.eeba.org

Description: EEBA, an international association of building professionals, provides information and educational tools for environmentally-responsible construction and renovation.

The Forest Stewardship Council (FSC)

Web site: www.fscus.org

Description: This Web site, provides information about forest stewardship and FSC certified wood products. Using the “Chain of Custody” database (www.fscus.org/certified_companies/?num=20), homeowners can access local companies that sell FSC-certified products.

National Association of Home Builders (NAHB)

Web site: www.nahb.org

Description: An association of local builders, NAHB offers insight on home construction from the builder's perspective. At the "For Consumers" page (www.nahb.org/page.aspx/category/sectionID=112), homeowners can learn about the environmental concerns associated with renovation and new construction. NAHB also provides search engines that can find builders/remodelers in your area as well as model green building criteria, which can be found in the Certification Programs section of this guide.

NeXus Green Building Resource Center

Web site: <http://www.nexusboston.com>

Description: Located in downtown Boston, NEXUS includes over 6,000 square feet of product and educational showrooms, a resource library and networking space. The center is staffed by green building experts and LEED-accredited professionals. It is open to building owners, architects, engineers, designers, developers and the general public.

A Public-Private Partnership for Advancing Housing Technology (PATH)

Web site: www.pathnet.org

Description: This Web site, a Housing and Urban Development (HUD) program, includes information from green building to energy efficiency, remodeling and buying a home. From the "Homeowners" link, readers can explore PATH's resources which aim to make homes healthier and more comfortable places to live.

Rocky Mountain Institute (RMI)

Web site: www.rmi.org

Description: The RMI site covers energy efficiency, green development, and home resource efficiency. From their "Home Resource Efficiency" page (<http://www.rmi.org/sitepages/pid186.php>) homeowners can find links to specific publications on topics from home energy efficiency, lighting and appliances, and water efficiency to building materials and recycling.

Southface – Responsible Solutions for Environmental Living

Web site: www.southface.org

Description: This non-profit organization is based in Atlanta, Georgia, but has some information applicable to New England such as environmental fact sheets, green building guidelines, and information on zero energy homes.

Sustainable Buildings Industry Council (SBIC)

Web site: www.psic.org

Description: SBIC's residential program offers seminars and workshops, residential building guidelines, and software tools that contractors and homeowners can consult. ([http:// www.sbiccouncil.org/](http://www.sbiccouncil.org/))

US Green Building Council (USGBC)

Web site: www.usgbc.org and www.usgbc.org/DisplayPage.aspx?CMSPageID=147

Description: The council is comprised of leaders from across the building industry and works to promote environmentally-responsible buildings that are profitable and healthy places to live and work. At this site, readers can find information about USGBC's new Leadership in Energy and Environmental Design (LEED) – Homes program (www.usgbc.org/DisplayPage.aspx?CMSPageID=147) and certification guidelines. The council also has a LEED for Neighborhood Development rating system that integrates the principles of smart growth, urbanism, and green building into a national standard for neighborhood design.

US Environmental Protection Agency (EPA) – Green Building

Web site: www.epa.gov/greenbuilding

Description: EPA's green building Web site features commercial and residential green building information. Here, readers can find green building facts, environmental issues regarding green buildings, as well as links to more information on EPA programs related to green homes and buildings.

Regional

These organizations are based within the six New England states and work to serve the local community. When browsing these Web sites give special attention to the information that is specific to the Northeast. While the following list of organizations may not be complete, exploration of their Web sites will give the reader an understanding of the current green building efforts in New England and links to other organizations.

Apeiron Institute for Environmental Living

Web site: www.apeiron.org

Description: Located in Rhode Island, the Apeiron Institute looks to bring methods of sustainable living from all parts of the world to the Northeast. Their Center is open to the public and showcases built exhibits that explain the green features and how they are different from conventional systems as well as the economics behind them. The Institute also hosts events from workshops to festivals.

