Kitchen, Bath, and Living Spaces

The contemporary home serves many different functions for both living and working. Today, best practice for remodeling these areas includes options that not only meet functional needs but are also highly effective in mitigating environmental impact. Kitchens and bathrooms are active spaces and significant consumers of water and energy; choosing environmentally friendly appliances, fixtures, and finishes helps to reduce energy and water consumption and protect non-renewable resources. In kitchens and especially bathrooms, it is advised to invest in durable, high performance features. Whether it's through an energy-saving dishwasher, living room flooring made from renewable materials, bed linens made from bamboo, or a high-efficiency exhaust system, greening living spaces is a fundamental part of the overall green home remodel.

Photo: Patricia Gaylor

Kitchen, Bath, and Living Spaces

How to Use the Guidelines

Health and Safety

HS1 - Nuisance and Toxic Dust Control
HS2 - Hazardous Materials - Asbestos & Lead
HS3 - Mold
HS4 - Radon

Green Home Maintenance and Housekeeping

Building Envelope

Detail window sills in wet areas **[IDP26]**
Seal and flash windows/skylights **[IDP27]**
Upgrade or replace existing windows **[EA56/59]**
Upgrade existing exterior door **[EA57]**
Provide shading of skylights as needed **[EA61]**
Isolate attached garages **[IEQ165]**

HVAC

Use ceiling fans for natural ventilation **[EA65]**
Install programmable thermostats **[EA67]**
Make sure ductwork is clean **[EA71]**
Install effective ventilation **[IEQ166-167/172]**
Provide fresh air in ventilation system **[IEQ171]**
Vent all combustion-based equipment **[IEQ168]**
Install automatic shut-off on bathroom fans **[IEQ167]**

Lighting and Electrical

Provide daylighting **[EA83]**
Provide appropriate lighting **[EA84]**
Install energy-efficient lighting **[EA85]**
Provide controllable interior shading **[IEQ178]**

Wall and Ceiling

Install eco-friendly interior sheathing **[MR126]**
Select eco-friendly interior doors **[MR127]**
Choose eco-friendly paints, sheens, and finishes **[IEQ185/MR130-131]**
Consider tile with recycled content **[MR132]**
Select eco-friendly wall coverings **[MR129/IEQ186]**
Use non-paper-faced gypsum board in moist areas **[IEQ183]**
Use low-VOC construction products **[IEQ187]**
Avoid carpeting in moist areas **[IEQ179]**

Floors and Flooring Products

Reuse existing flooring and subflooring **[MR133]**
Choose hard, low-formaldehyde floors **[IEQ180/MR134]**
Use reclaimed or renewable materials **[MR135-136]**
Refinish floors with eco-friendly products **[MR137]**
Select eco-friendly carpeting **[IEQ182/MR139]**

Plumbing

Install water-saving fixtures **[WE42-44]**
Install water filtration system **[IEQ175-176]**
Include a plumbing access panel **[MR123]**
Choose a high-efficiency water heater **[EA79]**
Consider eco-friendly piping material **[MR122]**
Reconfigure plumbing for efficiency **[EA77]**
Install instantaneous hot water heater

Equipment

Select high-efficiency clothes washer **[EA92]**
Select an energy-efficient refrigerator **[EA93]**
Choose an energy-efficient dishwasher **[EA94]**
Install energy-efficient cooking appliances **[EA95]**
Select energy-efficient office equipment **[EA99]**

Laundry

Install single-throw shut-off valve **[MR124]**
Install drain pan for clothes washer **[MR125]**
Provide air-lock dryer vent **[EA72]**
Minimize dryer duct lengths and turns **[EA73]**

Furniture and Fittings

Select eco-friendly furniture **[MR141-143/146-148/150]**
Select eco-friendly cabinetry and countertops **[MR140/145/148-149]**
Support local craftsmen **[MR153]**
Select furniture that is easy to clean **[IEQ192]**
Select healthier window treatments **[IEQ193]**

Uses

Use green cleaning materials/strategies **[IEQ196]**
Regularly maintain equipment **[EA91]**
Designate a built-in recycling center

Case Studies

Green Products and Services

Glossary of Terms

How to Use the Guidelines

Organization of the Guidelines

The Guidelines are organized into chapters by major project type: Kitchen, Bath and Living Spaces, Finished Basement and Major Addition, Weatherization and Energy, and Outdoor Living and Landscaping.

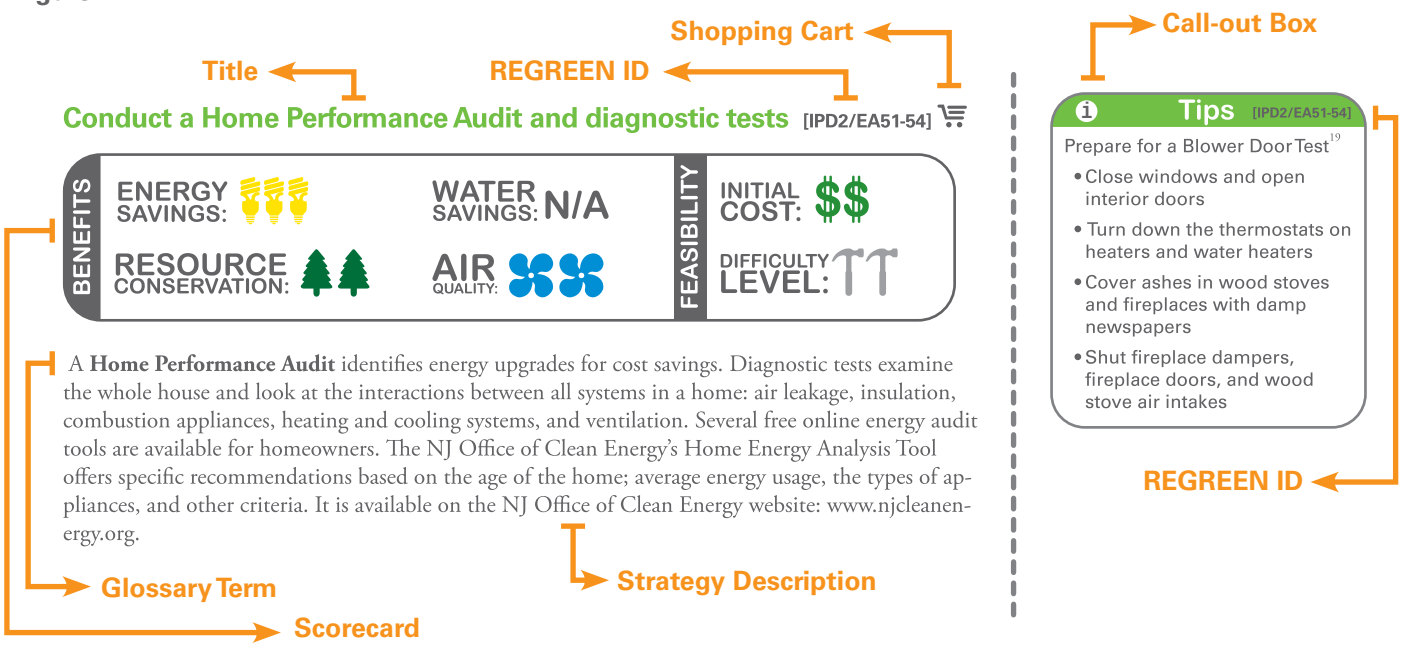
Each chapter includes the following:

- How to Use the Guidelines
- Health and Safety
- Green Home Maintenance and Housekeeping
- Best Practice Strategies
- Resources and References
- Case Studies
- Green Products and Services
- Glossary of Terms

Getting the Most from the Strategy Write-ups

The Guidelines provide information on best practice strategies for each project type. These strategy write-ups are organized by building system and follow the order of the 2008 REGREEN Residential Remodeling Guidelines (i.e., IDP2), which are incorporated with permission. **Figure 1** describes the information available.

Figure 1



Title and REGREEN Strategy ID – The strategies in the REGREEN Residential Remodeling Guidelines 2008 inspired most of the strategies in these Guidelines. Where appropriate, the strategy references the related REGREEN strategy ID.

Shopping Cart – The cart denotes entries in the Green Product and Service Guide located in the back of each project chapter.

Strategy Description – This write-up provides an overview of each strategy and its environmental benefits.

Glossary Term – Acronyms and green building terms are highlighted in bold and defined in a glossary at the back of each chapter.

Call-out Boxes - The call–out boxes in **Figure 2** highlight information of special importance. These include the following types of information:

- Tips - useful hints or practical facts for accomplishing a strategy
- Incentive - sources of financial assistance
- New Jersey Bio-Region - New Jersey has 5 bio-regions, each with unique elements and environmental features to consider when remodeling
- Building Age - a home's age can inform needed repairs and call out special circumstances
- Caution - on occasion, there are hazards associated, so items are called out for safety reasons

Hazard Symbol - Symbols were developed to advise users of certain health and safety threats related to specific strategies. The symbols, which appear below, reference the guidance on Health and Safety located at the beginning of each section.

HS1 – Nuisance and Toxic Dust Control HS1

HS2 – Hazardous Materials - Asbestos & Lead HS2

HS3 – Mold HS3

HS4 – Radon HS4

Web Link - When viewing this document electronically, the websites will hyperlink, however, occasionally website links change. In most cases, the site provides a seamless link to the new address. If this is not the case, users may need to copy and paste the link into the browser address bar. At the time of publication the hyperlinks in this report were all functional.

Scorecard - The scorecard, **Figure 3**, provides a snapshot of the environmental benefits, initial costs, and difficulty levels associated with a particular strategy. Both qualitative and quantitative information was used to assign scores to each strategy.

Figure 3

Conduct a Home Performance Audit and diagnostic tests [IPD2/EA51-54]

BENEFITS		FEASIBILITY	
ENERGY SAVINGS:	WATER SAVINGS: N/A	INITIAL COST: $$	
RESOURCE CONSERVATION:	AIR QUALITY:	DIFFICULTY LEVEL: TT	

It is divided into two parts: 1) Benefits and 2) Feasibility.

Graphic icons were developed for each impact category.

BENEFIT Key

1 icon = low benefit, 2 icons = medium benefit, 3 icons = high benefit

FEASIBILITY Key

$ low initial cost, $$ medium initial cost, $$$ high initial cost

T low difficulty level, TT medium difficulty level, TTT high difficulty

The icons above have been developed to graphically describe the ratings that follow.

BENEFITS

Energy Savings

Energy efficiency reduces energy use in the home, reduces **carbon dioxide** (CO_2) emissions, and helps stem climate change. New Jersey passed aggressive CO_2 reduction goals to lower greenhouse gas emissions to 1990 levels by 2020. The 20 percent reduction is followed by a further reduction of emissions to 80 percent below 2006 levels by 2050. The state has also established renewable energy targets. Green remodeling strategies utilizing renewable energy sources such as solar, geothermal, and wind will net a lower CO_2 footprint.

Figure 2

Tips [EA49]

Use the U.S. Department of Energy's Zip-Code Insulation Program to determine how much insulation to add and where to achieve the recommended insulation levels for maximum energy efficiency www.ornl.gov/~roofs/Zip/ZipHome.html

Incentive [EA49]

Federal tax credits may be available for added insulation to walls, ceilings, or other part of the **building envelope**. See the Tax Incentive Assistance Project: www.energytaxincentives.org/general/legislative.php.

NJ Bio-Region [EA49]

In colder climates, adding extra insulation is more cost effective than installing a **radiant barrier.**[26]

Building Age [EA49]

Insulation in older homes will have settled and at best be dusty or dirty so new attic insulation is typically installed on top of old insulation.

Caution [EA49]

Vermiculite Insulation was used in attics until it was discovered that vermiculite ores from some sources have naturally occurring **asbestos** in trace amounts. This type of insulation is only a health concern when someone comes into contact with it; while it is contained, it is not determined to be a health risk. If a remodeling or renovation project involves removal of this type of insulation, certified professionals will be needed to safely remove or contain the material. For more information, see **EPA** website: www.EPA.gov/asbestos/pubs/verm.html

Water Savings

Water conservation reduces water use both inside and outside the home. Within the home this may include low-flow fixtures. Outside the home this may refer to using **native plants** that have lower watering requirements or rain barrels to collect rainwater for reuse on the lawn and garden. Water management includes providing proper moisture control at footings, slab perimeter, and foundation walls as well as using porous paving materials to encourage stormwater recharge for reduced runoff.

Air Quality

Americans spend up to 90 percent of their time indoors where air quality can be more polluted than outdoors. Pollutants range from allergens such as mold, mildew, fungus, and dust mites to toxins, such as asbestos, and volatile organic compounds like formaldehyde and benzene found in building materials and a number of household items including pressed-wood furniture, computer ink, carpeting, and conventional household cleaners and cosmetics.

Resource Conservation

Resource conservation means using materials that are durable and easy to maintain with low embodied energy (the energy used in resource extraction, manufacturing, shipping). These come from renewable sources or are produced from waste, recycled materials, or salvaged from other uses. Avoiding building materials that deplete natural resources, such as old-growth timber, and materials made from toxic or hazardous substances improves nature's ability to provide goods and services.

FEASIBILITY

$ Initial Cost

Cost is always a consideration for remodeling projects. Evaluating the cost of a recommended green remodeling strategy provides homeowners with a better sense of the relative costs and benefits of each recommended measure.

Costs come in two forms, so it is important to consider both in assessing feasibility. The first reflects initial costs of the strategy compared to conventional practices. A second consideration to make is the pay-back period or life-cycle cost. The pay-back costs are less obvious and are often project specific, but they can have significant environmental and economic value that factor into the overall cost. For more information on average costs, savings, and payback periods of typical energy efficiency improvements, see the Energy Efficient Rehab Advisor at (www.rehabadvisor.pathnet.org/). For customized results, have an energy professional conduct a thorough energy audit of your home.

$ Less than $500

$$ $500-$5,000

$$$ Greater than $5,000

Difficulty Level

Time is money and expertise is gained over time. Some people may consider a Home Performance Audit strategy in the 'medium' category because although relatively straightforwardto act on, it requires experts with custom equipment to prepare an accurate assessment. Implementing the findings from a Home Performance Audit becomes a 'high' difficulty category as space heating and cooling systems, ventilation, water heating, appliances, climate and even site factors need to be integrated to assure desired energy improvements across 'ALL loads' and to avoid negative unintended consequences. It is expected that 'high' difficulty strategies may also be dangerous for the basic homeowner to undertake.

T Easy to Do It Yourself (DIY) - little previous knowledge necessary

TT Task for an Experienced DIYer or Professional - may require additional effort and higher learning curve than conventional strategy it replaces

TTT Task for an Expert/Certified Professional - high learning curve; new technique; requires specific green knowledge

Notes: [1] U.S. Environmental Protection Agency 2008. Healthy Buildings, Healthy People: A Vision for the 21st Century

Health and Safety

Green remodeling poses hazards typical of many other home renovation or remodeling projects because of the age of the homes (given that they are more likely to contain older and use more hazardous materials) and the incentive for green remodeling to replace older or damaged building systems.

New Jersey homeowners considering green remodeling should anticipate potential emissions of hazardous air contaminants during removal of old building materials. The risks associated with improper removal of materials containing **asbestos**, lead, mold or even fiberglass insulation are minimized by understanding and following the steps listed here prior to initiating work. For complex situations, consider hiring professionals.

General hazard recognition and risk reduction information for the following potential renovation-related risks are contained in this section:

HS1 – Nuisance and Toxic Dust Control HS1

HS2 – Hazardous Materials - Asbestos & Lead HS2

HS3 – Mold HS3

HS4 – Radon HS4

HS1 – Nuisance and Toxic Dust Control

Construction projects involving demolition of existing sheetrock, plaster, wood, brick or concrete products in ceilings, walls or floors of a home will release dust as these materials are ripped, sanded, ground, pulverized or crushed. Control of dust emissions during the pouring of solids or from transferring of small particles is controlled in industrial facilities. Homeowners planning renovation projects should also consider steps to minimize the release and maximize control of dust in the environment. These nuisance dusts, when released from the point of origin into the air of the home, tend to remain suspended in the air for very long periods of time, and as such, will be transported with air currents caused by open doors, cracks around and beneath doorways, forced air heating and cooling ductwork, and even by the air currents caused by persons walking in and out of dusty areas, to other areas of the home. At a minimum, allowing the uncontrolled release of nuisance dusts from any demolition project, as well as those created from sawing, sanding, or grinding of newly constructed materials (e.g., sheetrock, spackling, wood dust etc.) presents unnecessary and difficult dust cleanup demands for affected living spaces. At their worst, susceptible occupants of homes where uncontrolled nuisance dusts are allowed to escape into adjacent living spaces may temporarily experience eye, nose, or throat irritation. Asthmatics may experience adverse respiratory distress when exposed to high levels of nuisance dust particles.

There are several simple steps to minimize potential hazards of nuisance dust during remodeling.

1. Remove unnecessary porous and non-porous materials (e.g., draperies, bedding, upholstered furniture, children's toys, clothing, etc.) from the project area.
2. Seal the project area from the remainder of the home using polyethylene sheeting at doorways and at inlets to any forced air supply or **return registers** within the project space.
3. Consider installing **HEPA filtered air scrubbers** in the project area and discharging the exhaust air through an adjacent window using a tight fitting flexible duct through a sealed window opening (consider surrounding security requirements). Use a lightweight section of facial tissue at the doorways to confirm that air pressure is moving from the clean adjacent living space and into the project area (not the other direction) so that air leaks from the clean home into the dirty renovation area. This will reduce any potential for dusts from the renovation area to enter the adjacent areas of the home.
4. Periodically during the work session and after every work session, **HEPA vacuum** the renovation area following renovations to remove accumulated surface dust, without re-suspending it into the air.

HS2 – Hazardous Materials - Asbestos & Lead

When removing old building materials, know that they contain hazardous materials, which while intact present little to zero risk to occupants, but when removing can create airborne emissions and increase health and safety risks. This is especially true of **asbestos** and lead, and, possibly to a lesser extent, fiberglass. Removal of **asbestos**, lead or fiberglass needs to be planned and conducted with care to minimize exposures to airborne dust from these materials.

Asbestos

Asbestos is a mineral that has been mined in the U.S. since the early 1900's. Its superior heat resistance properties, combined with its lightweight, high-tensile strength, and non-corrosive qualities, made it an ideal building material for buildings constructed between 1940 and the late 1980's. **Asbestos** was banned as a building material in the U.S. after scientists concluded studies linking long-term occupational exposures to damaging respiratory health including asbestosis (scarring of the lung), lung cancer, and mesothelioma (cancer of the lining of the lung). Because intact **asbestos** presents no increased health risk, there is no requirement for removing it from existing homes. However, when it is disrupted, pulverized or suspended in air, the potential for inhalation of **asbestos** fibers increases risks of exposure. While health effects develop only after decades of long-term occupational or environmental exposure, homeowners should take particular care to prevent unintentional release of **asbestos** into the air of their homes during green remodeling efforts so that children and others are not exposed.

Asbestos is commonly found in older homes (constructed between 1940 and the late 1980's) in the following building materials:

- Pipe and boiler insulation
- Sprayed on fireproofing insulation
- Acoustical tiles and wall coverings
- Floor tiles
- Roof shingles
- Siding shingles

There is no requirement that homeowners remove **asbestos**-containing materials from homes. However, if removal is part of a green building remodeling project, material should be tested by a New Jersey licensed **asbestos** control monitor, and if determined to contain **asbestos**, be removed by a New Jersey licensed **asbestos** contractor. The number of the state program to contact for assistance in identifying qualified personnel to assist homeowners to safely address any possible **asbestos** concerns is (609) 292-7837.[5] General information about asbestos and its proper management and disposal can be found at the Department of Health website: www.state.nj.us/health/iep/asbestos.shtml and the Department of Environmental website: www.nj.gov/dep/dshw/rrtp/asbestos.htm.

Lead

Lead was in residential paints prior to 1978. It was banned after that time due to the significant health affects to children inhaling or consuming dusts from lead-based paints. Because of the hazards posed by dusts and chips of lead-painted surfaces, any remodeling or renovation which impacts painted surfaces of homes constructed prior to 1978 needs to be inspected by a New Jersey licensed lead inspector. If lead paint is identified, it should be safely removed by a state of New Jersey licensed contractor. They can safely remove lead-based paint and conduct follow-up surface lead testing to confirm that the removal was successful. Information on lead-based paint and qualifications for lead inspectors and contractors can be found at: www.state.NJ.us/health/iep/documents/pb_advisory_bulletin.pdf.

