

HOME REMODELING

GREEN BUILDING GUIDELINES



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These Green Building Guidelines are designed for professional contractors and homeowners

The Guidelines offer:

- ❖ Cost-effective suggestions to minimize construction-related waste, create healthier and more durable homes, reduce operating costs for homeowners and support local manufacturers and suppliers of resource-efficient building materials.
- ❖ Methods to reduce the impacts of building in Contra Costa County communities; including solid waste management, water conservation, energy efficiency and resource conservation.

The practices contained in these Guidelines were selected for their viability in today's market and their ability to promote sustainable building. Builders using this booklet will differentiate themselves in the marketplace while protecting our environment.

LOCAL RECYCLING AGENCIES

The local recycling agency phone numbers below will put you in contact with a representative for one of the nineteen cities or the unincorporated areas of the County. These agencies offer a wide range of programs in the areas of waste reduction, recycling, composting, market development and other related technical assistance.

City/County	Phone Numbers
Antioch	925-779-7097
Brentwood	925-516-5400
Clayton	925-673-7300
Concord	925-671-3394
Danville	925-906-1801
El Cerrito	510-215-4350
Hercules	510-215-3125
Lafayette	925-906-1801
Martinez	925-372-3531
Moraga	925-906-1801
Oakley	925-335-1231
Orinda	925-906-1801
Pinole	510-215-3125
Pittsburg	925-252-4110
Pleasant Hill	925-671-5203
Richmond	510-215-3125
San Pablo	510-215-3125
San Ramon	925-973-2552
Walnut Creek	925-906-1801
Unincorporated County (all other areas)	925-335-1231

HOUSEHOLD HAZARDOUS WASTE FACILITIES

Serving Central County:

Central Contra Costa Sanitary District
Household Hazardous Waste Collection Facility
800-646-1431

Serving East County:

Delta Diablo Sanitary District
Household Hazardous Waste Collection Facility
925-778-4040

Serving West County:

West County Household Hazardous
Waste Collection Facility
888-412-9277

LOCAL WATER UTILITIES

The following cities/communities are served by their own local water utility:

City/County	Phone Numbers
Antioch	925-779-7060
Brentwood	925-516-5400
Bay Point	925-458-3112
Martinez	925-372-3575
Oakley	925-625-3798
Pittsburg	925-252-4940

The remaining cities and unincorporated communities are served by one of the below water utilities.

Serving West County and portion of Central County:

East Bay Municipal Utilities District
510-287-1380 or www.ebmud.com

Serving majority of Central County:

Contra Costa Water District
925-688-8000 or www.ccwater.com

ENERGY UTILITY

PG&E's Smarter Energy Line
800-933-9555 or www.pge.com

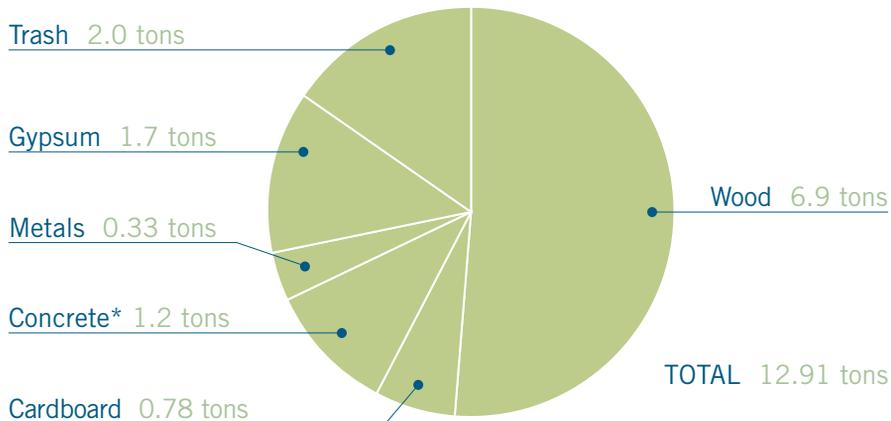
CONSTRUCTION & DEMOLITION RECYCLING

The "Contra Costa Builder's Guide to Reuse and Recycling" was developed to provide local building contractors with information about recycling facilities and services that recover rather than dispose of jobsite debris. Look inside the back cover for your free copy or call 1-800-750-4096 to request a copy.