Building for Social Responsibility (BSR)

Web site: www.bsr-vt.org

Description: Comprised of professional builders, Vermont BSR hosts seminars and workshops focusing on building related topics such as Healthy House Construction, Building the Green Home, Straw Bale Construction, and Environmental Design for both the public and building professionals. At their Web site, readers can learn more about the organization, Vermont Builds Greener (VBG) (see below), as well as sign up for meeting notices and view their member list.

Connecticut Department of Environmental Protection (CT DEP) – Pollution Prevention Newsletter

Web site: www.dep.state.ct.us/wst/p2/p2view/p2newsletter.htm

Description: This newsletter covers pollution prevention activities including those that relate to green buildings, such as energy and resource efficiency. Read their old newsletters and subscribe to the listserve to receive up-to-date publications.

Connecticut Green Building Council

Web site: www.ctgbc.org

Description: The CTGBC promotes education about the construction of green buildings in Connecticut. This independent, non-profit organization hosts regular meetings, dinners, and other events to teach about various aspects of green design and construction. There is a web link to local information on green homes.

greenGoat

Web site: www.greengoat.org

Description: Although greenGoat began as a resource for demolition debris placement, it also assembles 'green teams' for an interdisciplinary approach to green building to design, construction, and maintenance. This non-profit works with architects, contractors, and homeowners at any stage of the project to lower the environmental impact of the building process.

Green Homes Northeast (GHNE)

Web site: www.ghne.org

Description: GHNE is a residential green building program working proactively to leverage and transform the marketplace so that healthy, energy- and resource-efficient homes become common practice. At their site, find more information about the GHNE program as well as regional green building events and seminars.

The Green Roundtable

Web site: www.greenroundtable.org

Description: The Green Roundtable, an independent non-profit organization affiliated with the US Green Building Council. It is a forum allowing for interdisciplinary

discussion around design and construction issues and is targeted to contractors, engineers, developers, architects, federal, state, and local governments, building owners, etc. You can find out more about their education, technical, and policy programs as well as link to other active green building initiatives in the Northeast.

Massachusetts Technology Collaborative (MTC)

Web site: www.mtpc.org

Description: MTC is Massachusetts' development agency for renewable energy and innovation. At : www.mtpc.org/cleanenergy/greenbuilding.htm, homeowners will find green design and construction ideas and information about MTC programs, and links to other green building initiatives, resources, and incentives in Massachusetts.

New England Solar Energy Association (NESEA)

Web site: www.nesea.org

Description: NESEA brings together a network of interested parties that collaborate to promote energy-efficient technology. Through the "Green Building" link (www.nesea.org/buildings/info/), consumers can learn 11 easy steps to improve energy efficiency at home, what to look for when purchasing a home, how to update a hot water heating system, how to reduce pollution from household appliances, how to make solar heating work for them, and tips on energy-efficient construction.

Stop Waste: Green Building Standards and Guidelines

Web site: www.stopwaste.org

Description: The Green Building Guidelines offer recommendations for building green. They contain cost-effective suggestions to minimize construction-related waste, create healthier and more durable homes, reduce operating costs for homeowners and support local manufacturer and supplier of resource-efficient building materials. Although this Web site is published for Alameda County, California its resources are useful in New England.

Vermont Builds Greener (VBG)

Web site: www.vermontbuildsgreener.org

Description: This non-profit organization is an initiative of Building for Social Responsibility (BSR) and strives to certify residential buildings that are constructed to sustainable criteria. See VBG in the Certification Programs section of this guide for information regarding their certification criteria.

Vermont Green Building Network (VGBN)

Web site: www.vgbn.org

Description: VGBN is recognized as Vermont's USGBC chapter and promotes resource conservation, energy efficiency, renewable energy, and water conservation. Readers can learn about green buildings, why they should consider building green, as well as get information about VGBN and events they sponsor.

Additional Green Building Resources

The resources listed here can be used by readers looking for further research and information on green building.

BuildingGreen.com

Web site: www.buildinggreen.com

Description: At this Web site, subscribers have access to the GreenSpec® Guide and database, the BuildingGreen Suite, Environmental Building News (EBN) newsletter, and other BuildingGreen associated publications. Readers will find articles, case studies, and materials on a variety of green topics.