Contact the New Jersey Department of Health and Senior Services at (609) 292-7837 with any questions.

Fiberglass

Fiberglass insulation is a manufactured glass-wool-like material used as an insulation and sound absorption material in homes, schools, automobiles and consumer products since the 1970's. Fiberglass insulation can be safely installed if handled properly; any prolonged skin, eye or respiratory contact with fiberglass can cause temporary irritation. During renovation, wear loose fitting clothing and gloves to reduce skin contact, eye glasses or goggles to reduce eye exposure, and N95 disposable respirators (available from any home improvement store) if high levels of fiberglass dust are expected during removal or installation. More information on fiberglass safety precautions and handling recommendations can be found at the American Lung Association website at: www.lungusa.org/site/pp.asp?c=dvLUK9O0E&b=35439
or call the American Lung Association in New Jersey at (908) 687-9340.

HS3 – Mold

Mold contamination of building materials is not limited to older homes. Homes of any age can develop mold if moisture from leaky pipes, roofs, foundations, accumulates in the presence of dust, wood, paper or other **cellulose**-containing materials at normal room temperatures or high relative humidity (76 percent) for as little as 48 hours. Standing moisture around building materials such as wallboard, carpets, insulation, wood or other **cellulose** containing materials can cause mold. Many mold spores are known human allergens and produce toxins which may cause irritation or central nervous system effects. Because of vast differences in susceptibility, or if individual health impacts related to elevated mold spore exposure are of concern, consult a trained and experienced occupational/environmental health physician.

In addition to the above, mold damage can occur if flooding from faucets, showers, toilets (above the trap), is not completely dried within 48 hours of the incident. Floods from dirty water sources such as washing machines, dishwashers or sewers may contain high levels of bacteria, viruses, and protozoa which, along with potential mold growth, present additional risks.

If **mold amplification sites** occur, remove the affected material using methods that prevents unintentional dispersal of mold spores and the source of moisture intrusion. The U.S. **Environmental Protection Agency** indicates that small areas of mold growth (less than 10 square feet) can be cleaned or removed by homeowners themselves using precautions to prevent exposure and reduce spread of spores to adjacent areas. When mold contaminated areas exceed 10 square feet, special precautions including erecting containment barriers and the use of specialized **HEPA vacuum** devices should be used by trained professionals. When mold contamination occurs in excess of 100 square feet, professionals need to clean using full containment of the area (see www.epa.gov/mold/moldguide.html).

If mold growth from dirty water floods occurs, take special precautions to prevent skin, eye, oral and inhalation contact, and hire trained professionals to clean up in accordance with U.S. **EPA**: www.epa.gov/iaq/flood/index.html and IICRC S500 guidelines

Homeowners should anticipate that the amount of mold contamination shown on the outside of a piece of drywall or paneling may be less than the amount that will be exposed when wall cavities are opened up. If there is any doubt, consider hiring a professional Certified Industrial Hygienist (CIH) to evaluate the extent of damage before attempting to remove contaminated building materials yourself.

HS4 – Radon

Radon is a radioactive gas that comes from the natural decay of uranium in the ground. It is odorless, tasteless and invisible, and can only be detected through specialized tests. **Radon** enters homes through openings such as cracks and joints in the foundation, sump pits and openings around pipes. The home traps radon inside and it can build up to high levels.

Radon is the second leading cause of lung cancer in the United States, resulting in 15,000 to 22,000 deaths annually. It is the leading cause of lung cancer for non-smokers.

Radon concentrations can vary from house to house. The radon concentration in a home depends on a number of factors, including the amount of uranium present in the soil, the permeability of the soil, the number of openings in the foundation and air pressure differentials. Any home can have a **radon** problem, regardless of whether it is old or new, well sealed or drafty, or with or without a basement.

The New Jersey Department of Environmental Protection recommends radon testing for all homes in New Jersey. If the **radon** concentration is 4 pCi/L or higher, a **radon** mitigation system is recommended. There is no safe level of **radon** since lung cancer can result from very low exposures to **radon**, however, the risk decreases as the **radon** concentration decreases. f the **radon** concentration is less than 4 pCi/L, a mitigation company can be consulted to determine whether the **radon** level can be brought down still further. **Radon** levels have been brought to less than 1 pCi/L in sixty percent of the homes mitigated in New Jersey. Mitigation systems can also help reduce the potential for accumulation of volatile organic compounds that may be released from soil water vapor in areas where ground water contamination is an issue.

Radon test kits are commercially available at most home improvement stores, however, test conditions and locations may make data interpretation difficult or inaccurate. Carefully follow the kit directions to ensure proper use and confidence in the results. The New Jersey Department of Environmental Protection has issued licensing requirements for **radon** testing firms, and has a list of qualified professionals to perform **radon** testing and mitigation, see www.njradon.org.

Appendix

HS1= NUISANCE AND TOXIC DUST CONTROL

Fly ash Properties

www.austinenergy.com/energypercent20Efficiency/Programs/Greenpercent20Building/Sourcebook/flyashConcrete.htm

www.oikos.com/library/betterconcrete/index.html

HS2= HAZARDOUS MATERIALS - LEAD AND ASBESTOS

N.J. Department of Health Indoor Environments Program

www.state.NJ.us/health/iep/index.shtml

Agency for Toxic Substances and Disease Registry, New Jersey

www.atsdr.cdc.gov/Asbestos/sites/national_map/fact_sheets/trentonnj.html

N.J. Department of Environmental Protection, Guidelines for Disposal of Asbestos Containing Materials

www.state.NJ.us/dep/dshw/rrtp/Asbestos.htm

U.S. EPA Asbestos Caution Regulations adopted in New Jersey

www.EPA.gov/r02earth/ahera/ahera.htm

N.J. Department of Community Affairs Lead Testing and Abatement

www.state.NJ.us/dca/codes/code_services/xls/clc.shtml

New Jersey (NJ) Department of Health and Senior Services

http://www.state.nj.us/health/

Lead in Paint, Dust, and Soil (USEPA)

http://www.epa.gov/lead/

The Leadsafe NJ Program (NJDCA)

http://www.state.nj.us/dca/dcr/leadsafe/

HS3 = MOLD

USEPA Guide to Mold in Your Home

www.EPA.gov/mold/moldguide.html

USEPA Flood Clean-up Guidelines

www.EPA.gov/iaq/flood/index.html

N.J. Department of Health and Senior Services Indoor Environments Program

www.state.NJ.us/health/iep/index.shtml

HS4 = RADON

N.J. Radon Soil Gas Map

www.EPA.gov/radon/zonemap/newjersey.htm

N.J. Department of Environmental Protection Radon tiers by County

www.state.NJ.us/dep//rpp/radon/radonin.htm

N.J. Radon Levels

www.NJradon.info/NJ_counties.html

N.J. Radon Testing Guidelines

www.NJ.gov/dep/rpp/radon/radontes.htm

Green Home Maintenance and Housekeeping

Introduction

Your home is one of the biggest investments of your life. Can 'going green' protect your investment and make it safer, more enjoyable and save you money? Yes.

This guide to Green Home Maintenance and Housekeeping practices will improve the health, comfort and environment for your family, and save you money, most directly by reducing your utility bills. The guide's focus on 'Energy' savings, improvements to 'Indoor Air Quality', effective and efficient 'Household Waste Management' and conserving 'Water' all add measurable benefits to you and high return on your investment. Routine checks and repairs will ensure your home's appearance and proper function. By following these recommendations, you will also prevent more expensive damage from occurring.

Kitchen, Bath & Living Spaces

Kitchen, bath and living spaces comprise the prime areas of your home - with maximum utility, and hence require regular upkeep.

1. Maximize **natural ventilation** and daylight
   - Keep windows (especially kitchen window) open for **natural ventilation** whenever possible
   - Take full advantage of natural daylight
   - Clean and maintain windows and doors to keep them weatherproof and in good working order
   - Use the exhaust fan (vented to the outside) when cooking

2. Use appliances efficiently and effectively
   - If your refrigerator is more than 10 years old, consider replacing it as new technology has dramatically improved its energy efficiency
   - Clean the refrigerator's condenser coils twice a year
   - Clean the cooking range hood filter
   - Unplug appliances (like toaster, coffeemakers, etc..) when not in use.
   - Use microwave for quick food warming
   - Wash only full loads of dishes to save energy and water
   - Avoid the need for pre-rinse cycles by carefully scraping dishes before adding them to the load
   - Wash only full loads of laundry to save energy and water
   - Use cold water detergents to reduce the need for hot water laundry
   - Use a compost container instead of the garbage disposal to save energy and improve your garden soil

3. Minimize and dispose of waste appropriately - Reduce, Reuse, and Recycle
   - Provide easy access to and sufficient room for recyclables storage in the kitchen
   - Switch from disposable products to reusable products: food and beverage containers, cups, plates, writing pens, razors, towels, shopping bags, batteries, etc.
   - Instead of products that are packaged for single use, buy items in bulk and transfer to your own reusable containers
   - Buy recycled: resale shops offer good kitchen equipment at a fraction of retail costs
   - Sell or donate used goods instead of throwing them out
   - Recycle paper, yard trimmings, glass, aluminum, other metals, batteries, used motor oil, and plastics
   - Use canvas shopping bags
   - Use tap water in a reusable container instead of bottled water

4. Prevent Water-related Problems
   - Use bathroom fans while showering and allow them to run for 20 to 30 minutes after showering (installing a timer will make this easier)
   - Fix leaky toilets and repair dripping faucets
   - Check traps and drains under sinks, tubs, showers for leaks
   - Keep a check on bathtub surrounds to avoid mold problems

5. Use water wisely
   - Shut off water when brushing or shaving
   - Take short showers instead of baths
   - Dispose of tissues and other similar waste in the trash rather than flushing unnecessarily
   - Use a broom instead of a hose to clean your driveway or sidewalk

6. Keep your family and your home free from pollutants and pests
   - Organic fertilizers and pest control will cut down on the pollutants tracked into your home
   - Keep an entry mat and encourage everyone to remove their shoes at the doorway
   - Mount **carbon monoxide** monitors in living spaces
   - Do not allow smoking in homes as it can be harmful for the children and other occupants
   - Use non-toxic, biodegradable cleaners; vinegar and baking soda are among the most common (and cheapest!) recommended substitutes – and plain soap is still the cheapest effective disinfectant
   - Minimize the use of chemical formulations by cleaning surfaces and floors with soap and water along with additives such as lemons, vinegar and baking soda
   - Do not pour toxic cleaning products down the drain
   - Clean clogged drains with boiling water followed by baking soda and vinegar
   - Use a snake or a plunger for difficult clogs instead of toxic drain cleaners
   - Keep the kitchen counters, floor surfaces and stovetops clean to control pests (rodents, termites, roaches, etc.)
   - Keep exterior garbage (and kitchen compost) in tightly sealed containers
   - Handle pesticides and other products containing chemicals outside the house and apply only in recommended quantities
   - When using any strong cleaning products, or painting, keep windows open or a fan going to minimize inhaling unhealthy fumes
   - Never idle the car inside the garage
   - Use plants to improve indoor air quality

Detail window sills in wet areas HS3 [IDP26]

BENEFITS		FEASIBILITY	
ENERGY SAVINGS:	WATER SAVINGS:	INITIAL COST:	
RESOURCE CONSERVATION:	AIR QUALITY:	DIFFICULTY LEVEL:	

Windows near wet areas (such as in showers or near bathtubs) need to be properly detailed to avoid rot, mold, and mildew, and prevent air leakage. When installing a window in a wet area, select a window frame that is tolerant to high levels of moisture. Use a sill that is impermeable to water and seal as if it were an outdoor sill. Use moisture-resistant or impermeable materials such as marble or other durable material. This helps conserve resources by improving the durability of window frames, sill, and sheetrock and saving long-term costs for replacements.

Seal and flash windows/skylights HS1 HS3 [IDP27]

BENEFITS		FEASIBILITY	
ENERGY SAVINGS:	WATER SAVINGS:	INITIAL COST:	
RESOURCE CONSERVATION:	AIR QUALITY:	DIFFICULTY LEVEL:	

Air and water leakage problems commonly found around windows and skylights can cause structural damage and indoor air quality problems. According to the Partnership for Advancing Housing Technology (PATH), most leakage problems stem from improper or insufficient **flashing** details or the absence of **flashing**. By properly sealing and **flashing** around windows, doors and skylights one can reduce heat loss resulting in lower energy bills and prevent water damage which could lead to costly replacement of drywall and framing.

Upgrade or replace existing windows HS2 [EA56/59]

BENEFITS		FEASIBILITY	
ENERGY SAVINGS:	WATER SAVINGS:	INITIAL COST:	
RESOURCE CONSERVATION:	AIR QUALITY: N/A	DIFFICULTY LEVEL:	

Determining whether the home's windows need to be updated or replaced starts with a **Home Performance Audit** (see strategy IDP2/EA51-54), which will reveal window leaks. Visual inspection may also reveal window problems. Are any of the windows cracked? Do they open to allow fresh air to enter? Are there any windows without **storm windows**?

Upgrade or replace **single-pane** with **double-pane windows** with low-E or spectrally-selective glass to save 10 to 25 percent per year on heating.[1] To help offset the up-front cost, check for incentives from federal tax credits and through state and local utilities. If window replacement is not in the budget and old **single-pane windows** are in good condition, install **storm windows** in the winter months. Upgrading the sash alone can also save money. **Storm windows** can reduce heat loss through the windows by 25 percent to 50 percent.[2] **Storm windows** also protect against impacts from rain, ice and snow. Bear in mind that good windows installed badly will not achieve expected savings, so see the link in the resources section for tips on "How to Hire an Expert Installer." Finally, windows that are properly sealed and caulked prevent leakage of air in and out of the house and provide a protective barrier from water and noise. [For more information, see Weatherization and Energy: Weatherstrip doors and windows EA58.]

Tips [EA56/59]

1) Add shrink-wrap plastic sheeting on windows that are rarely opened in the winter.

2) Install tight-fitting, insulating window shades on windows that feel drafty after **weatherizing**.

3) In the winter, close curtains and shades at night; open them during the day. In the summer, close curtains on south- and west-facing windows during the day.

Incentive [EA56/59

By installing eligible windows and skylights, homeowners can receive a tax credit of 10 percent of the cost up to $200. Installation costs are not included. The maximum amount of homeowner credit for all improvements combined is $500 during the three-year period (2006, 2007, and 2009) of the tax credit.

Building Age [EA56/59]

A historic wood window, properly maintained and fitted with a storm window, can be just as energy-efficient as a new window.

For more tips on green historic windows, see www.preservationnation.org/issues/sustainability/additional-resources/July2008WindowsTipSheet.pdf

Caution [EA56/59]

Be careful of lead-based paints and enamels on older windows, trims, and **sashes**.

Incentive [EA57]

Rebates and Tax Credits for Windows, Doors, and Skylights: www.energystar.gov/index.cfm?c=windows_doors.pr_tax-credits

Upgrade existing exterior door [EA57]

BENEFITS		FEASIBILITY	
ENERGY SAVINGS:	WATER SAVINGS:	INITIAL COST:	
RESOURCE CONSERVATION:	AIR QUALITY: N/A	DIFFICULTY LEVEL:	

An exterior door that is old, improperly installed, or not well sealed can contribute significantly to energy losses in a home. If the home has older doors or if installing a new door can be included as part of a larger home improvement project, replacing them will result in lower heating and cooling costs. Adding a storm door can be a good investment if a home's existing door is old but still in good condition, however, adding a storm door to a newer, insulated door is not generally worth the expense since it won't save much more energy.[3] When selecting a door for energy efficiency, consider its **energy performance rating** and look for the **Energy Star®** and **National Fenestration Rating Council** Label. Check for federal tax credits and state and local incentives for qualifying doors.

Provide shading of skylights as needed [EA61]

BENEFITS		FEASIBILITY	
ENERGY SAVINGS:	WATER SAVINGS: N/A	INITIAL COST:	
RESOURCE CONSERVATION: N/A	AIR QUALITY:	DIFFICULTY LEVEL:	

Rooftop skylights, especially when facing south or west, cause significant household heat gain. Some skylights have built-in blinds mounted between the panes of glass that open and close to control heat gain. Skylights with **electrochromic glazing** to allow users to tint the glass with a push of a button. These are expensive, however, and while some exterior shading options are effective, they are not readily available. Translucent panel skylight systems are an alternative that provides optimal daylighting without glare that minimizes heat transfer. The best option is to install skylights only on north or east facing roofs.

Tips [EA65]

Turn ceiling fans off when rooms are unoccupied.

Open both sections of double-hung windows to allow cool air in the lower window and warmer air to escape upper windows.

Consider a solar powered attic or **whole house fan** for additional energy savings.

Isolate attached garages HS1 [IEQ165]

BENEFITS		FEASIBILITY	
ENERGY SAVINGS:	WATER SAVINGS: N/A	INITIAL COST:	
RESOURCE CONSERVATION: N/A	AIR QUALITY:	DIFFICULTY LEVEL:	

Rooms attached to a garage often suffer from poor indoor air quality and air leakage. For health, safety and energy efficiency reasons, it is important that air and thermal barriers be complete and continuous between these two spaces. Installing an exhaust fan or vent in the garage can also help in removing fumes from cars and chemicals stored in the garage.

NJ Bio-Region [EA65]

Shore locations can save cooling costs by capturing natural shore breezes from ocean-facing windows.

Use ceiling fans for natural ventilation [EA65]

BENEFITS		FEASIBILITY	
ENERGY SAVINGS:	WATER SAVINGS: N/A	INITIAL COST:	
RESOURCE CONSERVATION:	AIR QUALITY:	DIFFICULTY LEVEL:	

Use ceiling fans in conjunction with an air conditioning system in occupied rooms; people can tolerate higher temperatures when air is in motion. This reduces air conditioning use, saving money

Building Age [EA65]

Older homes pose challenges to designing optimal mechanical cooling, so consider ventilation options before installing air conditioning. Many older homes have cross ventilation systems built into their original design, as they were built before air conditioning became commonplace.

and electricity. In the summer, run ceiling fans in a counterclockwise motion. Ceiling fans can be used in the winter in a clockwise motion at low speeds to bring warm air back down into the occupied space.

Also consider a whole house fan to avoid air conditioner usage and expense. Generally a whole house fan is used at night and turned off during the day. It moves cooler nighttime air into the house through open windows and exhausts warm air through the attic.

Another way to cool the home is with **transoms** in window and door designs. Designing for convection directs cool air to enter the home on the lower floors (such as through the basement) and expels warm air through upstairs windows.

Strategic location of plants and landscaping can cool (and clean) the air before it enters the home. Finally, **awnings** and blinds provide additional passive cooling options.

Install a programmable thermostat [EA67]

BENEFITS			FEASIBILITY	
ENERGY SAVINGS:	WATER SAVINGS: N/A		INITIAL COST: $	
RESOURCE CONSERVATION: N/A	AIR QUALITY: N/A		DIFFICULTY LEVEL: T	

Programmable thermostats save energy and money by allowing homeowners to set temperatures based on occupancy and to schedule setting changes. This uses heating and cooling only when needed. **Programmable thermostats** are especially useful if the house is empty during the work week and only fully occupied on weekends. Pre-programming and proper use of a programmable thermostat saves energy costs by minimizing heating or cooling of an empty house. Save up to 2 percent on one's energy bill per 8-hour period by lowering the temperature in the winter from 2-5 degrees while no one is home or when occupants are asleep.[4]

Make sure ductwork is clean HS1 HS3 [EA71]

BENEFITS			FEASIBILITY	
ENERGY SAVINGS:	WATER SAVINGS: N/A		INITIAL COST: $$$	
RESOURCE CONSERVATION:	AIR QUALITY:		DIFFICULTY LEVEL: TTT	

Duct cleaning refers to the cleaning of heating and cooling system components in forced air systems, including the supply and return-air ducts, registers, grilles, **diffusers**, **heat exchangers**, **heating and cooling coils**, **drain pans**, fan motor, fan housing, and the air handling unit. While clean ducts help maintain healthy indoor air quality, unless done properly, cleaning ducts can cause more indoor air problems.

If a visual inspect reveals infestation, mold or extreme debris problems, duct cleaning may be necessary. If so, be sure the service provider cleans all components of the system to avoid any recontamination that may require more serious cleaning needs. Be sure the service provider is qualified by the **National Air Duct Cleaners Association (NADCA)**. A certified service provider uses specialized tools to dislodge dirt and other debris in ducts and vacuums them out with a high-powered vacuum cleaner. Different types of ducts require different cleaning methods; sheet metal ducts with external insulation are the easiest to clean. A **Duct Blaster Test** should also be performed when cleaning ducts to gauge the tightness of the ductwork. Finally, be sure to cover duct registers and openings during renovation or remodeling.