Reducing Construction and Demolition Waste

All cities and counties in California are required to develop and implement programs that divert waste from landfills. Construction and demolition debris comprise up to 30% of materials disposed in California landfills. Through job site recycling, efficient use of materials, use of recycled content building materials and similar practices, the Green Building Guidelines provide an effective tool to decrease the amount of materials needed for home construction while at the same time decreasing the demand on landfill space.

Construction Waste Generated from a 2,000 Square Foot New Home



* Concrete figure includes waste generated by sidewalk pour.

Acknowledgements

The Green Building Guidelines were developed through a partnership among local developers, architects, contractors, green building experts and staff of the Alameda County Waste Management Authority and Recycling Board.

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Disclaimer

Thank you to the Alameda County Waste Management Authority and Recycling Board (ACWMA) for offering their guidelines.

Contractors, architects and other professionals as well as owners, in the course of designing and constructing new or modified structures, should consider the information provided in these Guidelines. They are provided as a public service by the ACWMA, the Cities of Antioch, Clayton, Concord, Martinez, Pleasant Hill, Pittsburg, and San Ramon, the West Contra Costa Integrated Waste Management Authority and Contra Costa County in an attempt to provide environmental benefits and reduce costs. The Guidelines are not a substitute for the exercise of sound judgment in particular circumstances and are not intended as recommendations for particular products or processes.

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Chapter One: Introduction

This section gives an overview of the basic concepts and elements of green building. Contractors can use the Guidelines as a way to describe green building practices and benefits – highlighting the unique expertise and services they can provide to the homeowner. Homeowners can use the Guidelines to gain information on green building options and to define the objectives of their project.

Introduction

Green building is just applied common sense. To demystify the process and move forward with your construction project, it is helpful to think of green building as the convergence of three fundamental objectives:

- 1 Conserve natural resources**
- 2 Increase energy efficiency**
- 3 Improve indoor air quality**

Natural Resource Conservation

Conventional building practices consume large quantities of wood, plastic, cardboard, paper, water and other natural resources that lead – unnecessarily – to their depletion.

For example, wood is one of the most common building materials, but is often used wastefully. We have already harvested 95% of the nation’s old-growth forests – a trend that simply cannot continue. Engineered lumber products such as wood I-joists, wood fiber laminates and oriented strand board, utilize fast growing farm trees as an alternative to old-growth forests. These products can use as little as 50% of the wood fiber to perform the same structural functions and are typically stronger, straighter and lighter than solid-sawn lumber.

Remodelers have a rapidly expanding range of green building materials from which to choose. Recycled-content decking, insulation, reclaimed lumber and other products divert waste from landfills, while providing quality and durability that often exceed conventional materials. For example, decking material made out of recycled plastic resins mixed with wood waste fibers can last up to five times longer than wood decks, and never need to be treated or painted.

Water conservation is another important issue. Wise water usage reduces the strain on resources as well as lowers expenses. Today, remodelers can take advantage of a new generation of high-efficiency washers, dishwashers, and landscape water management systems.



CONTRACTOR TIP

PROVIDE A HOMEOWNER’S MANUAL OF PRODUCTS INSTALLED

Provide homeowners with a product manual that describes the benefits of the various green materials installed and how to maintain them. Informing the homeowner about the green features and products will ensure the effective use and maintenance of the features for many years after the project is completed.

Energy Efficiency

Energy efficiency is a cornerstone of any green building project. Generation and use of energy are major contributors to air pollution and global climate change. Improving energy efficiency and using renewable energy sources are effective ways to improve air quality and reduce the impacts of global warming.

Improving energy efficiency is also an economically effective choice for consumers. Lowering utility expenses allows residents to enjoy the financial benefits year after year.

The first step to increase energy efficiency is to add insulation and weather stripping wherever possible, install double-glazed/low-E windows and upgrade to high-efficiency appliances. Other energy upgrades/choices include installing solar water heaters, photovoltaic panels, and purchasing “green power” generated from renewable sources like the sun, wind and biomass (when available).