City of Austin, Texas – Green Building Program

Web site: <http://www.austinenergy.com/Energy%20Efficiency/Programs/Green%20Building/index.htm>

Description: At this Web site, readers will find links to this program's publications including The Sustainable Building Sourcebook, Seven Steps to Green Building, fact sheets, and the Green Building Program Newsletter. Although designed for Austin, Texas, this program has information that is useful throughout the country.

City of Portland, Oregon – Portland's Green Building Resource: Green/Rated

Web site: www.green-rated.org

Description: At the residential page (<http://www.portlandonline.com/osd/index.cfm?c=41591>) homeowners can find basic questions and answers about green building, case studies, green building strategies, and some financial incentives available.

City of Seattle, Washington - Green Home Remodel

Web site: <http://www.seattle.gov/dpd/GreenBuilding/SingleFamilyResidential/Resources/RemodelingGuides/default.asp>

Description: These guides explore green remodeling throughout the house. They offer guides on bath and laundry, roofing, landscaping, kitchen, painting, and reuse. They also published a guide that focuses on hiring a professional. The guides are available free of charge and order information can be found at the Web site.

Consumer Reports: Greener Choices

Web site: www.eco-labels.org/greenconsumers/home.cfm

Description: Here, consumers can find ratings for household products based upon environmental standards. Look for information on cars, appliances, electronics and food that affect the environment.

Current Publications

Search Terms: green building, green renovation, green homes, green construction

Description: By using these or similar search terms, readers should be able to access recent and current green building publications.

Green Building Products: The GreenSpec® Guide to Residential Building Materials

Search Terms: GreenSpec® Guide

Description: This guide, edited by Alex Wilson and Mark Piepkorn, is organized by household product and describes green choices that are available to consumers. Each product is listed with resource information—addresses, phone numbers, and web sites—as well as a description of the product.

US EPA – Environmentally Preferable Purchasing (EPP)

Web site: www.epa.gov/epp

Description: Environmentally Preferable Purchasing is a federal-wide program that encourages and assists Executive agencies in the purchasing of environmentally preferable products and services defined as “...products or services that have a lesser or reduced effect on human health and the environment when compared with competing products or services that serve the same purpose...” At the product and services page (www.epa.gov/epp/products.htm) readers can find purchasing information for several product categories such as buildings, carpets, and cleaners, as well as a database of environmental information for products and services including product-specific information developed by government programs.

US EPA – Comprehensive Procurement Guidelines (CPG)

Web site: www.epa.gov/cpg

Description: Through CPG, EPA designates items that must contain recycled materials that must be purchased where federal funds are used in federal, state, and local projects. EPA also issues companion guidance—the Recovered Materials Advisory Notice (RMAN)—that recommends levels of recycled content for those items. EPA updates the CPG every two years and adds new products. By visiting their product page (<http://www.epa.gov/epp/pubs/products/index.htm>), homeowners can find information on particular products (construction, landscaping, etc.) including RMAN facts, a database of manufacturers and suppliers, and additional fact sheets.

Vermont Sustainable Jobs Fund – Vermont Wood Products Resource Manual

Web site: <http://www.vsjf.org/>

Description: This publication is a collaboration of the Vermont Sustainable Jobs Fund and Vermont Wood Manufacturers Association. It provides information on sustainable furniture dealers and other wood products companies in Vermont.

GREEN HOME STANDARDS AND CERTIFICATION PROGRAMS

The following local and national organizations provide standards for residential green buildings. While some publish guidelines for public use, others only allow use upon the completion of seminar courses or payment of fees. Homeowners can use these standards as checklists, recommendations, or suggestions for their own projects or can strictly follow any set and apply for certification.

American Lung Association – Health House

Web site: <http://www.healthhouse.org/consumer/build.cfm>

Description: This indoor air building program was designed by the American Lung Association and holds home construction to the most stringent building standards in the United States. Health Homes are inspected during construction and tested upon completion. Visit the Web site to learn more and order a free copy of their building brochure.