Caution [EA65]

Fresh air is essential for indoor air quality and combustion safety, but energy-efficient homes may minimize air flows including fresh air. **Energy Star®** homes require a controlled mechanical vent to assure air exchanges such as a programmable bathroom fan.

Avoiding mold build-up in high humidity areas of the house may require mechanical cooling with dehumidifying capabilities.

Tips [EA67]

Before purchasing, check the compatibility of the thermostat with the respective **HVAC** system.

Make sure the thermostat selected operates via battery versus obtaining some power from the 24V AC **HVAC** lines.

Tips [EA71]

Cover air ducts and vents during any renovation. This can be done easily with duct tape and plastic and helps to avoid having to clean the ducts prematurely.

Caution [EA71]

Cleaning ducts is best done by a trained professional because if done improperly it can lead to the release of harmful contaminants and particles into the air.

Install effective ventilation HS1 [IEQ166-167/172]

BENEFITS			FEASIBILITY	
ENERGY SAVINGS:		WATER SAVINGS: N/A	INITIAL COST:	$$$
RESOURCE CONSERVATION: N/A		AIR QUALITY:	DIFFICULTY LEVEL:	TTT

To maintain healthy indoor air quality requires proper ventilation in bathrooms, kitchens, garages and utility rooms. Kitchen exhaust hoods are an important fire safety requirement and generally aid in improving ventilation. In bathrooms and other moist areas ventilation is key to preventing mold and mildew. Installing a fan appropriate to the size of the bathroom can help keep moisture levels down. Increase efficiency by reducing the number of sharp turns in the ductwork. For quiet bathroom and kitchen fans, look for units that produce less than 1.5 **sones** while in use.

Offices and hobby rooms with large amounts of electronics also need extra air conditioning to handle extra heat created. Garages and storage rooms where hazardous materials are stored will require a higher rate of ventilation than other rooms in the house. If the entire house has a ventilation system, increase the rate in these specific rooms. If no complete ventilation system is installed, provide an exhaust fan in each room where necessary. Installing ductwork and exhaust fans can be complicated; using a licensed contractor is recommended.

Provide fresh air in ventilation system HS4 [IEQ171]

BENEFITS			FEASIBILITY	
ENERGY SAVINGS:		WATER SAVINGS: N/A	INITIAL COST:	$$$
RESOURCE CONSERVATION:		AIR QUALITY:	DIFFICULTY LEVEL:	TTT

When closing leaks and tightening a building's envelope, mechanical ventilation becomes extremely important. Bringing fresh air into the spaces where people spend the most time in the home is important to maintain healthy indoor air quality. Relying on open windows for ventilation may not be enough during fall and spring, when pressure differences cannot properly ventilate the home. Also for those with allergy problems, open windows can cause respiratory problems and possibly complicate current health problems. Include a fresh intake on **HVAC** systems or install a dedicated ventilation system if necessary. Use a **heat- recovery ventilator (HRV)** that uses excess heat from the home to efficiently heat incoming fresh air. Installing **HVAC** and ventilation systems requires a licensed professional.

Vent all combustion-based equipment HS1 [IEQ168]

BENEFITS			FEASIBILITY	
ENERGY SAVINGS:		WATER SAVINGS: N/A	INITIAL COST:	$
RESOURCE CONSERVATION: N/A		AIR QUALITY:	DIFFICULTY LEVEL:	TT

Anytime **combustion equipment** is introduced into the home, it must be properly ventilated. Failing to properly vent **combustion equipment**, can introduce toxic gases into the house. This is most often caused by **backdrafting**, where unstable pressure in the equipment that relies on a natural draft to invert, instead forces the gases back into the building. To avoid **backdrafting**, choose equipment with **sealed combustion** or **power-vented combustion**. Most of the newer high-efficiency models already incorporate these features into their design. Wherever this equipment is installed, be sure to install a **carbon monoxide** detector to warn occupants if gas leaks into the building. Avoid unvented **combustion equipment** in the home because they release **carbon monoxide** and other toxic gases and add water vapor into the air, leading to potential mold and mildew problems.

NJ Bio-Region [IEQ171]

Urban areas of New Jersey may need to have better air ventilation and filtration.

Caution [IEQ171]

Improper pressure balancing can cause **radon** from the soil to leak into the house. Follow the new **ANSI/ASHRAE** Standard 62.2, Ventilation and Acceptable Indoor Air Quality in Low-Rise Residential Building.

Building Age [IEQ168]

In older homes, existing boilers and furnaces may not have a built-in power ventilation or **sealed combustion**. In these cases consider installing a fresh air intake or exhaust fan near the equipment.

Caution [IEQ168]

Improper venting of **combustion equipment** can lead to poor indoor air quality, releasing **carbon monoxide** and other contaminants into the air. Install a **carbon monoxide** detector where necessary.

Install automatic shut-off bathroom fans HS3 [IEQ167]

BENEFITS			FEASIBILITY	
ENERGY SAVINGS:	WATER SAVINGS:		INITIAL COST:	
RESOURCE CONSERVATION:	AIR QUALITY:		DIFFICULTY LEVEL:	

When installing a bathroom fan, find one that is quiet and of the appropriate size for the space. Installing a timer on a bathroom fan helps reduce energy consumption and improves indoor air quality. After showering, moist warm air in the bathroom contributes to mold and mildew growth. Installing an automatic timer vents the room and saves energy. Some bathroom fans come with a moisture sensor and turn off automatically once the room has been properly vented. Look for **Energy Star**® certified fans.

In general, exhaust fans should stay on for one hour after a bath or shower to effectively remove excess moisture from the room. A fan equipped with a timer ensures the fan remains on long enough to exhaust moisture completely. An electronic timer is quieter than a mechanical timer and offers a wide range of settings. Choose a timer setting with easy-to-understand instructions and be certain the timer itself is easy to operate. A delayed fan shut-off will keep the fan running for at least one hour after the homeowner leaves the room. Another option includes a motion sensor that activates the fan when anyone enters the bathroom.

Tips [IEQ167]

Fan loudness is measured in **sones.** The best fans have sound ratings of 0.5 **sones** or less. Avoid units that produce 4 **sones** or more.

Caution [IEQ167]

While most molds do not harm healthy people, people with allergies or asthma may be more sensitive.

Provide daylighting [EA83]

BENEFITS			FEASIBILITY	
ENERGY SAVINGS:	WATER SAVINGS: N/A		INITIAL COST:	
RESOURCE CONSERVATION:	AIR QUALITY: N/A		DIFFICULTY LEVEL:	

Sunlight is a natural way to reduce energy use during the daytime hours. Homes that only require artificial lighting at night and on darker days save more electricity and are more aesthetically pleasing than ones that do not.

Windows and skylights are obvious sources of daylight, but balance daylight access with appropriate **glazing** and shading techniques. Poorly designed window or skylight layouts can increase summer **cooling loads** significantly. **Awnings**, **louvers**, and shutters can block direct sunlight and allow indirect sunlight into the building. Conversely, a well-designed scheme reduces **heating loads** significantly in the colder months. In the northern hemisphere, south-facing windows receive the most sunlight over the course of the day. For these windows, properly sized overhangs will shade the window from direct summer heat but will allow the lower winter sunlight to filter through.

An alternative to window skylights is **solar tubes**. The flexible cylinders of the **solar tubes** draw sunlight from the roof into a ceiling fixture resembling a standard lighting fixture. They are useful in smaller interior rooms without space for a traditional skylight, such as a bathroom. Translucent panel skylight systems are another means of allowing in sunlight without producing glare and minimizing heat transfer.

Provide appropriate lighting [EA84]

BENEFITS			FEASIBILITY	
ENERGY SAVINGS:	WATER SAVINGS: N/A		INITIAL COST:	
RESOURCE CONSERVATION:	AIR QUALITY: N/A		DIFFICULTY LEVEL:	

Lighting consumes almost 15 percent of a household's electricity use.[5] Provide an appropriate mix of color-correct **ambient** and task lighting to improve both the quality and quantity of lighting used in the home.

Tips [EA84]

The U.S. Department of Energy offers the following energy-efficient lighting design tips:

- Remember that more light is not necessarily better. Human visual performance depends on light quality as well as quantity.
- Match the amount and quality of light to the performed function.
- Install **task lights**, such as desk lamps, where needed and reduce **ambient light** elsewhere.
- Use energy-efficient lighting components (i.e., **CFLs**, **LEDs**), controls, and systems.
- Maximize the use of daylighting.

Caution [EA84]

Fluorescent bulbs and lamps are considered hazardous waste and should be disposed of properly. If a bulb breaks, avoid direct contact with skin. Burned out or broken **fluorescent lamps** should be brought to a facility that recycles them. Check with your County's Solid Waste and Recycling Department or enter your zip code at www.Earth911.com to find out where you can recycle these materials.

Tips [EA85]

Not all **CFLs** are dimmable, so be sure to check before purchasing for a dimmable fixture.

Unplug **LED** lit appliances when not in use to further reduce energy costs.

Caution [EA85]

The **CFLs** contain traces of mercury; cleaning up a broken **CFL** must be done carefully, and check with your municipality for recycling instructions when bulbs wear out.

Tips [MR126]

Recycling opportunities for dry-wall cut-off waste are generally quite limited; on-site recycling of ground, unpainted **gypsum board** as a soil amendment is permissible in many locations.

Two ways of determining which lighting is appropriate for a particular use are its **color temperature** and its **Color Rendering Index (CRI)**.

Color temperature defines the color and warmness or coolness of a light source. **Color temperature** is measured in degrees **Kelvin (K)**. High **Kelvin** temperatures (3600–5500 **K**) are considered "cool" and low color temperatures (2700–3000 **K**) are considered "warm." Task lighting calls for cool light that produces a higher contrast than warm light and is better for visual tasks. Warm light is recommended for living spaces. A **color temperature** of 2700–3600 **K** is generally recommended for most indoor general and task lighting applications.

The **Color Rendering Index (CRI)** is a 1-100 scale that measures how colors appear under different light sources. A light source with a **CRI** of 80 or higher is considered acceptable for most indoor residential applications.

Install energy-efficient lighting [EA85]

BENEFITS		FEASIBILITY	
ENERGY SAVINGS:	WATER SAVINGS: N/A	INITIAL COST:	
RESOURCE CONSERVATION: N/A	AIR QUALITY: N/A	DIFFICULTY LEVEL:	

Traditional incandescent bulbs will be phased out by 2012. The technological improvements in **compact fluorescent lighting (CFLs)** over the past decade have made for a smooth transition. **CFLs** are inexpensive, last ten times as long as traditional bulbs, and use a fraction of the electricity. They also fit into standard light fixtures, allowing for their widespread use with minimal up-front cost.

Light-emitting diodes (LEDs), currently used in a variety of applications, potentially could find their way into more traditional lighting applications. Highly efficient, durable, and non-toxic, **LEDs** currently cost too much to warrant their widespread use. However, rapid advances in **LED** technology continue to push **LED** lighting to more practical uses.

Wherever possible, replace incandescent bulbs with greener alternatives. It is a simple and affordable way to significantly reduce home energy use.

Provide controllable interior shading [IEQ187]

BENEFITS		FEASIBILITY	
ENERGY SAVINGS:	WATER SAVINGS: N/A	INITIAL COST:	
RESOURCE CONSERVATION: N/A	AIR QUALITY: N/A	DIFFICULTY LEVEL:	

Rooms used frequently should have shades to reduce heat gain and minimize glare from natural light. Venetian or vertical blinds are effective, easy to install, and efficient means to control light entering the building. Manual and motorized screen shades are another means of interior shading. Accordion-shaped blinds effectively create an added layer of air preventing further heat loss Window quilts can be used at night to prevent warm air from escaping.

Install eco-friendly interior sheathing HS3 [MR126]

BENEFITS		FEASIBILITY	
ENERGY SAVINGS: N/A	WATER SAVINGS: N/A	INITIAL COST:	
RESOURCE CONSERVATION:	AIR QUALITY:	DIFFICULTY LEVEL:	

Paper-faced drywall is the most common and least expensive finishing for interior walls. It is easy to work with and its paper composition is typically recycled from 100 percent **post-consumer** waste. However, paper-faced drywall is highly susceptible to moisture damage and mold growth; do not use it in moist areas of the home.

Fiberglass-faced drywall is a paperless **gypsum** panel often used for exterior **sheathing** and interior walls in mold-prone areas. It contains no **cellulose**, which supports mold growth. Fiberglass-faced drywall, however, cannot be recycled and because of the fiberglass it cannot be ground for use as a soil amendment.

Select eco-friendly interior doors [MR127]

BENEFITS		FEASIBILITY	
ENERGY SAVINGS: N/A	WATER SAVINGS: N/A	INITIAL COST: $	
RESOURCE CONSERVATION:	AIR QUALITY:	DIFFICULTY LEVEL:	

Look for recycled interior doors from salvage yards or reuse vendors or choose new doors that are **formaldehyde**-free or have **urea-formaldehyde-free** wood components. Doors that are **FSC-certified** ensure the wood was **sustainably harvested**. Using recycled products or **sustainably harvested** wood saves **virgin materials** from extraction and helps the environment.

Choose eco-friendly paints, sheens, and finishes [IEQ185/MR130/131]

BENEFITS		FEASIBILITY	
ENERGY SAVINGS: N/A	WATER SAVINGS: N/A	INITIAL COST: $	
RESOURCE CONSERVATION: N/A	AIR QUALITY:	DIFFICULTY LEVEL:	

Traditional paints, finishes and coatings contain a variety of hazardous chemicals including **volatile organic compounds** (**VOC**s) which can be harmful to human health. Choosing zero- or low-**VOC** paints significantly improves indoor air quality. These products are readily available and come in a wide variety of colors and finishes. Also, choosing appropriate sheens can improve the durability of wall and other finished surfaces. For places that will be washed frequently use sheens with a high "scrubbability" rating.

To further reduce chemicals used in paints, manufacturers have recently introduced products made almost exclusively from plant oils and minerals. When possible, consider using natural paints, varnishes, finishes, and plasters instead of conventional petroleum-based products to help improve indoor air quality. The increasing availability of natural products has helped make them more competitively priced.

Consider tile with recycled content [MR132]

BENEFITS		FEASIBILITY	
ENERGY SAVINGS:	WATER SAVINGS: N/A	INITIAL COST: $$	
RESOURCE CONSERVATION:	AIR QUALITY:	DIFFICULTY LEVEL:	

When choosing tile and trim pieces, look for products that contain **recycled content** to help conserve natural resources. Utilizing waste from other products reduces the need for **virgin materials**. Recycled products can be made from glass and **pre-consumer** industrial waste.

NJ Bio-Region [MR126]

In high humidity areas request products that are resistant to moisture.

Caution [MR126]

Do not recycle or use fiberglass drywall for soil amendment.

Caution [MR127]

Salvaged or reused doors may have lead-based paint or traces of **formaldehyde** (used for drying).

Caution [IEQ185]

People with sensitivities to **terpenes** and other chemicals may still be affected by natural finishes. Follow the manufacturer's instructions to properly apply any paint products.

Tips [MR129/IEQ186]

An easy and inexpensive way to avoid mold and mildew growth in walls, moist areas and basements is to use **porous** paints or clay treatments. Preventing moisture build up improves the overall health of the home.

Select eco-friendly wall coverings HS1 [MR129/IEQ186]

BENEFITS			FEASIBILITY	
ENERGY SAVINGS: N/A	WATER SAVINGS: N/A		INITIAL COST: $$	
RESOURCE CONSERVATION: N/A	AIR QUALITY:		DIFFICULTY LEVEL:	

When it is time to update wall covers, look for low-**VOC**-emitting products. Traditional wallpaper is coated with **PVC** and **plasticizers** that over time release chemicals found to interrupt the **endocrine system**. These impermeable plastic coatings also keep moisture in the walls which can lead to mildew and mold. Research linking the production and **off-gassing** to potential health effects spurred the introduction of many new low-**VOC** and natural fiber products. These products help reduce airborne chemicals and protect indoor air quality. They also prevent moisture retention behind walls. Natural and low-**VOC** products are slightly more expensive than traditional products and may need special care when installing. Follow any manufacturing guidelines that may come with the product.

Caution [MR183]

Moisture resistant "green board" that is coated with wax and still uses paper is not recommended.

Use non-paper-faced gypsum board in moist areas HS3 [IEQ183]

BENEFITS			FEASIBILITY	
ENERGY SAVINGS: N/A	WATER SAVINGS: N/A		INITIAL COST: $$	
RESOURCE CONSERVATION:	AIR QUALITY:		DIFFICULTY LEVEL:	

Minimize mold growth and maintain high indoor air quality and durability by using better wall and ceiling finishes. **Gypsum board (drywall)** is a universally used building product in the U.S. available in several varieties that resist mold growth. The most reliable is non-paper-faced **gypsum board**. Paper components absorb moisture because paper is a food source for mold. Non-paper-faced **gypsum**, originally developed for exterior **sheathing**, is useful in moist areas such as basements and bathrooms.

In damp areas, **cement board**, **mortar**, or non-paper faced **gypsum** can be used safely. Paper-faced **gypsum board** should never be used as backer for tub or shower surrounds where ceramic tile, marble, or any material with joints or grout lines is used as the finish. While more expensive to purchase than conventional paper-faced products, there are long-term savings in preventing damage from mold growth. Mold resistant paper faced board should not be used in damp areas. It is important to seek comparable data to assess performance of other mold resistant claims by manufacturers, as little independent analysis is available.

Use low-VOC construction products [IEQ187]

BENEFITS			FEASIBILITY	
ENERGY SAVINGS: N/A	WATER SAVINGS: N/A		INITIAL COST: $	
RESOURCE CONSERVATION: N/A	AIR QUALITY:		DIFFICULTY LEVEL:	

Like paints and coating products, construction adhesives, grout, caulking, and sealants can have high VOC content. Low-**VOC** products are becoming readily available and are just as durable as conventional products. Avoiding products with **VOCs** improves indoor air quality.

Avoid carpeting in moist areas HS3 [IEQ179]

BENEFITS		FEASIBILITY	
ENERGY SAVINGS: N/A	WATER SAVINGS: N/A	INITIAL COST: $	
RESOURCE CONSERVATION:	AIR QUALITY:	DIFFICULTY LEVEL:	

Carpeting may provide comfort, but it produces airborne dust and releases particulates from both the carpet and the padding. Avoid carpet in moist rooms or "high-spill areas" to maintain healthy indoor air quality. Carpets are difficult to clean, take time to dry properly, and can retain dust and dirt tracked in from the outdoors. Older carpet padding can deteriorate over time and may release **flame retardant** chemicals into the air.

Reuse existing flooring and subflooring HS3 [MR133]

BENEFITS		FEASIBILITY	
ENERGY SAVINGS:	WATER SAVINGS: N/A	INITIAL COST: $	
RESOURCE CONSERVATION:	AIR QUALITY:	DIFFICULTY LEVEL:	

A great way to reduce the use of natural resources is to reuse old flooring. Often homes are made with structurally sound hardwoods or concrete. Refinishing these existing floors reduces the need to harvest new materials and reduces exposure to chemical **off-gassing** from new products. There are many new low- or no-**VOC** products for refinishing flooring.

Choose hard, low-formaldehyde floors [IEQ180/MR134]

BENEFITS		FEASIBILITY	
ENERGY SAVINGS: N/A	WATER SAVINGS: N/A	INITIAL COST: $$	
RESOURCE CONSERVATION:	AIR QUALITY:	DIFFICULTY LEVEL:	

Hard surface and low-**formaldehyde** flooring improves indoor air quality significantly. Hard surface floors do not hold dust and particles making them easier to keep clean. Also, by using materials such as concrete, a homeowner reduces the amount of natural resources used for flooring. If choosing to use new wood, look for **FSC-certified wood** to ensure sustainable harvesting practices. Many floor tile now use recycled materials. Always use low- or no-**VOC** adhesives, grout, and sealants when installing flooring.

Use reclaimed or renewable materials [MR135-136]

BENEFITS		FEASIBILITY	
ENERGY SAVINGS:	WATER SAVINGS: N/A	INITIAL COST: $$	
RESOURCE CONSERVATION:	AIR QUALITY:	DIFFICULTY LEVEL:	

Choose wood flooring responsibly to preserve natural resources. **Reclaimed** or **rapidly renewable materials** (like bamboo, cork or linoleum) significantly reduce the pressure on natural forests. If a homeowner decides to buy new wood flooring, choose **FSC-certified wood** to ensure the manufacturers followed sustainable harvesting practices. Other products made from cork, wheat, and recycled waste paper offer environmentally benign options. As with other finishing products, always look for low-**formaldehyde** and low-**VOC** floor finishing products to maintain a healthy indoor environment.