Indoor Air Quality

The United States Environmental Protection Agency (EPA) reports that the air in new homes can be ten times more polluted than outdoor air. According to the New England Journal of Medicine, 40% of children will develop respiratory disease, in part, due to the chemicals in their homes. Poor indoor air quality is caused by the offgassing of chemicals found in many building materials as well as mold and mildew that build up in homes due to poorly designed and maintained heating and cooling systems.

One of the most common indoor pollutants is formaldehyde, a suspected human carcinogen. Kitchen cabinets, countertops, shelving and furniture are typically made from particleboard held together by formaldehyde-based adhesives. The formaldehyde is released into the home for years after these products have been installed. Many paints and floor finishes also contain unhealthy volatile organic compounds (VOCs). That “new house smell” is actually the odor of these volatile compounds offgassing and is a telltale sign that there are harmful chemicals in the indoor environment.

The building products industry has responded to these indoor pollution problems by developing alternative paint, finish, and adhesive products. For example, solvent-free adhesives used in flooring and countertops can eliminate many of the suspected and known human carcinogens. Paints, varnishes, and cleaners that don't utilize volatile compounds are now commonly available from most major manufacturers at costs comparable to conventional products.

In addition to the growing number of readily available and cost-effective green materials – an increasing number of builders and remodelers are also using natural building materials such as straw-bale, rammed earth, adobe and cob. While less common in their use, natural building products have a positive impact on the environment as they are renewable and abundant; energy-efficient in production, transport and use; non-polluting; durable and long lasting.

Benefits of Green Building

There are many reasons to build green. These include a concern for the environment, an interest in building more efficiently, health considerations or a desire to create an environmentally friendly image for your business. By applying a sustainable perspective to design, construction and remodeling, green building brings the benefits of resource conservation, energy savings and healthy living.

Each of the features listed in these Green Building Guidelines benefit the environment by addressing one or more of the following: resource conservation, energy efficiency, indoor air quality.

Cost Considerations

While green building and its environmental benefits are becoming more mainstream, it is commonly assumed that green building features and products translate into additional costs. What is often overlooked is the added value that green building contributes to the home: energy-efficiency, improved indoor air quality, healthier homes for the family, and durability. These Guidelines recommend methods and materials that range in cost—some of them cost no more or even less than conventional options.

Often the homeowner focuses on the “up-front” costs (materials and installation) to incorporate green features into a home. When other factors are considered, such as lower maintenance and operation costs, many of the recommended strategies in these Guidelines offer tangible economic benefits to the homeowner. Energy upgrades alone usually result in a payback through lower monthly energy costs.

When considering green building measures, it is very important to balance product and installation costs with other significant benefits such as energy savings, increased durability, enhanced air quality and healthier homes for occupants.



Chapter Two: Green Building Methods and Materials

This section provides more detailed descriptions of green building practices, material applications, as well as the associated environmental benefits. The items are ordered by ease of implementation as well as cost effectiveness.

A. Site

1. Recycle Job Site Construction and Demolition Waste

Description:

Construction waste generally consists of wood, drywall, metals, concrete, dirt and cardboard – materials that can be reused or recycled if prepared properly. Each year millions of tons of construction and demolition debris are disposed of at county landfills in California.

Application:

Identify the types and quantities of materials generated at the job site. Contact local recycling facilities and haulers to identify terms and conditions required for recycling materials. Allocate space for recycling bins and containers. Contact your local recycling agency or green building program listed on Page 2 for more information.

Benefit:

Recycling reduces pressure on landfills, saves money by reducing tipping fees, and provides raw materials for future building products.

2. Salvage Reusable Building Materials

Description:

Various building materials can be salvaged and reused, such as flooring, doors and windows, tubs and sinks, cabinets, fixtures, etc.

Application:

When remodeling, consider salvage and deconstruction, by selectively and carefully removing materials for reuse. There are a number of licensed contractors that offer dismantling services to salvage materials for reuse. Many firms are non-profits and will provide itemized donation receipts. Usable items can also be dropped off at used building material stores. Contact your local recycling agency or green building program listed on Page 2 for more information.