EarthCraft House – Responsible Solutions for Environmental Living

Web site: <http://www.southface.org/>

Description: This certification program is part of the Greater Atlanta Home Builders Association. With flexible construction and renovation guidelines, the EarthCraft criteria adapt to all types of green building methods allowing for different approaches to green design.

Energy Efficient Rehab Advisor – PATH

Web site: <http://rehabadvisor.pathnet.org>

Description: Full of useful information and tools, this Web site provides links for green building tools, energy advisors, and building technology evaluations.

ENERGY STAR Homes – Field Guide to Residential New Construction

Web site: <http://www.energystarhomes.com/>

Description: This site provides readers with links to ENERGY STAR Homes.com “Valued Documents.” The Field Guides (found here for MA and RI) are available for download and cover ENERGY STAR, current energy building codes, and improved detailing based on the latest building science.

ENERGY STAR – Home Improvement Tools

Web site: <http://www.energystar.gov> KEY WORD=Residential Home Improvement

Description: ENERGY STAR offers the online tool *The Home Energy Yardstick*, which helps users calculate if they are consuming more than average energy for their size home.

ENERGY STAR Qualified New Homes

Web site: www.energystar.gov/index.cfm?c=bldrs_lenders_raters.pt_bldr

Description: This site provides builders, raters, sponsors, and lenders of new homes with information about the voluntary label for ENERGY STAR Qualified New Homes and information about Indoor Air Quality pilot specifications.

ENERGY STAR – Store Locator

Web site: www.energystar.gov/index.cfm?fuseaction=store.store_locator

Description: This database allows consumers to find local stores that stock ENERGY STAR products and appliances.

Green Building Guidelines: Meeting the Demand for Low-Energy, Resource-Efficient Homes

Web site: <http://www.sbicouncil.org/displaycommon.cfm?an=1&subarticlenbr=113>

Description: This guide, a publication of Sustainable Buildings Industry Council, provides homeowners green building criteria, checklists, and recommendations that they can share with their contractor. The guide is available online for a fee.

Green Communities Criteria

Web site: <http://www.greencommunitiesonline.org/>

Description: The criteria here are focused on creating green affordable housing in American communities. Although not completely applicable to homeowners, some of the approaches can be incorporated into renovation and new home construction. Readers can request the criteria from the above Web site for free.

Green Guard Environmental Institute

Web site: <http://www.greenguard.org/Default.aspx?tabid=14>

Description: The mission of Greenguard Environmental Institute (GEI) is to improve public health and quality of life through programs that improve indoor air. In accordance with that mission, GEI currently has an Indoor Air Quality third-party certification program as well as a Building Construction certification program.

GreenHomeGuide

Web site: www.greenhomeguide.com

Description: This Web site is open to any interested party and lists product reviews, product information, and stories from members (membership is free) who have already used green products in their home – their motto is “sharing the passion, experiences, and expertise of the green building community.” From this site, readers can review many environmentally-friendly products related to renovating any room in the house.

Green Points

Web site: www.stopwaste.org/home/index.asp?page=469

Description: Although designed for Alameda County, California, the Green Points system is applicable throughout the country. From this site, homeowners can find suggestions and guidelines for home remodeling, new construction, and the Green Points rating tool for evaluation of their home's green characteristics.

Green Seal

Web site: <http://www.greenseal.org/>

Description: Green Seal is an independent non-profit dedicated to promoting the manufacture, purchase and use of environmentally-responsible products and services. In developing environmental standards and certifying products, Green Seal follows the Guiding Principles and Procedures for Type I Environmental Labeling adopted by the International Organization for Standardization (ISO 14024).