Tips [IEQ179]

Using area rugs instead of wall-to-wall carpeting can help to create comfort in the home while also being easier to remove and clean to prevent the build-up of pollutants in the air.

Caution [IEQ179]

Older carpet cushions deteriorate over time and release harmful chemicals into the air.

Building Age [MR133]

Make sure flooring is structurally sound before reusing it in older homes.

Caution [MR133]

Beware of the possibility of lead based paints and **asbestos** in existing wood floors. Look at **HUD** and **EPA** guidelines for dealing with **asbestos** and lead-based products.

Refinish floors with eco-friendly products HS1 [MR137]

BENEFITS		FEASIBILITY	
ENERGY SAVINGS: N/A	WATER SAVINGS: N/A	INITIAL COST: $	
RESOURCE CONSERVATION: N/A	AIR QUALITY:	DIFFICULTY LEVEL:	

When remodeling, reusing old wood flooring both conserves resources and preserves the character that older hardwoods gather over time. However, when looking to refinish these floors, be advised that older floors may have lead-based paint on them and should be tested. When selecting finishes, look for zero- or low-**VOC** finishes or a finish derived from a natural product like plant oils (i.e. , linseed) or beeswax. This helps maintain the home's indoor air quality. Some products may be hard to find so leave time to special order. Whenever possible, avoid products with **heavy metals** or harsh **solvents**. If a container has any "danger" or "warning" symbols, try and choose a different less toxic alternative. Beware of "organic" labels with finishes. Organic food is a good thing, but in terms of finishes, 'organic' could mean they are created from petrochemicals and probably contain **solvents**. Always have a constant flow of fresh air in areas when applying a finish and wear a mask for added protection. Overall, zero- or low-**VOC** products may cost more initially, but they pay off through reduced health concerns.

Select eco-friendly carpeting HS3 [IEQ182/MR129]

BENEFITS		FEASIBILITY	
ENERGY SAVINGS: N/A	WATER SAVINGS: N/A	INITIAL COST: $$	
RESOURCE CONSERVATION:	AIR QUALITY:	DIFFICULTY LEVEL:	

Wall-to-wall carpeting and large-area carpets can affect air quality in the home. The carpets and pads are difficult to clean and dry properly (creating an environment for mold and mildew) and hold on to dust and other particles. Small area rugs that accent hard floors are easier to remove and clean. Furthermore, new carpets and rugs may contain **VOCs** that **off-gas** and are unhealthy to breathe.

To reduce environmental and health impacts, look for carpets made from natural fibers with little or no chemical treatment. Also, purchase carpets with natural-fiber backing attached with less-toxic adhesives. Recommendations include organic cotton, hemp, **sisal**, seagrass, **jute**, or wool. Buying carpet "tiles" instead of a broadloom piece, as individual tiles can be replaced easily. Finding carpet made with low-**VOC** adhesives that meets Carpet and Rug Institute indoor-air quality standards. Use tacks instead of adhesive and look for **recycled content** or **reclaimed** carpet.

Install water-saving fixtures [WE42-44]

BENEFITS		FEASIBILITY	
ENERGY SAVINGS:	WATER SAVINGS:	INITIAL COST: $	
RESOURCE CONSERVATION: N/A	AIR QUALITY: N/A	DIFFICULTY LEVEL:	

Kitchens and bathrooms continue to be a source of significant daily water waste. Replacing existing toilets, faucets, and showerheads can reduce home water and save money. It takes energy to deliver, heat and treat water, so by using less water a homeowner decreases energy use in the home. By installing a **WaterSense Labeled** High Efficiency Toilet that uses 1.28 gallons or less per flush, a homeowner can save a large amount of water and significantly reduce a home's water utility bill. Dual flush toilets have two buttons, a light flush that uses 0.9 gallons of water and a heavy flush that uses 1.6 gallons of water. When looking to replace faucets, look for fixtures that have a flow rate of 2.0 to 1.5. For replacing showerheads look for showerheads that uses less than 2.5 gpm.

Tips [WE42-44]

Leaks are one of the biggest causes of water waste in a home. When looking to reduce water usage, first check and repair any leaks. To check for a leak, turn off all water using appliances off in your home. Then go to the water meter and observe the location of the dial and see if it is moving. If it is moving then there is a leak. Also check the position of the dial and return in 10 minutes; if it has moved, then there is a slow leak.

Caution [WE42-44]

When older shower heads are replaced with low flow models, the valves must also be changed in accordance with the model. This will ensure that the shower head functions properly and avoids scalding.

Install water filtration system [IEQ175-176]

BENEFITS		FEASIBILITY	
ENERGY SAVINGS:	WATER SAVINGS:	INITIAL COST:	
RESOURCE CONSERVATION:	AIR QUALITY: N/A	DIFFICULTY LEVEL:	

Home water filtration systems can remove some contaminants from water and improve taste. This is an inexpensive alternative to bottled water. There are several different systems available for under the sink filtration, which include **reverse osmosis**, **ultraviolet treatment**, and (most common and least expensive) are the **carbon or specialized media** filters. Also it is recommended to install filters on showerheads to remove chlorine from the water for bathing.

Include a plumbing access panel HS1 [MR123]

BENEFITS		FEASIBILITY	
ENERGY SAVINGS: N/A	WATER SAVINGS:	INITIAL COST:	
RESOURCE CONSERVATION:	AIR QUALITY: N/A	DIFFICULTY LEVEL:	

When putting in new piping, install an access panel for easy access to make repairs or upgrades. This allows for easy inspection and reduces the amount of materials to be removed and discarded in order to make an otherwise simple repair. Install the access panel at a location that is most convenient to areas that could need maintenance, like pipes going toward a shower or bath. Proper sealing of the panel avoids spaces where air and moisture can leak into the house.

Choose a high-efficiency water heater [EA79]

BENEFITS		FEASIBILITY	
ENERGY SAVINGS:	WATER SAVINGS:	INITIAL COST:	
RESOURCE CONSERVATION: N/A	AIR QUALITY: N/A	DIFFICULTY LEVEL:	

Hot water heaters are one of the biggest energy consumers in the house (between 14-25 percent of total energy usage).[6] By replacing or upgrading an existing hot water heater, a homeowner can reduce significantly the amount of energy consumed on a yearly basis. Electric hot water heaters are not recommended for home use because of high energy demand. Gas-fired heaters with an electric ignition are more efficient than those that use a pilot light. The efficiency of a hot water heater is also determined by the efficiency of the **heat exchangers**, the insulation value of the tank, and the configuration of the burner. Tankless water heaters are becoming increasingly popular. These systems heat water when it is needed and eliminate the wasted energy during the storage of the hot water. However, tankless systems are not for every household. If the house uses hot water frequently in short amounts (like washing hands a dozen times a day) than the system will never reach its peak efficiency and could be wasting energy. Evaluate the home's needs and speak to a professional before buying one of these systems. When looking at gas-fired systems, be sure to choose a closed **combustion** system to avoid releasing toxic fumes into the house. Also, always be sure that the area around is properly ventilated.

Tips [EA79]

For a small investment of around $20 you can buy an insulating kit for your hot water heater that pays for itself in only a few months. Insulating your water heater you increase its efficiency and decreases heat loss.

Incentive [EA79]

For efficient water heaters New Jersey BPU offers a $25 rebate:

www.njcleanenergy.com/residential/programs/warmadvantage/warmadvantage

For tankless water heaters homeowners can receive up to a $300 tax credit:

www.pseg.com/customer/home/install/waterheaters.jsp

Tips [MR122]

Insulating piping can help reduce heat losses, make a system more efficient and limit wasted water while waiting for hot water to reach the faucet.

Consider eco-friendly piping material [MR122]

BENEFITS		FEASIBILITY	
ENERGY SAVINGS: N/A	WATER SAVINGS: N/A	INITIAL COST: $$	
RESOURCE CONSERVATION:	AIR QUALITY: N/A	DIFFICULTY LEVEL:	

There are several common household piping options: cast iron, copper, **chlorinated polyvinyl chloride (CPVC)**, **PEX (cross-linked polyethylene)**, **vitrified clay**, and **HDPE (High Density Polyethylene)**. Heavy cast iron pipes are energy intensive to mine and manufacture, and can corrode over time. They are, however, good in situations with large temperature fluctuations. Mining ore for copper pipes damages the environment and the manufacture of the pipes are energy intensive. There is some **recycled content** in newer copper piping, but most is still **virgin material**. Copper piping has high heat conductivity, so they need insulation to be efficient. **PEX** pipes are composed of a plastic made from carbon and hydrogen so environmentally-speaking it is relatively clean. **Vitrified clay pipes** have the lowest thermal expansion and therefore are good in places with high temperature fluctuations. They are very durable and resist corrosion from chemical reactions, however, like iron, they are very heavy. Variety in the sizes for new piping systems maximize efficiency by better matching the size to the use. Copper pipes may need insulation, but **PEX**, since it can be matched to specific use, is more efficient and may not need any insulation. **CPVC** pipe is not recommended, for although it does not need much insulation and is very inexpensive, the environmental costs of production are very high.

Reconfigure plumbing for efficiency HS2 [EA77]

BENEFITS		FEASIBILITY	
ENERGY SAVINGS:	WATER SAVINGS:	INITIAL COST: $$	
RESOURCE CONSERVATION:	AIR QUALITY: N/A	DIFFICULTY LEVEL:	

Advancements in piping materials and plumbing systems cut installation and material costs, conserve water, and save energy. **Cross-linked polyethylene (PEX)** piping material has quickly earned a reputation as a durable replacement for copper because it is: [7]

- Flexible – allowing for fewer joints and an easier (and quicker) installation
- Durable - capable of withstanding extreme temperatures and highly resistant to chemicals
- Consumer friendly – quieter than traditional piping materials and offered in color-coded **PEX** tubing for simple identification of cold and hot water lines
- Energy-efficient – reduces heat loss from water in the pipe because it is a better thermal insulator than copper
- Water efficient – right-sizing capability allows for quicker hot water delivery

PEX also lends itself to **home run** or parallel pipe configurations in which hot and cold pipes originate at a manifold and service individual fixtures with dedicated supply lines. **Home-Run** systems can be installed more quickly (because of flexible piping) than more rigid and conventional "tree" type plumbing systems. The dedicated supply lines from the manifold to the fixture – particularly in the hot water supply lines – are often smaller in diameter for a **home-run** system, so less water goes down the drain while waiting for hot water at the fixture. Finally, **home-run** systems operate much like an electrical system breaker box, allowing homeowners to easily turn off the water for repairs or maintenance.

Install instantaneous hot water heater

BENEFITS			FEASIBILITY	
ENERGY SAVINGS:		WATER SAVINGS:	INITIAL COST:	$$
RESOURCE CONSERVATION:	N/A	AIR QUALITY:	N/A	DIFFICULTY LEVEL:

Installing an instantaneous or on-demand hot water heater greatly increases efficiency by eliminating the wasted heat during the storage of hot water. These devices save 8-14 percent compared to a conventional heater with a tank. When looking to install one of these hot water heaters, evaluate the home's water use first. If hot water use in the home is high, then this will not be the right system. If hot water use is relatively centralized, these systems can save on energy, materials for piping, and water wasted in the heating process. For these systems to run properly, they should be used with highly efficient fixtures. They do not provide the high flow rate of tank systems and provide lower water pressure than traditional tank systems. Use a professional to install these systems as they require specialized knowledge and some homes may not be equipped to meet the high voltage demanded by the electric version of these systems.

Select a high-efficiency clothes washer [EA92]

BENEFITS			FEASIBILITY	
ENERGY SAVINGS:		WATER SAVINGS:	INITIAL COST:	$$
RESOURCE CONSERVATION:		AIR QUALITY:	N/A	DIFFICULTY LEVEL:

Clothes washers are responsible for about 22 percent of household water consumption or about 13,000 gallons of water each year.[8] Today's energy-efficient washers reduce water use and energy bills.

Replace a clothes washer when 1) a repair will cost more than half the price of a comparably equipped new appliance, and 2) a washer is more than seven years old. If you are in the market for a new clothes washer consider the following:[9]

- In selecting a washer load capacity, consider the household's largest routine load – larger capacity means fewer loads, saving time and energy
- Front-loaders use less energy and water, are usually gentler on clothes, and have faster spin speeds that drain more water out of laundry than regular top-loaders do
- Look for washers with the **Energy Star® label**

Front-loading washers are more expensive than top-loading washers, but in New Jersey, rebates are available for units that meet Tier 3 **Energy Star®** standards which require a **Modified Energy Factor (MEF)** of 2.2 or higher and a maximum **Water Factor (WF)** of 4.4. There is no certification for dryers, but a unit with a moisture sensor turns off automatically when clothes are dry saves money and energy.

Select an energy-efficient refrigerator [EA93]

BENEFITS			FEASIBILITY	
ENERGY SAVINGS:		WATER SAVINGS:	N/A	INITIAL COST: $$
RESOURCE CONSERVATION:		AIR QUALITY:	N/A	DIFFICULTY LEVEL:

Refrigerators consume more electricity than any major kitchen appliance. Energy efficient refrigerators like **Energy Star®** models are about 40 percent more efficient than refrigerators built before 2001, and 50 percent more efficient than those built before 1993. If an existing refrigerator is more than 10 years old, consider upgrading to a refrigerator that meets or exceed **Energy Star®** standards as a new refrigerator with an **Energy Star®** label uses at least 20 percent less energy than one required by current federal standards.

Tips [EA92]

By using the cold-water option on a washer, one can save on energy bills by eliminating the energy needed to heat the water. Season and weather permitting, hang clothes to dry; most of the energy consumed by a single load of laundry is from drying, so by using the sun and fresh air one can reduce their energy consumption.

Incentive [EA92]

Check the New Jersey's Clean Energy Program for rebates on teligible **Energy Star®** qualified clothes washers.

www.njcleanenergy.com/misc/residential/clothes-washers-rebates

Tips [EA93]

Cleaning the refrigerator coils once or twice a year can help to improve an existing refrigerator's efficiency. Keep some distance around the refrigerator to allow for proper air flow around the coils.

Size, options and freezer compartment configurations affect energy use. A larger unit may be **Energy Star**®certified, but a smaller unit may still use less energy, so choose the smallest refrigerator that appropriately meets household needs. Features (such as water dispensers) use energy, so fewer features mean both greater energy efficiency and a lower likelihood of repairs. Top freezer models are generally more energy efficient than side-by-side models. Leave room around the unit for proper air flow around the cooling coils to ensure peak efficiency. Maintaining the unit is also important.

Choose an energy-efficient dishwasher [EA94]

BENEFITS		FEASIBILITY	
ENERGY SAVINGS:	WATER SAVINGS:	INITIAL COST:	
RESOURCE CONSERVATION:	AIR QUALITY: N/A	DIFFICULTY LEVEL:	

Most dishwasher energy use goes toward heating water, however, today's high-efficiency dishwashers use as little as three gallons of water thanks to sensors, high-efficiency pumps, and improved filtration. The expected life of a dishwasher is 9-12 years, and the payback period for a new dishwasher is long, but studies suggest it is more sensible to replace a dishwasher that is more than six years old rather than pay for repairs. Look for dishwashers the carry the **Energy Star**® label, which are over 40 percent more energy-efficient than the minimum government standards.

Caution [EA95]

When installing a gas range or oven, make sure to properly vent the area since you are introducing **combustible gas** into your home.

Install energy-efficient cooking appliances [EA95]

BENEFITS		FEASIBILITY	
ENERGY SAVINGS:	WATER SAVINGS:	INITIAL COST:	
RESOURCE CONSERVATION:	AIR QUALITY:	DIFFICULTY LEVEL:	

Cooking itself does not contribute significantly to overall home energy use, but preheating does, making it sensible to invest in an energy-efficient model. When shopping for new cooking appliances or remodeling the kitchen, consider making a fuel switch since running gas pipes, vents, and electrical connections will influence the layout of the kitchen. Consider cooking preferences and local gas and electric rates. If another appliance such as a furnace, clothes dryer, or water heater is also on a switch list, take this into consideration when you look at placement and installation costs.

In general, electric ranges and ovens are more efficient than gas units. The most efficient ovens are convection ovens that cook by circulating hot air around the food, using only one-third as much energy to operate as conventional ovens. They produce further savings through reduced cooking times because the food is more evenly exposed to heat. Among electric ranges, induction models may cost more but they are also the most efficient.

In terms of gas units, look for electronic or thermal igniters instead of standing pilot lights. For smaller meals, consider using a microwave oven or a toaster oven that require less energy than a large oven. Self-cleaning gas or electric ovens are more efficient because they have more insulation than non-self cleaning models.

Tips [EA99]

Energy-saving features, such as sleep mode, can be deactivated by users; homeowners should not disable energy conservation features.

Select energy-efficient office equipment [EA99]

BENEFITS		FEASIBILITY	
ENERGY SAVINGS:	WATER SAVINGS: N/A	INITIAL COST:	
RESOURCE CONSERVATION:	AIR QUALITY:	DIFFICULTY LEVEL:	

Today there are about 18 million home-based business owners and 24 million telecommuters.[10] Working from home eliminates commute times and transportation related emissions, but it contributes to higher electricity bills to power office equipment and lighting. In fact, small electronic

devices alone account for 16 percent of an average home's energy bill. Office equipment that has earned the **Energy Star®** label uses less energy to perform regular tasks and automatically enter a low-power mode when not in use, thereby reducing **phantom loads**. Up to 75 percent of the electricity these units consume occurs while these devices are turned off.[11] When buying new office equipment, consider both the standby and the operating power consumption.

Energy Star® ratings are available for computers, monitors, printers, scanners, copiers, fax machines, multi-function devices (machines that combine printing, scanning, and faxing), lighting, cordless phones, answering machines, audio equipment, and room air conditioners.

Install single-throw shut-off valve [MR124]

BENEFITS		FEASIBILITY	
ENERGY SAVINGS: N/A	WATER SAVINGS:	INITIAL COST: $	
RESOURCE CONSERVATION:	AIR QUALITY:	DIFFICULTY LEVEL:	

A **single throw shut-off valve** is a quick inexpensive device to help prevent leakage problems. Installing this simple valve on the supply line for the hot and cold water efficiently allows the user to shut off a malfunctioning system before it leaks substantial amounts of water.[12]

Install drain pan for clothes washer [MR125]

BENEFITS		FEASIBILITY	
ENERGY SAVINGS: N/A	WATER SAVINGS:	INITIAL COST: $	
RESOURCE CONSERVATION:	AIR QUALITY:	DIFFICULTY LEVEL:	

More and more homeowners today install laundry rooms over finished spaces instead of in basements and utility rooms. Because of this trend, it is important to install a drain and **drain pan** below the clothes washer to avoid the damage that could be caused by a burst or a leak in the equipment. This will conserve resources and avoid potentially costly repairs.

Provide air-lock dryer vent [EA72]

BENEFITS		FEASIBILITY	
ENERGY SAVINGS:	WATER SAVINGS: N/A	INITIAL COST: $$	
RESOURCE CONSERVATION:	AIR QUALITY:	DIFFICULTY LEVEL:	

Vents for the dryer that expel hot moist air to the exterior can be a significant source of leakage. Install a vent cap to help reduce both air leakage to the exterior and the overall **heating load** in the home.

Minimize dryer duct length and turns [EA73]

BENEFITS		FEASIBILITY	
ENERGY SAVINGS:	WATER SAVINGS: N/A	INITIAL COST: $	
RESOURCE CONSERVATION: N/A	AIR QUALITY:	DIFFICULTY LEVEL:	

A dryer vents properly when it has the right resistance to air flow in the ductwork. Minimizing the length and number of turns in the duct improves the capacity of the dryer to run efficiently. If needed, install a booster exhaust fan, following the manufacturer's guidelines for the maximum turns and length to retain efficiencies from the improvement.

Tips [MR124]

Washer hoses are notoriously weak, so always close the valves when leaving home for an extended period.[13]

Caution [MR142-150]

Materials made outside the United States could exceed federal standards for formaldehyde, so look out for imported products with formaldehyde.

Select eco-friendly furniture HS2 [MR142/147-148/150]

BENEFITS		FEASIBILITY	
ENERGY SAVINGS: N/A	WATER SAVINGS: N/A	INITIAL COST: $$	
RESOURCE CONSERVATION:	AIR QUALITY:	DIFFICULTY LEVEL:	

Before purchasing new furniture, consider refurbishing or using existing furniture in new ways, or buying salvaged items. When purchasing new furniture, select products from companies with responsible business practices that use recycled materials, **FSC-certified wood**, **formaldehyde-free**, and **low-VOC** finishes. Also, spending a little more up front to purchase high quality, solid furniture and cabinetry will help prevent the premature replacement and maintenance of the home and will use fewer resources in the long run.

Look for furnishings made locally. Products produced outside the United States and Canada use more transportation resources traveling to New Jersey. These imports also tend to have fewer controls on **formaldehyde** and **VOC** content.

Choose moisture-resistant furniture for longer life to save money and preserve natural resources. Select products made from **certified sustainable wood**, **reclaimed** materials, bamboo, recycled or recyclable metal or plastic, fixable materials, and durable materials for further value.

Tips [MR149]

When installing new countertops, specify that they are installed in one piece and in a way that they eventually can be removed and reused easily.[14]

Caution [MR140]

Avoid salvaging cabinets that contain lead paint.

Select eco-friendly cabinetry and countertops [MR140/145/148-149]

BENEFITS		FEASIBILITY	
ENERGY SAVINGS: N/A	WATER SAVINGS: N/A	INITIAL COST: $$	
RESOURCE CONSERVATION:	AIR QUALITY:	DIFFICULTY LEVEL:	

When choosing materials for cabinets and countertops, consider salvaged items first. Refinishing old cabinets or furnishing countertops from salvaged stone or recycled material greatly reduces the energy intensity needed to process **virgin materials**.

If purchasing new cabinets, look for retailers that utilize recycled materials, **FSC-certified wood**, **formaldehyde**-free materials, and low-**VOC** finishes. In 2006, the Kitchen Cabinet Manufacturer's Association created a voluntary rating program called the Environmental Stewardship Program (ESP). ESP-certified cabinets are a good sustainable option. Conventional cabinetry contains urea **formaldehyde** that **off-gasses** at room temperature and can pose long-term health risks. Also consider wood veneer cabinets which give the look and feel of solid wood but use a fraction of the resources.

For countertops, there are several alternative materials that are more environmentally-friendly than conventional laminate or granite countertops. These include recycled concrete, glass tiles, plastic, paper composite, terrazzo, and wood.[13] Locally recycled or produced items are preferable, especially to imported furnishings from countries where standards on **VOCs**, **formaldehyde** and other toxic content may be more relaxed.

An investment in more durable high-quality materials, while more expensive initially, serves a dual purpose; not only will it benefit the environment and enhance the quality of the indoor environment, it will also save money and future resources by reducing the need for replacement of these items.

Support local craftsmen [MR153]

BENEFITS			FEASIBILITY	
ENERGY SAVINGS:	WATER SAVINGS: N/A		INITIAL COST:	
RESOURCE CONSERVATION:	AIR QUALITY: N/A		DIFFICULTY LEVEL:	

An easy way to promote sustainability is to buy art, furniture, and other home accessories from local artists and artisans. Usually local artists and **indigenous** peoples are more protective over the ecosystem. It is also possible to converse about the materials used in the production of their art if there are any particular concerns about their sources. Though almost any green product is available on the internet, a superior choice is to buy green products and services made and sold as close to home as possible. By doing so one uses products more appropriate to the local region and helps build a strong local economy.

Select furniture that is easy to clean [IEQ192]

BENEFITS			FEASIBILITY	
ENERGY SAVINGS: N/A	WATER SAVINGS:		INITIAL COST:	
RESOURCE CONSERVATION:	AIR QUALITY:		DIFFICULTY LEVEL:	

When looking for furniture and other items for the home, consider how easy they will be to clean and maintain. Items with reduced maintenance and cleaning needs are replaced less often, mitigating any higher up-front expenses by reducing future costs. Replacing furniture and household items less often conserves resources, reduces the need for new production, and eases the burden on landfills.

Materials that are easier to clean require fewer chemical products to be used within the home as well. Products that can be cleaned with natural "green" cleaning agents will also help maintain healthy indoor air quality.

Select healthier window treatments [IEQ193]

BENEFITS			FEASIBILITY	
ENERGY SAVINGS:	WATER SAVINGS: N/A		INITIAL COST:	
RESOURCE CONSERVATION:	AIR QUALITY:		DIFFICULTY LEVEL:	

Most people do not think about window treatments as a way to go green, but consciously selecting these elements can have positive impacts. Good window treatments reduce harmful **UV** radiation and increases passive heating in the winter while keeping out excess heat in the summer and generally reducing heat loss. However, some drapes are very **porous**, thus absorbing dust and airborne particles. The difficulty in removing dust or cleaning the drapes can degrade air quality inside the home. Also, avoid curtains treated with toxic flame-retardants which are unhealthy to inhale. If possible, choose **non-porous** treatments like blinds and shutters and be careful to look for products with zero- or low-**VOC** finishes.

Caution [IEQ193]

Look out for products with toxic **fire retardants**. The may volatize and contribute to poor indoor air quality.

Use green cleaning products/strategies [IEQ196]

BENEFITS		FEASIBILITY	
ENERGY SAVINGS:	WATER SAVINGS:	INITIAL COST:	
RESOURCE CONSERVATION:	AIR QUALITY:	DIFFICULTY LEVEL:	

Using environmentally conscious cleaning products is healthier for indoor air quality and for occupants. Given the frequent use and close exposure to the user, toxic **VOC**-releasing cleaning products are dangerous to be around and inhale. Using less toxic cleaning products also keeps rivers cleaner because when products do end up down the drain, they do less damage to the ecosystem. This is especially true for laundry and dishwashing detergent and bathroom cleaning products, which flow directly down the drain.

Regularly maintain equipment [EA91]

BENEFITS		FEASIBILITY	
ENERGY SAVINGS:	WATER SAVINGS:	INITIAL COST:	
RESOURCE CONSERVATION:	AIR QUALITY:	DIFFICULTY LEVEL:	

Regular maintenance of appliances and mechanical equipment in the home greatly reduces home energy demand and the amount of repairs and replacements that will need to be made on the equipment. Simple things, like vacuuming refrigerator coils, emptying the lint trap before every load in the dryer, cleaning oven trays, and emptying the dishwasher food scrap bin can help to keep equipment running efficiently and save money. Follow manufacturers' guidelines for maintaining various appliances.

Designate a built-in recycling center

BENEFITS		FEASIBILITY	
ENERGY SAVINGS: N/A	WATER SAVINGS: N/A	INITIAL COST:	
RESOURCE CONSERVATION:	AIR QUALITY: N/A	DIFFICULTY LEVEL:	

Recycling at home reduces household garbage and landfilling of useful materials by up to 75 percent. By recycling, one can also decrease the amount of **virgin materials** extracted from the environment and reduce the overall strain on natural ecosystems. Many products containing toxic **heavy metals** and **solvents** require special arrangements for disposal. Proper disposal or recycling of these products prevents the contamination of local waterways and soils.

When buying for the home, look for products that contain the most **post-consumer recycled content** to ensure the least impact on the environment (i.e. toilet paper made from recycled paper). Many home products, especially paper products, are becoming available with **recycled content**. As part of your kitchen design, include waste disposal compartments that allow easy sorting of recyclables into the relevant types, including paper, mixed glass metal and plastics, an aluminum can crusher, and even compost and hazardous waste. By incorporating recycling into a kitchen design, it's easy for homeowners to properly recycle waste.

Building Envelope

Properly detail window sills in wet areas [IDP26]

Resources:

Toolbase Services: Tech Set 2 Durable Building Envelope

www.toolbase.org

Properly seal and flash windows/skylights [IPD27]

Resources:

U.S. Department of Energy: Weather Resistant Barriers

www.eere.energy.gov/buildings/publications/pdfs/building_america/28600.pdf

Durability by Design: A guide for residential builders and designers

www.pathnet.org/sp.asp?id=984

Moisture Resistant Homes

www.pathnet.org/sp.asp?id=18574

Upgrade or replace existing windows [EA56/59]

Resources:

USEPA Energy Star®. Rebates and Tax Credits for Windows, Doors, and Skylights.

www.EnergyStar.gov/index.cfm?c=windows_doors.pr_taxcredits

U.S. Department of Energy: Windows

www.eere.energy.gov/consumer/tips/windows.html

Consumer Reports: Windows.

www.consumerreports.org/cro/home-garden/home-improvement/hardware-building-supplies/windows/windows-10-07/overview/wind-ov.htm

Efficient Windows Collaborative

www.efficientwindows.org/index.cfm

National Fenestration Rating Council

www.NFRC.org/

References:

[1] **Consumer Reports: Windows**

www.consumerreports.org/cro/home-garden/home-improvement/hardware-building-supplies/windows/windows-10-07/overview/wind-ov.htm

[2] **U.S. Department of Energy: Windows**

www.eere.energy.gov/consumer/tips/windows.html

Upgrade existing exterior door [EA57]

Resources:

U.S. Department of Energy: Exterior Doors

www.eere.energy.gov/consumer/your_home/windows_doors_skylights/index.cfm/mytopic=13610

USEPA Energy Star® Rebates and Tax Credits for Doors

www.EnergyStar.gov/index.cfm?c=windows_doors.pr_taxcredits

References:

[3] **U.S. Department of Energy: Exterior Doors**

www.energysavers.gov/your_home/windows_doors_skylights/index.cfm/mytopic=13620

Provide shading of skylights as needed [EA561]

Resources:

Efficient Windows Collaborative

www.efficientwindows.org/

The National Fenestration Research Council

www.NFRC.org/

SkyVision free software

www.irc.nrc-cnrc.gc.ca/ie/lighting/daylight/skyvision_e.html

Isolate attached garages [IEQ165]

Resources:

USEPA Energy Star® Thermal Bypass Checklist

www.EnergyStar.gov/

Five Steps to a Healthier Garage

www.web.extension.uiuc.edu/will/factsheets/family116.html

USEPA: Indoor Air Quality

www.EPA.gov/iaq/pubs/insidest.html

HVAC

Use ceiling fans for natural ventilation [EA65]

Resources:

U.S. Department of Energy: Ventilation

www.eere.energy.gov/consumer/your_home/space_heating_cooling/index.cfm/mytopic=12351

Forget AC! Cool Your Home Naturally by Carol Venolia and Kelly Lerner, Mother Earth News Homes: Guide to Affordable and Sustainable Building, Spring 2008.

www.MotherEarthNews.com

U.S. Department of Energy: Summer Energy Savers

www.energy.gov/4242.htm

Rocky Mountain Institute - Home Cooling

www.rmi.org/sitepages/pid208.php

USEPA Energy Star®

www.EnergyStar.gov/index.cfm?c=ceiling_fans.pr_ceiling_fans

Install programmable thermostats [EA67]

Resources:

American Council for an Energy Efficient Economy (ACEEE)

www.aceee.org/consumerguide/heating.htm

USEPA Energy Star® - Thermostats

www.EnergyStar.gov/index.cfm?c=thermostats.pr_thermostats

References:

[4] **American Council for and Energy-Efficient Economy**

www.aceee.org

Make sure ductwork is clean [EA71]

Resources:

Should You Have the Air Ducts in Your Home Cleaned?

www.EPA.gov/iaq/pubs/airduct.html

National Air Duct Cleaners Association

www.nadca.com/

Install effective ventilation [IEQ166-167/172]

Resources:

Home Ventilating Institute

www.hvi.org/

Oversized Kitchen Fans—An Exhausting Problem

www.homeenergy.org/archive/hem.dis.anl.gov/eehem/99/990113.html

Read This Before You Ventilate

www.buildingscience.com/documents/primers/bsp-042-read-this-before-you-ventilate-1

ASHRAE Standard 62.2: Ventilation and Acceptable Indoor

ASHRAE, Air Quality in Low-Rise Residential Buildings

www.bookmarki.com/ANSI-ASHRAE-62-2-2007-p/86158.htm

Provide fresh air in ventilation system [IEQ171]

Resources:

Home Ventilating Institute Library,

www.hvi.org/

ASHRAE Standard 62.2: Ventilation and Acceptable Indoor Air Quality in Low-Rise Residential Buildings, ASHRAE

www.bookmarki.com/ANSI-ASHRAE-62-2-2007p/86158.htm

Read This Before You Ventilate

www.buildingscienceconsulting.com/resources/mold/

USEPA: Ventilation for Homes

www.epa.gov/iaq/homes/

Vent all combustion-based equipment [IEQ168]

Resources:

Backdrafting: Causes and Cures

www.homeenergy.org/archive/hem.dis.anl.gov/

Building Performance Institute: Combustion Safety Test Procedure for Vented Appliances

www.bpi.org/documents/gold_sheet.pdf

Lighting and Electrical

Provide daylighting [EA83]

Resources:

Understanding High Performance Lighting: Room-by-Room Designs

www.ibacos.com/hpl5.html

U.S. Department of Energy: Consumer's Guide: Window Overhangs

www.eere.energy.gov/consumer/your_home/windows_doors_skylights/index.cfm/mytopic=13570

Southface: Passive Solar Design

www.southface.org/web/resources&services/publications/technical_bulletins/PSD-Passivesolarpercent2000-790.pdff

Low Impact Living: Install Solar Tube Lighting

www.lowimpactliving.com/blog/2008/01/14/how-to-install-solar-tube-light/

Provide appropriate lighting [EA84]

Resources:

New Jersey Clean Energy Program - Energy Efficiency Store for New Jersey Residents

www.energyfederation.org/njcleanenergy/default.php

Rensselaer Polytechnic Institute- Lighting Research Center

www.lrc.rpi.edu/

U.S. Department of Energy: Lighting Principles and Terms

www.eere.energy.gov/consumer/your_home/lighting_daylighting/index.cfm/mytopic=11990

References.

[5] **U.S. Department of Energy, EERE. 2008. AConsumer's Guide: Lighting**

www.eere.energy.gov/consumer/your_home/lighting_daylighting/index.cfm/mytopic=11980

Install energy-efficient lighting [EA85]

Resources:

Consumer Guide to Home Energy Savings, Lighting,ACEE 2009

www.aceee.org/consumerguide/lighting.htm

Energy Star® - Light Bulbs and Fixtures

www.energystar.gov/index.cfm?c=lighting.pr_lighting

EPA, Mercury – Spills, Disposal and Site Cleanup

www.epa.gov/mercury/spills/index.htm

Toolbase Services: LED Lighting

www.toolbase.org/Technology-Inventory/Electrical-Electronics/white-LED-lighting

Provide controllable interior shading [IEQ178]

Resources:

Window Orientation and Shading

www.fsec.ucf.edu/en/consumer/buildings/homes/windows/

Green Building Advisor - Do window shades save energy?

www,greenbuildingadvisor.com

Wall and Ceiling

Install eco-friendly interior sheathing [MR126]

Resources:

Green Building Advisor: Sheathing

www.greenbuildingadvisor.com

Select eco-friendly interior doors [MR127]

Resources:

REGREEN Reference Guide to Product Considerations

www.regreenprogram.org

Green Building Advisor: Interior Doors

www.greenbuildingadvisor.com

Choose eco-friendly paints, sheens, and finishes [IEQ185/MR130-131]

Resources:

REGREEN Reference Guide to Product Considerations

www.regreenprogram.org

Green Seal

www.greenseal.org/index.cfm

National Geographic Green Guide: Paint Buying Guide

www.thegreenguide.com/

Consider tile with recycled content [MR132]

Resources:

Green Buyer's Guide To Stone & Tile

www.bayarea.greenhomeguide.com/index.php/knowhow/entry/642/C225/

National Geographic Green Guide: Floor Buying Guide

www.thegreenguide.com/

Select eco-friendly wall coverings [MR129/IEQ186]

Resources:

Live Earth – Paint and Wallpaper

www.liveearth.org/2008/02/paint-or-wallpaper/

Green Seal

www.greenseal.org/

Green from Wall to Wall

www.edcmag.com/CDA/Archives8f8837e14c697010VgnVCM100000f932a8c0

Use non-paper-faced gypsum board in moist areas [IEQ183]

Resources:

Read This before You Design, Build or Renovate

www.buildingscienceconsulting.com/resources/foundations/

Use low-VOC construction products [IEQ187]

Resources:

U.S. Green Building Council

www.usgbc.org/ShowFile.aspx?DocumentID=2267

REGREEN Product Selection Resources

www.regreenprogram.org

Avoid carpeting in moist areas [IEQ179]

Resources:

House Dust Mites–OSU Extension Fact Sheet

www.ohioline.osu.edu/hyg-fact/2000/2157.html

Floors and Flooring Products

Reuse existing flooring and subflooring [MR133]

Resources:

National Wood Flooring Association

www.woodfloors.org/consumer/maintRenewal.aspx

National Geographic Green Guide: Floor Buying Guide

www.thegreenguide.com/

Choose hard, low-formaldehyde floors [IEQ180, MR134]

Resources:

Concrete Floor Finishes

www.toolbase.org

Floor Score: What and Why

www.rfci.com/int_FloorScore.htmorganic

Formaldehyde in the Home

www.arb.ca.gov/research/indoor/formaldgl08-04.pdf

Forest Stewardship Council

www.FSC.org

APA Wood – Formaldehyde Regulations

www.apawood.org/level_b.cfm?content=srv_env_form

Use reclaimed or renewable materials [MR135-136]

Resources:

Navigating the Flooring Ticket

www.bayarea.greenhomeguide.com/index.php/knowhow/entry/802/C22ether

REGREEN Product Selection Resources

www.regreenprogram.org

Refinish floors with eco-friendly products [MR137]

Resources:

Buyer's Guide to Clear Finishes

www.greenhomeguide.com/index.php/knowhow/

National Geographic Green Guide: Wood Finishes Information

www.thegreenguide.com/reports/product.mhtml?id=24&sec=2

Select eco-friendly carpeting [IEQ/182/MR139]

Resources:

National Geographic Green Guide – Finding a Healthy Carpet

www.thegreenguide.com/doc/BGG2/letters

Carpet and Rug Institute

www.carpet-rug.org

Carpet Cushion Council

www.carpetcushion.org

Greenguard Environmental Institute

www.greenguard.org

Plumbing

Install water saving fixtures [WE42-44]

Resources:

USEPA: Water Sense

www.EPA.gov/watersense/pp/het.htm

H2ouse.org – Top 5 ways to save water at home

www.h2ouse.org/

Water Use It Wisely

wwww.wateruseitwisely.com

Install water filtration system [IEQ175-176]

Resources:

REGREEN Program

www.regreenprogram.org/

Consumer Guide to Water Filters

www.nrdc.org/water/drinking/gfilters.asp

NSF: Home Water Treatment Devices

www.nsf.org/consumer/drinking_water/dw_treatment.asp

American Water Works Asscociation - WaterWiser

www.awwa.org/resources/waterwiser

Include a plumbing access panel [MR123]

Resources:

REGREEN Program

www.regreenprogram.org/

Do-It-Yourself Life.com – Installing a plumbing access panel instructions

www.diylife.com/2008/06/23/plumbing-access-panel-installation/

Choose a high-efficiency water heater [EA79]

Resources:

U.S. Department of Energy: Water Heating

www.eere.energy.gov/consumer/your_home/

Consumer Guide to Home Energy Savings: Water Heating

www.aceee.org/consumerguide/waterheating.htm

References:

[6] **U.S. Department of Energy, EERE. Water Heating**

www.energy.gov/waterheating.htm

Consider eco-friendly piping material [MR122]

Resources:

Copper Development Association

www.copper.org/environment/homepage.html

Plastic Pipe Institute, Information on Plastic Piping Systems
www.plasticpipe.org

Piping in Perspective: Selecting Pipe for Plumbing in Buildings

www.buildinggreen.com/auth/article.cfm?fileName=160401a.xml

Reconfigure piping for efficiency [EA77]

Resources:

American Water Works Association: Hot Water Delivery – Systems and Construction Practices

www.awwa.org/waterwiser/references/pdfs/RES_HW_Klein_G_Hot_Water_Delivery_Systems_and_Constructi.pdf

Tech Set 1: Resource Efficient Plumbing

www.toolbase.org

References:

[7] **James Lyons. 2009. Promising Plumbing. BUILDER. January 2009.** www.builderonline.com

Install an instantaneous water heater

Resources:

American Council for an Energy Efficient Economy

www.aceee.org/consumerguide/waterheating.htm#new

U.S. Department of Energy: Water Heating

www.eere.energy.gov/consumer/your_home/water_heating/index.cfm/mytopic=12820

Equipment

Select high-efficiency clothes washer [EA92]

Resources:

Consortium for Energy Efficiency

www.cee1.org

USEPA Energy Star®

www.EnergyStar.gov

References:

[8] **American Water Works Association Research Foundation**

www.awwa.org/

[9] **Consumer Reports, Greener Choices**

www.greenerchoices.org/

Select an energy-efficient refrigerator [EA93]

Resources:

Consortium for Energy Efficiency: Refrigerators

www.cee1.org/resid/seha/refrig/refrig-main.php3

USEPA Energy Star® - Refrigerators

www.EnergyStar.gov/index.cfm?c=refrig.pr_refrigerators

New Jersey State Website – Information on Energy Star® Appliances

www.state.New Jersey.us/globalwarming/help/

Choose an energy-efficient dishwasher [EA94]

Resources:

USEPA Energy Star® - Dishwashers

www.EnergyStar.gov/

Consortium for Energy Efficiency : Home Appliances

www.cee1.org/resid/seha/seha-main.php3

Install energy-efficient cooking appliances [EA95]

Resources:

Consumer Guide to Home Energy Savings: Cooking

www.aceee.org/consumerguide/cooking.htm

Select energy-efficient office equipment [EA99]

Resources:

American County for an Energy Efficient Economy: Consumer Guide to Home Energy Savings

www.aceee.org/consumerguide/electronics.htm

USEPA Energy Star®: Home Electronics

www.energystar.gov

References:

[10] **Alliance to Save Energy**

www.ase.org/

[11] **U.S. Department of Energy: Home Office and Home Electronics**

www.eere.energy.gov/consumer/tips/home_office.html

Laundry

Install single-throw shut-off valve [MR124]

Resources:

Read This before You Design, Build, or Renovate

www.buildingscienceconsulting.com/resources/mold/

Do It Yourself – How to Install Shut Off Valves

www.doityourself.com/stry/installshutoffvalve

References:

[12] **This Old House. 2007: How to Stop a Flood in its Tracks**

www.thisoldhouse.com/toh/article/0,,193969,00.html.