Leadership in Energy and Environmental Design (LEED) for Homes (LEED-H)

Web site: www.usgbc.org/DisplayPage.aspx?CMSPageID=147

Description: The new LEED-H pilot program, released in August 2005, applies the US Green Building Council's (USGBC) existing programs to residential construction. You can find the new checklist, program provider lists, and contact information at their Web site. This Web site also provides information regarding LEED for Neighborhoods, a rating system that integrates the principles of smart growth, urbanism, and green building into the first national standard for neighborhood design (<http://www.usgbc.org/DisplayPage.aspx?CMSPageID=148>).

National Association of Home Builders (NAHB) – Model Green Home Building Guidelines

Web site: www.nahb.org/publication_details.aspx?publicationID=1994

Description: This set of voluntary guidelines was developed by the NAHB Research Center in an open, public process with many stakeholder groups from the home building industry. The guidelines are free and available for download at the Web site listed above.

US EPA Office of Compliance – Managing Your Environmental Responsibilities (MYER): A Planning Guide for Construction and Development

Web site: www.cicacenter.org/links/

Description: The MYER Guide contains two different sets of checklists and detailed discussion/case studies on major environmental areas (including stormwater) affecting the construction industry. Readers will find answers to many environmental questions and can conduct self audits by using the self-audit checklists, included in Part II of the Guide, during the Construction phase.

GREEN BUILDING EXAMPLES

The examples described here demonstrate successful residential green building and residential green building programs. Although they are not all in the New England area, they are useful models that readers might further investigate before starting their green building project.

Apeiron Institute for Environmental Living

Web site: www.apeiron.org

Description: Located in Rhode Island, the Apeiron Institute looks to bring methods of sustainable living from all parts of the world to the Northeast. Their Center is open to the public and showcases built exhibits that explain the green features and how they are different from conventional systems as well as the economics behind them. The Institute also hosts events from workshops to festivals.

Duke University Smart House

Web site: <http://delta.pratt.duke.edu/>

Description: This house will act as a “living laboratory” for Duke University engineering students. Their goals are to promote the use of residential green building design, influence the market demand for green residential technology, foster innovation, and educate students.

Habitat for Humanity

Web site: www.habitat.org/env/materials_conservation.aspx

Description: This organization provides low-income housing while focusing on re-used/recycled materials use and resource efficiency.

Hickory Consortium Projects

Web site: www.hickoryconsortium.org/2_projects/projects.htm

Description: These projects—Cambridge CoHousing, Erie Ellington, Reviviendo Housing, and more—are examples of green construction projects in New England.

Maine Solar House

Web site: www.solarhouse.com

Description: This house, built and owned by a Massachusetts couple, derives all of its energy from the sun. Solar panels on one side of the roof heat water tanks in the basement, while those on the other side provide electricity to the local grid so they can borrow from the grid at night when the panels are not active. Visit the site for more information about site determination, contractors, and other solar resources.

ACRONYMS AND DEFINITIONS

For the purpose of this guide, the following definitions have been compiled from various sources:

Albedo: A mathematic ratio that describes a compounds ability to reflect sunlight. High albedos refer to compounds that reflect more light than they absorb.

Carcinogen: A substance or agent that causes cancer.

Construction: The act of building a residential structure.

Green: A synonym for sustainable, environmentally responsible, or eco-friendly.

Heat Island Effect – the reflection of heat from a ‘black top’ roof, generally associated with large commercial buildings.

Materials: A synonym for commodities, goods, or products.

Photovoltaic Cell: A panel that converts sunlight directly into electricity.

Recycle: A process of collecting a product or material, separating and processing it and then returning it to the economic mainstream in the form of raw materials; or remelting into a new finished good.

Refurbish: A process of making “cosmetic” changes to update the appearance of a product, such as cleaning, changing fabric, painting, or refinishing. This term is often associated with used office furniture and differs from remanufacturing in that none of the structural parts of the product are replaced.

Renovation: The act of remodeling or updating an existing residential structure.

Reuse: The use of a product or material again in its original form or with little enhancement or change to be utilized again for the same purpose.

Toxic: A synonym for ‘poisonous’.

VOC: Volatile Organic Compound – Organic (carbon containing) chemicals that evaporate readily at room temperature.

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