Install drain pan for clothes washer [MR125]

Resources:

Checklist for Decay Resistance

www.lsuagcenter.com/en/family_home/home/la_house/my_house/Durable/

Clotheswasher Drain Pan Specifications

www.floodsaver.com/24_Specs.htm

Provide air-lock dryer vent [EA72]

Resources:

Heartland Dryer Vent Closure

www.energyfederation.org/consumer/default.php/cPath/86_742_110

American County for an Energy Efficient Economy: Consumer Guide to Home Energy Savings

www.aceee.org

Minimize dryer duct length and turns [EA73]

Resources:

Toolbase Services: In-line Fans

www.toolbase.org

Furniture and Fittings

Select eco-friendly furniture [MR141-143/146-147/150]

Resources:

Sustainable Furniture Council

www.sustainablefurniturecouncil.org

Habitat for Humanity Restores

www.habitat.org/env/restores.aspx

Craigslist

www.craigslist.org

Freecycle

www.freecycle.org

National Geographic Green Guide: Green Starter Furniture Finds

www.thegreenguide.com

Select eco-friendly cabinetry and countertops [MR140/145/148-149]

Resources:

Green Home Guide, Choosing Kitchen Countertops: Our Top Picks

www.greenhomeguide.com/index.php/knowhow/entry/931/C222/

Greenbuilding.com, Green Cabinets

www.greenbuilding.com/green-home-improvement/green-cabinets

Greencabinetsource.org

www.greencabinetsource.org/index.cfm?fuseaction=Defining.welcome

Habitat for Humanity, Habitat ReStores

www.habitat.org/env/restores.aspx

Sierra Club Green Home, Eco Cabinets

www.sierraclubgreenhome.com/educate/cabinets/eco-friendly-cabinets/

Natural Home Magazine, Cradle to Cradle Countertops

www.naturalhomemagazine.com/Tools-and-Tricks/Cradle-to-Cradle-Countertops.aspx

References:

[13] **Green Home Guide, Choosing Kitchen Countertops: Our Top Picks**

www.greenhomeguide.com/index.php/knowhow/entry/931/C222/

Support local craftsmen [MR153]

Resources:

Ten Thousand Villages.com – Fair Trade Retailer

www.tenthousandvillages.com

Select furniture that is easy to clean [IEQ192]

Resources:

Destination Green

www.destinationgreen.com

National Geographic Green Guide

www.thegreenguide.com/

Select healthier window treatments [IEQ193]

Resources:

How Do I Select Safe Natural Fiber Products for My Home?

www.greenhomeguide.com/index.php/knowhow/

Natural Home Magazine

www.naturalhomemagazine.com/

Sierra Club Green Guide: Window Coverings

www.sierraclubgreenhome.com

Uses

Use green cleaning products/strategies [IEQ196]

Resources:

U.S. Department of Health and Human Services: Household Product database

www.householdproducts.nlm.nih.gov

Properly maintain equipment [EA91]

Resources:

American Council for an Energy-Efficient Economy Consumer Guide to Home Energy Savings

www.aceee.org

HARDI Architect, Builder & Remodeler Good Practice Guide

www.hardinet.org/pdf/GdPractGuide2.pdf

Designate a built-in recycling center

Resources:

Climate Crisis – Things you can do at home

www.climatecrisis.net/takeaction/whatyoucando/index3.html

Earth 911 Recycling

earth911.com/recycling/

Earth Easy.com – Home Recycling Info

www.eartheasy.com/live_recycling.htm

NJ DEP Household Recycling & Recycled Product Directory

www.nj.gov/dep/dshw/recycling/

Case Study

Location of Project: Montclair, New Jersey

Interior Designer: Jacqueline Germany, President-Owner, and Principal Designer, Nina's Nuances Interior Design, Inc.

General Contractor: Jacqueline Germany

Overview and Scope

This project incorporated a total kitchen remodel with upgrades to the **HVAC** and water resource systems. The impetus for this green design and renovation project was twofold. The primary reason was that the kitchen did not meet the client's needs: it was outdated, aesthetically unappealing, inflexible, and functionally inefficient. This client was very conscious of his personal use of everyday household items and overall energy and resource consumption. Therefore, when deciding to remodel and renovate, the client chose to employ energy and environmental conservation strategies.

Design Approach

The environmentally-conscious client provided the principal inspiration for the project, however, being the designer's first truly "green" project opportunity, the designer was equally as excited about completing the remodel. The team undertook the project in 2004 at a time when resources for green design in the residential arena were more limited and the public's knowledge of the benefits and rewards of "green design" was not as sophisticated as it is in 2009. This provided some challenges but also gave the project a more innovative feel.

Team and Process

The respective backgrounds of the homeowner and designer complemented each other well. The homeowner possessed significant experiential insight as to what green products were available at the time, while the designer, by virtue of training in the environmental sciences and interior design, brought a professional awareness and knowledge of the synthesis and composition of the products. Facilitating the implementation of the green design aspects was the eagerness of suppliers to promote their green products and services.

Finance

At the time of the project, the cost of utilizing green design techniques was roughly 27 percent higher than conventional design; however, the rapid increase in availability of green design choices and products over the past several years has diminished this premium. For the designer, this project served as a "barometer" for project- related costs. Relative to today, the remodel came well within budget, even with the extra costs for the green features. The client reported energy savings of approximately 20 percent over the first full year following the renovation, and when he decided to sell the home in 2007, the green kitchen turned out to be the most compelling factor in the new owner's decision to purchase.

Lessons and Trade-offs

Through this project, both the client and designer learned a lot about the varying levels of "greenness" in products marketed as such. When researching green products, they found that one needs to examine carefully the product information and Material Safety Data Sheets (MSDS) to verify the accuracy of the claim. The homeowner and designer were surprised by the lack of quality in some green-labeled products. Therefore, they felt that research into product choices was critical. Luckily, there are several reliable resources available today as well as many more practicing green design and remodeling professionals.

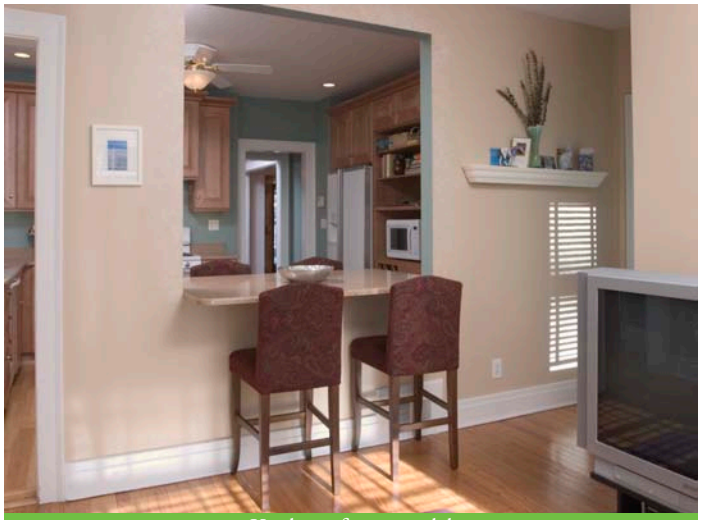
"In our efforts to help the environment by adhering to green principles of living, we often times forget to factor in how we dispose of our waste products…An important part of our efforts to do green building, design, or remodeling should be how we deconstruct that environment and what we do with its components and waste."

- Jacqueline Germany

Before

After

List of Green Strategies


Kitchen after remodel

Energy Conservation

- Replaced original appliances with energy-efficient ones
- Replaced original lighting fixtures with energy-efficient fixtures and lamps
- Utilized dimmer switches and more effective lighting controls
- Upgraded windows to improve insulation

Water Conservation

- Replaced original water heater with a tank-less model that heats water on demand
- Incorporated a **reverse osmosis** water filter with an instant hot water faucet
- Installed a whole-house water filter with water softener

Indoor Air Quality

- Used **low-VOC** paint and non-toxic interior finishing products on cabinets, walls, and flooring
- Replaced **HVAC** system and added new vents and filters
- Added a cooking hood with pollution controls to aid clean exhausting of odors and fumes
- Replaced old plaster and lath with paperless sheetrock

Sustainable Materials

- Installed countertops made from Azrock, a granite alternative made from 70 percent consumer recyclable materials
- Installed cabinets made from river-recovered wood
- Installed bamboo flooring
- Reused door hinges and some antique hardware from original kitchen

Before

After

Case Study

Location of Project: Elkins Park, PA
Homeowners: Mr. and Mrs. Ryan Quinn
Interior Designer: Lori Jacobsen, Lori Jacobsen Design, LLC.
Area Affected: 190 sq. ft.

Overview and Scope

The primary objective of the design firm was to create a safe and healthy nursery for an expanding family. Working within the framework of a nearly seventy-year-old home, the team made minimally invasive architectural changes to maintain the integrity of the home. Without changing the layout of the existing space, they focused on "choosing materials and products that are healthier for people, conserve resources and energy, and are resource efficient (as defined by ASID, June 2007)." Subscribing to the parameters of sustainable design, the constraints of the existing space, a fixed budget, and consideration of time, they created an eco-friendly or "green" baby's nursery.

Design Approach

The homeowners wanted to create the safest and healthiest environment for their baby. The firm helped to educate the couple on everyday products that can have an adverse effect on their health and helped the homeowners both select safe, environmentally-friendly products and make changes to improve indoor air quality.

Team and Process

Lori Jacobsen Design worked together with the homeowners throughout the design process. The project began with an in-home consultation with the clients. After defining the design needs of the client and considering the budget, they worked together to create a plan that met those needs. The homeowners were then asked to approve the final design plan.

Finance

Working with a budget of $10,000 the team was pleased to find out that their green choices and strategies came in under budget. Generally the design firm does not work with clients on a strict budget. Therefore, this project offered the opportunity to create a baseline for other projects of this kind.

The homeowners expect cost savings from their investments by lowering heating and cooling costs through yearly maintenance of the **HVAC** system, upgraded air filters, and installation of natural window shades with insulators.

Lessons and Trade-offs

Because of their extensive knowledge and continuing research in the area of green design, the design firm was not surprised by the project cost. To create a non-toxic nursery, the firm made suggestions to the homeowner about removing materials that could degrade indoor air quality. In general, the firm advises homeowners to participate in the design process, which helps create a transparent plan with few or no surprises in the end.

"This particular project was a dream. The client's and our firm's green objectives were completely aligned. Therefore, we all were on the same page from the beginning to the end."

- Lori Jacobsen

List of Green Strategies

Energy Conservation

- Checked heating and cooling systems to ensure optimal efficiency
- Upgraded air filters
- Installed energy-saving window shades and insulators

Resource Conservation

- Installed area rug made from 100 **post-consumer recycled content** (polyethylene terephthalate (PET) from recycled plastic bottles)
- Repurposed a salvaged chair using remnant fabric from a furniture manufacturer

Indoor Air Quality

- Removed all existing materials with high-**VOC** contents
- Used low-**VOC** paint
- Refinished hardwood floors with a no-sanding and non-toxic finishing product
- Cleaned floors with a neutral product that contains no harmful **solvents**
- Used environmentally-friendly, low-**VOC** carpeting and furnishings
- Chose a natural organic wool fiber and cotton mattress and bumpers for the crib

Repurposed chair from remnant fabric

Case Study

Location of Project: Highland Park, New Jersey
Homeowners: Randall Solomon and Rebecca Hersh
General Contractor: Richard Stryker Contracting
Area Affected: approx. 1350 sq. ft.

Overview and Scope

This green remodel of a 90-year-old craftsman bungalow included an upgrade to a high-efficiency natural gas furnace, replacement of **single-pane windows**, installation of spray denim insulation, and the addition of a dual-layer high-venting roofing system. Green interior renovations included upgrades to the kitchen with **Energy Star®** appliances and installation of water saving fixtures and dual flush toilets in the bathroom. Existing materials were preserved whenever possible, such as exterior cedar siding, wooden porch floor boards, antique doors and fixtures, and subway-style bathroom tiles. Care was also taken to properly remove lead paint and to use only non-toxic paints and finishes.

Design Approach

Randy and Rebecca wanted to design a home that embraced their sustainable values and lifestyles, and that would save them money through reduced utility bills, and provided a healthy environment for their growing family.

Team and Process

The homeowners were the driving force behind the green aspects of this project. They researched and proposed almost all of the green techniques and materials that went into the remodel, working step-by-step with the contractor to decide on the best options. By communicating the commitment to green design from the start, the homeowners made sure that the contractor also understood the importance of reducing construction waste materials and using non-toxic finishes whenever possible.

Finance

The homeowners looked to reduce costs and conserve resources by preserving and reusing existing features of the home. For example, instead of replacing bathroom tile with all new **recycled content** tiles, they only replaced the most worn out sections with new tiles. When it made sense to replace older systems (such as pre-1994 water guzzling toilets) the homeowner chose to invest in greener alternatives, such as low-flow dual flush toilets, that cost more up-front but that will pay for themselves in reduced water bills over time.

Lessons and Trade-offs

Do your homework. The homeowners didn't have to hire a "green" contractor but they did have to put in the extra time and effort to research green features and materials and to communicate these choices to the contractor.

"The good news is that the dual-flush toilets are a big hit with our friends…the bad news is that anytime we have a guests over we end up using more water because everyone wants to check them out!"

- Randy Solomon

Upstairs bathroom before

List of Green Strategies

Energy Conservation

- Replaced old single-pane windows with energy-efficient double-pane, **low-E**, argon filled windows with fiberglass composite frames
- Upgraded existing oil/steam heating system with highly-efficient (87 percent efficient) natural gas/hot water furnace
- Installed zone heating and **programmable thermostats**
- Upgraded kitchen appliances with **Energy Star®** dishwasher and refrigerator
- Added spray denim insulation (recycled blue jeans) to attic, basement, and exterior walls where no or little insulation existed
- Sealed cracks and leaks to reduce air **infiltration**
- Installed a dual layer, high-venting roofing system to reduce temperature build-up inside the attic during the summer months

Water Conservation

- Installed low-flow faucets and shower heads and added faucet aerators to existing fixtures
- Installed dual flush (0.8 and 1.6 gallon per flush) toilets

Resource Conservation

- Preserved 90 year old existing cedar siding
- Refurbished antique bathtub with a new coat of paint
- Preserved black and white subway tiles in upstairs bathroom by replacing only broken tiles
- Refinished and reused antique doors and fixtures
- Replaced rotten floor boards on the front porch with antique floor boards in the attic where they could be appreciated

Indoor Air Quality

- Professionally stripped lead paint from windows and doors
- Vacated the house during the renovation to avoid construction-related dust and air pollution
- Used low-**VOC** water-based finishes on all trim work

Downstairs bathroom after remodel

Case Study

Location of Project: Chatham Township, New Jersey
Homeowners: Ken and Kathy Abbott
Architect: Brian and Janet Siegel, Siegel Architects
Interior Designer: Eco-Interiors by Patricia Gaylor
General Contractor: John Marinaccio Construction
Green Building Consultant: Anna Hackman
Landscape Architect: Back to Nature
Organic landscaper: Greenpath Organic Landcare

Overview and Scope

Located in Chatham Township, New Jersey, this project entailed significant changes to a home previously renovated in 1988. It included changes to the kitchen, dining room, and family room as well as the addition of new living space over the garage. The dining room was relocated to its original location in the front of the house while the kitchen was shifted over to the dining room's position. This allowed the kitchen to become the "heart" of the home, providing a connection to the deck, family room, mudroom, and dining room. The wall between the new kitchen and existing family room was opened up completely, letting light flow from front to back of the house and giving a view of the family room and backyard from the kitchen. The mudroom, removed during the previous renovation, was restored. All of this reconstruction was done within the existing footprint of the house, except for a 72 square foot extension in the rear corner to make enough room for an office off the mudroom.

The 366.5 square foot addition above the garage contains a fifth bedroom, bath and laundry room. To make this section over the garage blend in with the rest of the house, the architect designed a hip roof for the entire house.

Design Approach

The homeowners, Ken and Kathy Abbott, were very focused on a green renovation. Their major goals included improving traffic flow and daylight downstairs, getting more counter space and cooking space in the kitchen, and providing an extra room for a new baby and an office upstairs.

Team and Process

Ken and Kathy Abbott provided the initial impetus for the green remodel. Working with the architect, the green building consultant, and the designer, she was very mindful of trying to save energy, re-purpose items she already had, use local materials, and keep the indoor air quality as clean as possible.

Finance

The Abbotts wanted to make the renovations as "green" as possible without incurring much additional expense. To that end, the only thing that cost more up front was the solar water heater, for which the estimated payback period was eight years.

Lessons and Trade-offs

If able to do it all over again, the Abbotts would choose an architect that was **LEED** certified, as they felt that they needed to educate the architect and builder on the green aspects of the project. One major lesson would be to perform air sealing before laying the sheetrock; they performed the air sealing after the building was done and afterwards an energy audit showed lots of air leaks from the attic and basement. One major design change would be to avoid putting recessed "can" lights (also called high-hats or recessed downlights) in ceilings that open to unconditioned spaces, such as the cathedral ceiling in the family room or upstairs rooms, because they allow unwanted heat flow between conditioned and unconditioned spaces.

"I love my bioswale, stream and organic gardens. I also like that we didn't put as much construction waste in the landfill as we would have with a conventional demolition or carpenter. I think about what my children and their children will do as landfill space becomes scarcer and scarcer. Sustainability is important to me. I felt a responsibility not to add to my family's carbon footprint."

- Kathy Abbott

Solar hot water heating

List of Green Strategies

Energy Conservation

- Replaced 30-year-old windows with new **low-E** windows throughout the house
- Installed triple cellular blinds in master bedroom
- Installed new **Energy Star**® appliances
- Added two solar panels used for hot water

Water Conservation (Outdoors)

- Ensured that there would be no net increase in stormwater **runoff** from the slight increase in our house footprint
- Contoured the garden on both sides of the house to absorb rain water
- Built a **bio-swale** containing attractive **native plants** on the uphill side of the yard that historically collected too much rain water and caused basement flooding
- Used sump pump water to make a landscaped stream that provides a frog habitat

Indoor Air Quality

- Used zero-**VOC** paints
- Installed **formaldehyde-free, sustainably-harvested wood** kitchen cabinets
- Purchased natural jute fabric for window treatments
- Used water-based wood floor finishes

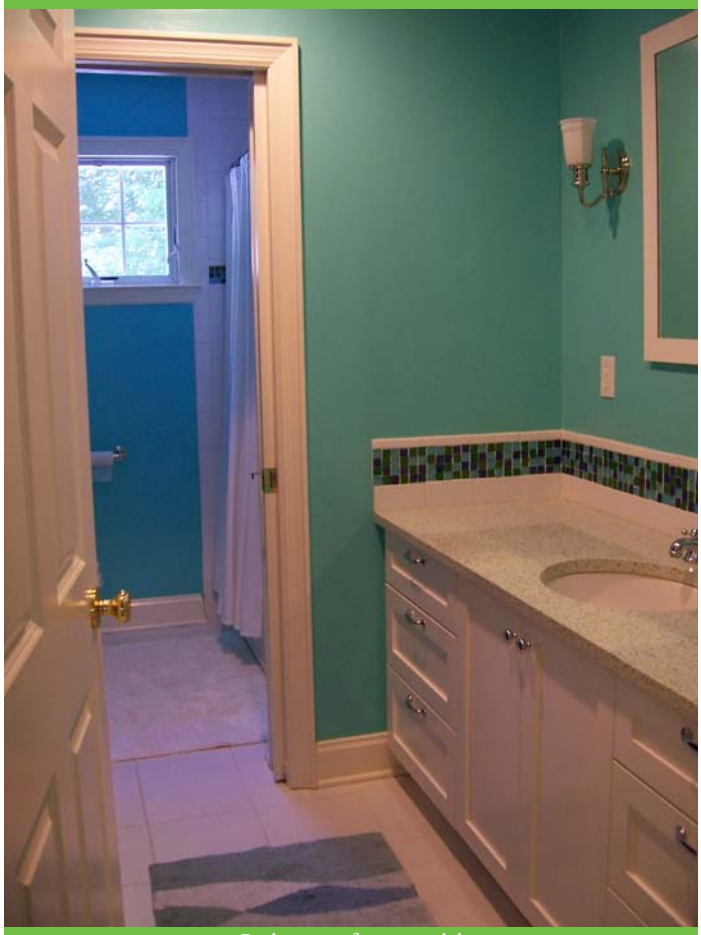
Resource Conservation

- Repurposed existing kitchen cabinets into two armoires and one laundry cabinet
- Altered existing wall unit in the family room to fit a new flat-screen TV
- Repurposed old kitchen sink into a laundry sink
- Installed recycled glass bathroom countertops and border tiles
- Installed an acrylic laundry countertop made from **recycled content**
- Purchased handmade kitchen tiles from New Hampshire, meeting criteria for locally-based products
- Requested a separate dumpster for concrete for the demolition of the old front porch and sidewalk

Sustainable Sites

- All the plantings, grass, etc., were planted with no pesticides
- Chose an organic landscaper to take care of the lawn and garden

Kitchen after remodel



Bathroom after remodel

Case Study

Location of Project: Montclair, New Jersey
Homeowners: Jeff and Amy Plaut
Architect: John Thomas Collins
Interior Designer: Eco-Interiors by Patricia Gaylor
General Contractor: Woodhaus Construction
Area affected: 1000 square feet

Overview and Scope

This house is an 1801 Federal-style farmhouse, one of the oldest continually-occupied homes in Montclair, and is on both the New Jersey and the National Registers of Historic Places. The current owners worked to achieve a balance between preservation of the historic character and fabric with green environmental standards and the everyday needs of an active family lifestyle. The renovation focused on opening up rooms and repurposing space. This included updates to the existing kitchen, family room, laundry room, and the addition of a breakfast room.

Design Approach

Designer Patricia Gaylor and the homeowners, Jeff and Amy Plaut, both desired to do as green a renovation as possible. The designer worked with the Plauts to develop an environmentally-conscious, practical design that also preserves the historic quality.

Team and Process

Patricia worked with the Plauts on the general look and plan for the renovation, and Patricia specified all the products being used to be as green as possible. All plywood used on the renovation by the contractor contained no added **formaldehyde**, energy-efficient lighting and appliances were specified, and the cabinets used were no added **formaldehyde** plywood boxes with a low-**VOC** paint finish.

Finance

The cost of the renovation was considerably high to begin with due to the age of the home. Special consideration had to be taken at every turn to keep costs to a minimum. But for the most part, selections were made on the basis of their sustainability and green quality, not over high price. The construction and materials costs were fair. There will be a huge return on investment in energy savings. Before the renovation, the house was leaky, and the homeowner's heating bills were very high. Good insulation, the addition of radiant heat flooring in the kitchen, and energy-efficient windows contribute to the new tighter building envelope.

Lessons and Trade-offs

The major surprise was how much work was required to fix old renovations and get the home up to current code. While this was expected for such an old house, the costs were higher than anticipated. Although the project was completed on time, the team ended up substantially over budget due to the poor condition of the home's infrastructure. However, both Patricia and the Plauts were very satisfied with the results.

"I thoroughly enjoyed working on a period renovation, and melding new technologies with the old house…Green remodeling is the only way to go, as far as I'm concerned. As a designer, it's my job to show the homeowner that a remodel of her home should be as healthy to the family as possible, leave as low a carbon footprint as possible, and make it as energy-efficient as possible. I think these things can be accomplished in a 'green' fashion with very little in the way of extra cash output…What surprised me the most? Nothing! Being in the remodeling business for so many years, green or not, it's always a challenge."

- Patricia Gaylor

Breakfast room

List of Green Strategies

Energy Conservation

- Selected **Energy Star®** appliances, including the refrigerator, dishwasher, television, and clothes washer and dryer
- Purchased a stove and refrigerator made domestically
- Installed hydronic radiant heat under the kitchen floor
- Installed highly efficient **low-E** glass and argon filled windows
- Chose borate-treated blown-in **cellulose insulation** for the space between the interior and exterior walls for significantly increased energy efficiency
- Used **CFLs** in the majority of light fixtures, including the outside fixtures

Water Conservation

- Installed water filtration systems at sinks to eliminate use of bottled water
- Installed low flow faucets and faucet aerators

Indoor Air Quality

- Built cabinets from wood with no added **formaldehyde**, and painted them with **low-VOC** paint
- Painted interior walls with environmentally-friendly **low-VO**C paint
- Purchased laundry room cabinets made of medium-density fiberboard (MDF) with no added urea **formaldehyde**
- Coated soapstone countertops are coated with food-grade mineral oil once a month

Sustainable Materials

- Stripped and repaired the original brick hearth to restore it as the focus of the kitchen
- Constructed porches using local bluestone and flooring made from **recycled content**
- Installed eastern white pine floors, harvested from family-owned, responsibly-managed New Hampshire forests
- Used domestic clay for the butler's pantry wall tile made by an environmentally responsible New Hampshire firm that reuses clay waste, water for processing, and shipping boxes
- Installed white Danby marble countertop from Vermont in baking area
- Installed Marmoleum linoleum flooring, made from **jute**, flax, and linseed oil

Gas range and oven

Mud room

Case Study

Location of Project: Galloway, New Jersey
Homeowners: Stephen and Barbara Fiedler
Interior Designer: Fiedler Designs, LLC
General Contractor: Fiedler Designs, LLC
Area affected: 350 sq. ft.

Overview and Scope

This project involved a total renovation of an existing kitchen and dining room into a combined kitchen with two sit-down eating spaces. The "great room" effect of this gathering space was the goal of the design, and the materials used helped meet the design goal of a total "green" or sustainable kitchen.

Design Approach

The Stephen and Barbara Fiedler looked to the **U.S. Green Building Council's Leadership in Energy and Environmental Design (LEED)** for general green building guidance. They were inspired initially by the Jackie O'Neil LEED home in Perkiomenville, Pa.

Team and Process

The project involved numerous phone calls to green product suppliers and requests for product samples. The Fiedlers visited green product installation showrooms, read blogs on green products and attended seminars and conventions to educate themselves on green kitchen remodeling strategies and materials.

Finance

The Fiedlers put aside some cost considerations for this project in order to test the viability of several green products, many of which were new to the marketplace. In order to cut costs, the entire project's labor was performed by Fiedler Designs LLC. The cost savings of **Energy Star®** appliances, the tankless water heater, a smaller lighting load, and greater long-term material durability may pay for themselves, but not for some time. It will benefit future customers to choose sustainable products and techniques as they become more mainstream.

Lessons and Trade-offs

The biggest surprises of this project were the durability and stability of No-Added Urea Formaldehyde (NAUF) composite casework products and the bamboo cabinets. The Fiedlers would urge others to consider rapidly renewable woods, fibers, and composites as opposed to traditional woods with long growing times, and also to avoid products with high-**VOC** and urea **formaldehyde** content. Seeking out higher production capacity fabricators to use similar green materials would cut some costs. One of the biggest trade-offs was the lack of **LED** lighting choices for different applications. The designer looks forward to when **LED** lighting is available at a reasonable cost for task lighting and overhead lighting.

"The entire project was a valuable learning experience, particularly in researching and working with new green materials; understanding which green materials to recommend for future clients."

- Stephen Fiedler

Energy Star® refrigerator

List of Green Strategies

Energy Conservation

- Installed 14" round **solar light tubes** to bring in natural light
- Purchased **Energy Star**®-rated dishwasher, gas stove, refrigerator, and microwave
- Installed recessed hi-hat ceiling light fixtures with sealed, close contact insulation capability
- Used **LED** bulbs in high hat recessed fixtures
- Chose low-voltage lighting fixtures

Water Conservation

- Chose a two-handle kitchen faucet to minimize hot water demand
- Installed a tankless gas water heater
- Installed a reverse osmosis water purification system with a separate dispenser tap at sink
- Installed an under-mount stainless steel single bowl sink with a built-in drain board

Indoor Air Quality

- Used NAUF plywood for sub=flooring and cabinet case construction; NAUF bamboo materials
- Chose no-**VOC** paints for the walls, ceiling and trim
- Hazardous Air Pollutant (HAP) -free, no-VOC, water based finish on all cabinetry components

Sustainable Materials

- Chose bamboo products for cabinet doors, drawer fronts, side veneers, panels and case edging
- Installed recycled glass/concrete countertops
- Purchased engineered quartz secondary table tops
- Installed low-**VOC** natural linoleum flooring
- Installed insulation made from **borate**-treated shredded cotton blue jeans
- Tiled walls with 100 percent **pre-consumer recycled content** wall tiles
- Used 100 percent recycled wall board from power plant scrubber lime and recycled paper

Energy Star® gas range, oven, microwave, and dishwasher

Recycled glass countertop

Dining area

Case Study

Location of Project: Summit, New Jersey at the 100 year-old Twin Maples Estate

Homeowners: The Fortnightly Club of Summit (501c3 charity organization)

Architect: Hiland Hall Turner, Hiland Hall Turner Architects

General Contractor: Roger Polo, Polo Master Builders

Interior Designers: Peter Salerno of Peter Salerno Inc.; Kim Nadel of Niche Interior Design; Joan Picone of Joan Picone, Inc.; Jerri Eskow of Iron Gate Interiors; Sherrie Legro Round of Enchantment Lives; Kristen Bouterse of Paints Plus; Danielle Ann Millican of Danielle Ann Millican, Inc

Photographer: Marisa Pellegrini

Area Affected: Approximately 2200 square feet.

Overview and Scope

This project involved the preservation and complete green renovation of a century-old historic carriage house at the Twin Maples Estate in Summit, New Jersey. The work was completed for the recent Twin Maples Centennial Show. The second floor apartment was fully renovated, as was the lower level foyer and all of the heating, cooling and water systems for the structure. The lower level bays were left intact to preserve their historic terra-cotta tile floors and mahogany bead board walls and ceilings. Wood insulated garage doors were added to improve energy efficiency in the lower level.

Design Approach

One of the most important aspects of sustainable building practice and design is the reuse of existing structures and materials; the renewal of this 100 year-old carriage house represents a prime example of how new life can be brought to a historic building. The designers wanted to demonstrate that green design could be practical and aesthetically pleasing. They aimed to create beautiful interior spaces using environmentally-friendly furnishings, reclaimed and renewable flooring, and energy-efficient appliances throughout the house.

Team and Process

Seven interior designers teamed up with architect Hiland Hall Turner and builder Roger Polo. The designers incorporated several themes, including natural colors and materials, circular patterns representing the natural cycle, and a juxtaposition of contemporary and rustic details. The concept was to reuse, recycle and use renewable and energy-efficient resources.

Finance

Polo Master Builders and their subcontractors donated the materials and labor necessary to renovate the carriage house. Hiland Hall Turner donated his architectural services. The designers and their suppliers donated the interior finishes. Perfection Contracting donated the installation of the new high-efficiency hybrid heating and cooling system.

Lessons and Trade-offs

The design team found that while many green products, such as energy and water-efficient features, are readily available, other environmentally friendly products may be more expensive and require more careful research. Product availability for certain spaces may be trickier than others due to lack of knowledge on the part of suppliers as well.

"We hope to inspire architects, builders and homeowners to take action to make historic buildings more sustainable by installing history-friendly and eco-friendly building materials, as well as state-of-the-art efficient energy systems."

- Heidi Evenson, Co-Chairman, Twin Maples Centennial Show House

Remodeled Kitchen

List of Green Strategies

Energy Conservation

- Installed **Energy Star**® appliances in the kitchen
- Installed a high-efficiency hybrid heating and cooling systems to heat and cool the apartment and lower level foyer
- Added blown-in insulation to the walls and attic space
- Added a new insulated hay loft door and two insulated garage doors to improve energy efficiency and add natural light to the interior

Water Conservation

- Installed low-flow fixtures in the kitchen and bathroom
- Installed a dual-flush toilet in the bathroom

Indoor Air Quality

- Installed **formaldehyde-free** cherry cabinets in the kitchen
- Used low-**VOC** paints throughout the structure
- Used a green product to finish the recycled barn wood floor

Resource Conservation

- Incorporated fixtures comprised of existing materials such as **reclaimed** wood and recycled aluminum
- Refurbished new items from recycled materials such as a stairway runner from an old conveyor belt, a lamp from a wrought-iron gate, a nightstand from a sewing machine table, and a writing desk from an old barn door
- The flooring throughout was reclaimed from a barn in West Virginia

Sustainable Materials

- Utilized renewable and recycled materials throughout the house, including recycled leather tiles, bamboo flooring, reclaimed barn wood flooring, recycled glass, natural carpeting and wall-covering materials (including hemp, straw, and sea grass)

Remodeled Bedroom

Remodeled Foyer

Remodeled foyer

Remodeled bathroom

Remodeled and restored exterior

Green Products and Services

Introduction

The purpose of the Green Products and Services is to help homeowners navigate the market with some helpful tips on what to look for when shopping for a particular green home remodeling project. The Guide is organized by building system and lists the general products and services that pertain to remodeling tasks within that system. It includes features and applicable certifications to look for, as well as web links to more information on that product or service. Each item in the Guide also refers to the related REGREEN strategy IDs.

Please note that the New Jersey Green Home Remodeling Guidelines Version 1.0 do not endorse any particular brand or company. It is not the function of the Green Product and Service Guide to direct the consumer to a specific product, but rather to provide a resource to seek out an appropriate manufacturer or service provider to handle remodeling needs.

With the ever-increasing number of green products and services coming into the home remodeling market, finding the appropriate ones can be a challenge. Some manufacturers market products as "green" when in reality they are only marginally better for the environment or whose green features are neutralized by other aspects of their manufacturing or composition. This phenomenon is referred to as "greenwashing" and calls on consumers to seek out references and ensure the true extent of green value.

Product Certification Programs

That being said, there are several leading green product standards and certification programs that can help consumers identify products that meet predefined green criteria. The leading green product standards and programs include:

- Energy Star® - identifies efficient products that reliably deliver energy savings and environmental benefits
- WaterSense – identifies high performing, water efficient products and practices
- Cradle to Cradle - certifies products based on lifecycle of materials used to construct a product and the overall lifecycle of the product
- GreenGuard® Certification Program - certifies products and processes for their low chemical emissions and low toxicity
- Green Seal® - certifies products and practices for their low toxicity and overall environmental impact
- GreenSpec Directory - a published resource on environmentally preferable products
- Forest Stewardship Council (FSC)- certifies wood products coming from forests managed to meet social economic and ecological needs
- Sustainable Forestry Initiative (SFI) - certifies wood products coming from well-managed forests and responsible procurement practices
- National Fenestration Rating Council® (NFRC) - a non-profit organization that administers the only uniform, independent rating and labeling system for the energy performance of windows, doors, skylights, and attachment products

For more information on various certification programs currently in use by architects and designers see:

- the ecolibrary™matrix - www.thegreenstandard.org/documents/GGNC09_EcoLibCert.pdf
- Gaia Product Profile developed by The Green Standard™ - www.thegreenstandard.org/gaia.html

Two other reputable sources for green products and services are:

- Green Building Advisor that lists products from the GreenSpec Guide to Residential Building Materials www.greenbuildingadvisor.com/
- National Association of Home Builders (NAHB) Research Center - www.nahbrc.org/manufacturer/greenapproved/index.aspx

Product Standards for GreenSpec[1]

1. Products Made with Salvaged, Recycled, or Agricultural Waste Content
   a. Salvaged products
   b. Products with **post-consumer recycled content**
   c. Products with **pre-consumer recycled content**
   d. Products made with agricultural crop waste material

2. Products That Conserve Natural Resources
   a. Products that reduce material use
   b. Products with exceptional durability or low maintenance requirements
   c. Certified wood products
   d. Rapidly renewable products

3. Products That Avoid Toxic or Other Emissions
   a. Natural or minimally processed products
   b. Alternatives to ozone-depleting substances
   c Alternatives to hazardous products
   d. Products that reduce or eliminate pesticide treatments
   e. Products that reduce stormwater pollution
   f. Products that reduce impacts from construction or demolition activities
   g. Products that reduce pollution or waste from operations

4. Products That Save Energy or Water
   a. Building components that reduce heating and cooling loads
   b. Equipment that conserves energy and manages loads
   c. Renewable energy and fuel cell equipment
   d. Fixtures and equipment that conserve water

5. Products That Contribute to a Safe, Healthy Built Environment
   a. Products that do not release significant pollutants into the building
   b. Products that block the introduction, development, or spread of indoor contaminants
   c. Products that remove indoor pollutants
   d. Products that warn occupants of health hazards in the building
   e. Products that improve light quality
   f. Products that help noise control
   g. Products that enhance community well-being

Sources

[1] The online GreenSpec® Directory lists product descriptions for over 2,000 environmentally preferable products at www.buildinggreen.com

Alex Wilson."Building Materials: What Makes a Product Green?" EBN Volume 9, Issue 1 (revised January, 2006) www.buildinggreen.com/auth/article.cfm?fileName=090101a.xml

Kitchen Bath and Living Spaces

Building Envelope

Product	Features	Certifications	Product Directory/Service Resources	REGREEN ID
Windows	Look for windows with a high R-Value or low U-factor, and a low air leakage value.	ENERGY STAR NFRC National Fenestration Rating Council	National Fenestration Rating Council - Product Directory cpd.nfrc.org/search/searchdefault.aspx Energy Star® - Windows, Doors, Skylights www.energystar.gov/index.cfm?c=windows_doors.pr_windows Creating Windows of Energy-Saving-Opportunity www.homeenergy.org/archive/hem.dis.anl.gov/eehem/97/970908.html Efficient Windows Collaborative www.efficientwindows.org/	EA56-59
Doors	Look for doors with a high R-Value or low U-factor, and Low Air Leakage Value.	ENERGY STAR NFRC National Fenestration Rating Council	National Fenestration Rating Council - Product Directory cpd.nfrc.org/search/searchdefault.aspx Energy Star® - Windows, Doors, Skylights www.energystar.gov/index.cfm?c=windows_doors.pr_windows Creating Windows of Energy-Saving-Opportunity www.homeenergy.org/archive/hem.dis.anl.gov/eehem/97/970908.html Efficient Windows Collaborative www.efficientwindows.org/	EA56-59
Skylights	Look for skylights with a high R-Value or low U-factor, and Low Air Leakage Value.	ENERGY STAR NFRC National Fenestration Rating Council	National Fenestration Rating Council - Product Directory cpd.nfrc.org/search/searchdefault.aspx Energy Star® - Windows, Doors, Skylights www.energystar.gov/index.cfm?c=windows_doors.pr_windows Creating Windows of Energy-Saving-Opportunity www.homeenergy.org/archive/hem.dis.anl.gov/eehem/97/970908.html Efficient Windows Collaborative www.efficientwindows.org/	EA56-59
Weatherstrip-ping	Weather resistant and durable will last longer and save resources because they are replaced less often.		U.S. Department of Energy - Energy Efficiency and Renewable Energy www..eere.energy.gov/consumer/your_home/insulation_airsealing/index.cfm/mytopic=11280 Caulking and Weatherstripping www.eere.energy.gov/consumer/your_home/ How Stuff Works - Installing Weatherstripping home.howstuffworks.com/how-to-apply-weatherstripping.htm California Energy Commission - Consumer Energy Center www.consumerenergycenter.org/home/tightenup/weatherstrip.html	EA56-59

Product	Features	Certifications	Product Directory/Service Resources	REGREEN ID
Insulation	Reflective or radiant barrier insulation with a High R-Value will decrease heat loss.	ENERGY STAR	Energy Star® - Do It Yourself Guide to Sealing and Insulation www.energystar.gov/index.cfm?c=home_sealing.hm_improvement_sealing U.S. Department of Energy - Energy Efficiency and Renewable Energy www.eere.energy.gov/consumer/tips/insulation_sealing.html	EA56-59
Caulk and sealants	Always look for low- or no-VOC products.	GREEN SEAL, GREENGUARD	GreenGuard - Product Search www.greenguard.org/Default.aspx?tabid=12 Green Seal - Product Search www.greenseal.org/findaproduct/paints_coatings.cfm Green Builder Magazine - Adhesives and Caulk www.greenbuildermag.com/content/blogcategory/31/124/ Green Builder Magazine - Adhesives and Caulk www.greenbuildermag.com/content/blogcategory/31/124/	IEQ165/MR132
HVAC				
Dryer vent	Install an air-lock dryer vent to release hot moist air produced by the dryer. Installing a vent cap can reduce the heating load home by reducing air leakage.		Energy Federation Incorporated: "Heartland Dryer Vent Closure" www.energyfederation.org/consumer/default.php/cPath/86_742_110	EA72
Range hood/ kitchen ventilation	Units that produce 1.5 sones or less (measure of how loud fan is) are best for home use.	ENERGY STAR	American Council for an Energy-efficient Economy www.aceee.org/consumerguide/ventilation.htm EPA Energy Star® Ventilating Fans www.energystar.gov Home Ventilating Institute www.hvi.org	IEQ166/167/ IEQ172
Thermostat	Install a programmable thermostat that will save energy and money. The thermostat will reduce wasted cooling or heating by turning lower when no one is home.	ENERGY STAR	Climatecrisis.net: Take Action – What You Can Do www.climatecrisis.net/takeaction/whatyoucando/ American Council for an Energy-efficient Economy www.aceee.org/consumerguide/heating.htm Energy Star®: Thermostats www.energystar.gov/index.cfm?c=thermostats.pr_thermostats	EA67

Kitchen Bath and Living Spaces

Wall and Ceiling

Product	Features	Certifications	Product Directory/Service Resources	REGREEN ID
Fan shut-off	Automatic shut-off on bathroom fans can save money, energy and improve indoor air quality. Fans should be on for an hour after a shower or bath to remove moisture preventing mold growth.	ENERGY STAR	HGTV.com: Bathroom Fan Timers www.hgtv.com/home-improvement/bathroom-fan-timers/index.html HGTVpro.com –Bathroom Exhaust Fans www.hgtvpro.com/hpro/bp_mechanical/article/0,,HPRO_20151_4433444,00.html	IEQ167
Paint	Paints with natural pigments and oils and with low or no VOCs.	GREEN SEAL, GREENGUARD	GreenGuard - Product Search www.greenguard.org/Default.aspx?tabid=12 Green Seal - Product Search www.greenseal.org/findaproduct/paints_coatings.cfm Selecting Healthy and Environmentally Sound Finishes www.bayarea.greenhomeguide.com/index.php/knowhow/entry/760/C224	IEQ185/IDP5/MR130
Gypsum board	Products that are moisture resistant, non-paper faced, and mold resistant will improve indoor air quality and prevent premature replacement and repair.		Architech Magazine - Gypsum Board for the 21st Century www.architechmag.com/articles/detail.aspx?contentID=5938 ToolBase.org - Moisture Resistant Gypsum Panel Products www.toolbase.org/Technology-Inventory/Interior-Partitions-Ceilings/mold-resistant-gypsum-panel	IEQ183/IDP1/24 MR126
Tiles	Look for products with recycled content and that are durable.		GreenSupply.com - Recycled Tile Products www.greenbuildingsupply.com/Public/NaturalFlooring/RecycledTile/index.cfm National Parks Service - Toolkit www.nps.gov/sustain/spop/tile.html Green Buyer's Guide To Stone & Tile www.bayarea.greenhomeguide.com/index.php/knowhow/entry/642/C225/	MR132/156
Construction adhesives, grouts, caulking, and sealants	Products with low- or no-VOCs.	GREEN SEAL, GREENGUARD	GreenGuard - Product Search www.greenguard.org/Default.aspx?tabid=12 Green Seal - Product Search www.greenseal.org/findaproduct/paints_coatings.cfm Green Builder Magazine - Adhesives and Caulk www.greenbuildermag.com/content/blogcategory/31/124/	IEQ187/MR132

Kitchen Bath and Living Spaces

Floors and Flooring Products

Product	Features	Certifications	Product Directory/Service Resources	REGREEN ID
Hard surface flooring	Products with low -or no-formaldehyde, recycled content, low-or no-VOC finish, and hard durable surfaces.		FSC - Product Search www.fscus.org/faqs/fsc_products.php Green Seal - Product Search www.greenseal.org/findaproduct/index.cfm Green Guard - Product Search www.greenguard.org/?tabId=12 Formaldehyde in the Home www.arb.ca.gov/research/indoor/formaldgl08-04.pdf	IEQ180/159-160/191 MR134/114/IDP5
Certified, reclaimed or rapidly renewable flooring products	FSC-certified, recycled content, bamboo or other renewable material reduces strain on the environment. Always try to use low or no VOC finishes.		FSC - Product Search www.fscus.org/faqs/fsc_products.php Green Floors www.greenfloors.com/ ToolBase.org - Recycled Wood Floors www.toolbase.org/Technology- SmartWood Program of the Rainforest Alliance www.rainforest-lliance.org/forestry.cfm?id=certification Sustainable Forestry Initiative www.sfiprogram.org/	MR118/135-137
Finishes	Finishes derived from natural products like plant oils or beeswax are healthier for indoor air quality.		Building Supply- Non-Toxic Finishes www.greenbuildingsupply.com/Public/Non-ToxicFinishes/index.cfm Greener Building - Product List www.greenerbuilding.org/product_list.php?cid=45 Buyer's Guide To Clear Finishes www.greenhomeguide.com/index.php/knowhow/	MR137/IEQ159
Carpet	Brominated flame retardants (PBDE) are hazardous for indoor air quality.		Canada - Health Department www.hc-sc.gc.ca/hl-vs/iyh-vsv/environ/pbde-eng.php National Geographic -The Green Guide www.thegreenguide.com/doc/106/pbde	MR139/IEQ182
Grout, caulk, sealants	Look for low- or no-VOC products.		GreenSeal - Product Search www.greenseal.org/findaproduct/index.cfm GreenGuard - Product Search www.greenguard.org/?tabId=12	IEQ180/MR134

Kitchen Bath and Living Spaces

Plumbing

Product	Features	Certifications	Product Directory/Service Resources	REGREEN ID
Faucet fixtures and aerators	Low-flow faucets or aerators with a flow rate between 1.5 to 2.0 gallons per minute. Water Sense®-labeled faucets require a maximum flow rate of 1.5 gpm and a minimum flow rate of .8 gpm.	WaterSense Meets EPA Criteria	EPA Water Sense Program epa.gov/watersense/ Consumer Reports -Low Flow Faucets blogs.consumerreports.org/home/2008/05/epa-watersense.html H20use – Water Saver Home www.h2ouse.org/	WE41-44
Water filter	The most commonly used filter is a Granulated Activated Carbon (GAC,home carbon filter). More expensive options are Ultra-Violet (UV) filter, reverse osmosis.	NSF	NSF Water Treatment Product Search www.nsf.org/Certified/dwtu/ Minnesota Dept. of Health- Water Treatment Carbon Filters www.health.state.mn.us/divs/eh/hazardous/topics/gac.html Consumer Guide to Water Filters www.nrdc.org/water/drinking/gfilters.asp	IEQ175-176
Piping	Cross-linked polyethylene (PEX), or copper piping. PVC pipes are made from toxic chemicals that pollute the environment.	NSF	Hot Water Delivery – Systems and Construction Practices www.awwa.org/waterwiser/references/pdfs/RES_HW_Klein_G_Hot_Water_Delivery_Systems_and_Constructi.pdf Toolbase: Resource Efficient Plumbing www.toolbase.org Hot Water Delivery – Systems and Construction Practices www.awwa.org/waterwiser/references/pdfs/RES_HW_Klein_G_Hot_Water_Delivery_Systems_and_Constructi.pdf	MR122
Water heater	Units with closed combustion or electric ignition. Tankless water heaters may also work depending on the user.	GREEN SEAL, GREENGUARD	PSEG - Tankless Water Heaters www.pseg.com/customer/home/install/waterheaters.jsp American Council for an Energy Efficienct Economy www.aceee.org/consumerguide/waterheating.htm Insulate Your Water Heater Tank for Energy Savings http://www.energysavers.gov/your_home/water_heating/index.cfm/mytopic=13070	EA79
Equipment				
Refrigerator	The most efficient units are ones with the freezer on the top. Bottom freezer units are also very efficient, but avoid side-by-side units.	ENERGY STAR	American Council for an Energy-efficient Economy www.aceee.org/consumerguide/refrigeration.htm Energy Star® - Purchasing Tips www.energystar.gov/index.cfm?c=refrig.pr_tips_refrigerators Consortium For Energy Efficiency – Refrigerators www.cee1.org/resid/seha/refrig/refrig-main.php3	EA93

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Dishwasher	Units with an air-dry option and Energy Factor (EF) of at least 0.65		American Council for an Energy-efficient Economy www.aceee.org/consumerguide/dishwashing.htm Energy Star® - Purchasing Tips www.energystar.gov/index.cfm?c=dishwash.pr_tips_dishwashers	EA94
Cooking appliances (ovens, ranges)	Electric ignition ranges are more efficient than those with pilot lights. Self-cleaning ovens are more insulated and more efficient. Induction ovens are the most efficient but expensive; convection ovens are also efficient and more affordable.		American Council for an Energy-efficient Economy www.aceee.org/consumerguide/cooking.htm	EA95
Uses				
Cleaning products	Products derived from natural ingredients, plant-based oils,and disinfectants are healthier for home use. Always look for low- or no-VOC products.		Low Impact Living www.lowimpactliving.com/ Grist.org – A Test of 8 Green Bathroom Cleaning Products www.grist.org/advice/products/2008/03/25/	IEQ196
Laundry				
Shut-off valve	Install a single-throw shut-off valve on the supply line the for hot and cold water. This is a quick and inexpensive way to prevent potential leakage problems.		Do It Yourself – How to Install Shut Off Valves www.doityourself.com/stry/installshutoffvalve	MR124
Drain/drain pan	Install a drain and drain pan under the clothes washer that will prevent water damage should a break or a leak occur.		Checklist for Decay Resistance www.lsuagcenter.com/en/family_home/home/la_house/my_ house/Durable/ Clotheswasher Drain Pan Specifications www.floodsaver.com/24_Specs.htm ReGreen Reference Guide to Product Considerations, www.regreenprogram.org	MR125

ambient lighting Ambient lighting uses warm lighting sources with a color temperature between 2700 - 3000K that is more flattering to skin tones and clothing. Recommended for living spaces.

ANSI/ASHRAE

ANSI The American National Standards Institute oversees the activities of many industries in the United States to ensure competitiveness in the global marketplace, the health of consumers, and environmental protection.

ASHRAE The American Society of Heating, Refrigerating and Air-Conditioning Engineers is an international organization whose mission is to advance the arts and sciences of heating, ventilating, air conditioning, and refrigerating to serve humanity and promote a sustainable world.

asbestos Asbestos is the name given to a number of naturally-occurring, fibrous silicate minerals mined for their useful properties such as thermal insulation, chemical and thermal stability, and high tensile strength. Asbestos is commonly used as an acoustic insulator, and in thermal insulation, fire proofing and other building materials. Many products in use today contain asbestos.

awning An awning is a constructed frame covered in a material that extends from an existing structure (usually the side of a house) to provide protection from the sun and rain.

backdrafting Backdrafting occurs when a home becomes depressurized from air escaping to the outside and is replaced with air entering from the exterior. This air may contain combustion products including carbon monoxide.

Blower Door Test The Blower Door Test measures the leakiness of the house or its air infiltration and helps a homeowner prioritize problem areas. This test uses pressure differences created by air flow via a calibrated fan that mounts on the frame of an existing door and pulls air out of the house, lowering the inside air pressure. As higher pressure outside air travels in through unsealed cracks and openings, tools like a smoke pencil can detect these air leaks as part of a visual inspection process.

brominated Brominated materials are combined with Bromine, a heavy, volatile, corrosive, reddish-brown, nonmetallic liquid element, having a highly irritating vapor. Some of the materials include flame retardants, photographic chemicals, and dyes among others.

building envelope The building envelope of a structure is descriptive term that separates its interior from the exterior.

carbon dioxide (CO_2) Carbon Dioxide is a gas byproduct of the burning of fossil fuels and other forms of combustion.

carbon monoxide (CO) Carbon Monoxide is a toxic gas byproduct of combustion that is both odorless and colorless. Sources of its production include wood stoves, fireplaces, gas stoves, and furnaces among others.

carbon/specialized media Carbon or specialized media refers to the presence of bacteria that can be applied to a filtration system to remove certain pollutants.

cellulose Cellulose fibers from recycled newsprint can be applied as a form of insulation resistant to flame, mold, and pests; provides thermal and sound insulation, and resists settling.

cellulose fiber Cellulose fibers from recycled newsprint can be applied as a form of insulation that resists flame, mold, and pests, provides thermal and sound insulation, and resists settling.

cement board Cement board is a non-combustible, water-durable, and mold-resistant panel that is typically used under tile and other finishes, for interior and exterior use.

certified sustainable wood Certified sustainable wood meets specific criteria developed by organizations such as the Forest Stewardship Council to promote responsible wood harvesting and condemn the exploitation of local peoples.

Chlorinated Polyvinyl Chloride (CPVC) Chlorinated Polyvinyl Chloride (CPVC) are thermoplastic piping materials used for such applications as water distribution, industrial fluid handling, and fire suppression systems.

Color Rendering Index (CRI) The Color Rendering Index (CRI) is a 1-100 scale that measures how colors appear under different light sources. A light source with a CRI of 80 or higher is considered acceptable for most indoor residential applications.

combustion Combustion is the chemical process of the release of gasses in the process of burning of a fuel.

combustion appliances Combustion appliances burn fuels including stoves, water heaters, and clothes dryers. It is important to make sure that these appliances work correctly and are properly ventilated to prevent carbon monoxide, a byproduct of combustion, from entering the home.

combustion equipment Combustion equipment refers to appliances that burn fuels including stoves, water heaters, and clothes dryers. It is important to make sure that these appliances work correctly and are properly ventilated to prevent carbon monoxide, a byproduct of combustion, from entering the home.

Compact Fluorescent Lights (CFLs) Compact fluorescent lights are the miniature fluorescent lights that can screw into light fixtures that conventionally use incandescent bulbs. CFLs are more energy-efficient and durable than incandescent bulbs.

cross-linked polyethylene (PEX) Cross-linked polyethylene is a plastic often used for water supply piping that is flexible, resistant to scale and chlorine, doesn't corrode, is faster to install, and has fewer connections and fittings than does metal piping or rigid plastic piping such as PVC, CPVC, and ABS.

diffuser Diffusers are circular, square or rectangular air distribution outlets which are usually located in the ceiling. They are comprised of deflecting blades which discharge supply air in various directions. Diffusers are designed to mix the conditioned air entering the space with the air already contained in the space.

disposable respirators Disposable respirators or filtering facepieces can be made of cloth or paper and are designed to clean the air as you breathe it to prevent you from inhaling irritating substances.

double-hung window(s) Double-hung windows have two vertically sliding sashes, each closing a different part of the window.

double-pane window(s) Double-Pane Windows consist of two pieces of glass separated by an air space. The air space allows for less heat transfer between the interior and the exterior of the home reducing heating and cooling loads.

drain pan Drain pans are installed to catch any fluids leaking from a piece of equipment such as a clothes washer.

Duct Blaster Test A duct blaster utilizes a fan and a pressure gauge to measure the amount of air escaping from the ductwork of a home by pressurizing the system.

duct cleaning Duct cleaning refers to the cleaning of heating and cooling system components in forced air systems, including the supply and return-air ducts, registers, grilles, diffusers, heat exchangers, heating and cooling coils, drain pans, fan motor, fan housing, and the air handling unit.

electrochromic Electrochromic windows can convert from being transparent to tinted via an electrical switch, or a sunlight or temperature sensing detector that applies an electrical charge to the window. These window systems can control the amount of light and solar energy that pass through providing control over daylighting, glare, solar heat, and protection from harmful ultraviolet (UV) rays.

endocrine system The endocrine system regulates the release of hormones throughout the body. They control metabolism, growth and development, mood, and tissue function.

energy performance rating Energy performance ratings indicate the potential for heat transfer and sunlight transmittance of windows, doors, and skylights.

Energy Star® Label The Energy Star label appears on appliances that meet the standards developed by the United States Environmental Protection Agency of energy, water and other resource conservation.

Environmental Protection Agency (EPA) The United States Environmental Protection Agency conducts research, educates, and assesses issues in environmental science to promote human health and a healthy environment.

fire retardants Fire retardants are chemicals used to prevent or resist the spread of fire.

flame retardants Flame retardants are non-combustible materials that resist the spread of fire.

flashing Any piece of material, usually metal or plastic, installed to prevent water from penetrating the structure.

formaldehyde Formaldehyde is a chemical compound used in products including paper towels, photographic film, glues, and inks among others. It is important to avoid products containing formaldehyde whenever possible as they off-gas potentially hazardous pollutants.

Forest Stewardship Council (FSC) The Forest Stewardship Council (FSC) is an independent, non-governmental, not-for-profit organization established to promote the responsible management of the world's forests.

Forest Stewardship Council (FSC)-Certified Wood The Forest Stewardship Council certifies wood that complies with its standards, disapproving of illegally harvested wood, wood harvested in violation of traditional and civil rights, in forests in which High Conservation Values (areas particularly worthy of protection) are threatened through management activities, from conversion of natural forests, and from areas where genetically modified trees are planted.

glazing Window glazings are compounds applied to glass to reduce the amount of heat transfer between the interior and the exterior of a building and/or the ultra-violet (UV) light passing that passes through it.

grille Grilles are vent covers that are normally used on air return ducts. Grilles do not have a pre-attached damper. Louver assemblies can be used with grilles so that the grilles can be used on forced air ducts and still provide airflow control.

gypsum Gypsum is a mineral found in sedimentary rock formations in a crystalline form known as calcium sulfate dihydrate. It is typically used in wall board to create of a non-combustible core.

gypsum board Gypsum board or drywall is used in various paneling applications that consist of a paper-faced non-combustible gypsum core.

H-axis machines Horizontal-axis (H-axis) or front loading washing machines use less water by dipping clothes into the water at the bottom of their basins as they rotate.

heat exchanger(s) Commonly used in space heating, refrigeration, air conditioning, and other applications, heat exchangers are devices built for efficient heat transfer from one medium to another.

Heat-Recovery Ventilator (HRV) Heat-recovery ventilators are air circulation systems that minimize the amount of heat that gets lost as air is transferred between the interior and exterior of a home, saving energy.

heating and cooling coils The heating and cooling coils of an appliance or piece of machinery converts electricity into heat energy.

heating load Heating load refers to the amount of heat it takes to maintain the temperature of an indoor space.

Heating, Ventilation, and Air Conditioning (HVAC) Systems Heating, Ventilating, and Air Conditioning systems process and supply air through ductwork helping to regulate humidity and temperature in buildings to provide safe, healthy, and comfortable conditions.

heavy metals Heavy metals including copper, selenium, and zinc are elements found in the earth's crust that can't be degraded or destroyed. Some in small doses are vital to bodily functions while high concentrations can be lethal.

HEPA filtered air scrubbers High efficiency particulate air or HEPA air filters are a type of high-efficiency air filter that remove at least 99.97% of airborne particles down to a size of 0.3 micrometers (μm) in diameter.

HEPA vacuum High efficiency particulate air or HEPA filters are a type of high-efficiency air filter that remove at least 99.97% of airborne particles 0.3 micrometers (μm) in diameter. HEPA filter