Benefit:

Salvaging reusable building materials decreases disposal costs, saves natural resources and increases landfill capacity. Donations can be tax deductible.

3. Install Drip Irrigation

Description:

Drip irrigation systems provide a small but constant water supply to landscape, thus preserving soil moisture, and significantly reducing water waste from overspray.

Application:

Replace standard sprinkler systems with drip irrigation systems for all landscape applications except turf.

Benefit:

Drip irrigation systems dramatically reduce landscape water use and lower water costs.

4. Incorporate Permeable Paving

Description:

Permeable paving allows water to percolate into the soil. For driveways, walkways and paths, utilize gap-spaced unit pavers, decomposed granite, gravel or grass-stabilization systems.

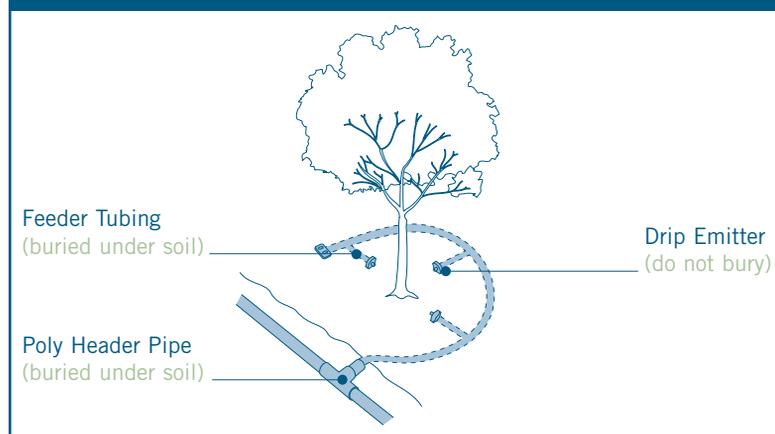
Application:

Use permeable paving for walkways, patios, and driveways. Installed like conventional pavers.

Benefit:

Allowing stormwater percolation reduces the volume of polluted water that flows into rivers or the Bay, while replenishing soil moisture and local aquifers. Additional benefits include reduction in irrigation requirements as well as lower risk of flooding.

Drip Irrigation System for widely-spaced plants and trees



5. Design Resource-Efficient Landscapes and Gardens

Description:

Conventional landscapes have high inputs of water and chemicals and are often overplanted or planted without regard for climate and soil conditions. This results in excess water use, water pollution and waste generation.

Application:

Specify plants that are appropriate for the climate and soil of the area; select slow growing, drought tolerant plants; design with perennials instead of annuals; and site plants appropriately – giving them plenty of room to mature and reducing the need for pruning. Recycle yard trimmings by grasscycling, mulching and composting.

Benefit:

Sustainable landscape techniques are in harmony with the local environment and help conserve water, reduce use of chemicals, create healthier soil and plants, and increase bio-diversity in landscape areas.



Resource-Efficient Garden

6. Provide for On-Site Water Catchment / Retention

Description:

Rainwater is channeled through gutters and downspouts to an above ground cistern or underground gravel dry well. Stored water is used for landscape irrigation.

Application:

Install wherever there is guttered roof runoff and room for the cistern.

Benefit:

Water catchment reduces the need to use treated, drinkable water for watering of lawns and gardens.

7. Remodel for Mixed Use, Adaptive Reuse and Historic Preservation

Description:

Reusing existing buildings is one of the most straightforward ways to conserve resources. Older buildings typically feature high-quality materials in the structure, doors, windows, and finishes. When working with historic buildings, remodelers should also review the Department of the Interior Standards for Historic Preservation.

Application:

Many high quality materials found in older structures can be left in place or reused. Large timbers, beams, columns, and trusses can be regraded and certified for use in structural applications.

Benefit:

The reuse of older buildings conserves resources, diverts demolition waste from landfills, and preserves neighborhood character.



HOMEOWNER TIP

COMPOST FRUIT, VEGETABLE AND YARD TRIMMINGS

Compost is nature's way of recycling. Turn fruit, vegetable and yard trimmings into a first rate soil conditioner. Use compost to replace store-bought soil conditioners. Compost adds nutrients and beneficial microbes to soil, improves soil fertility and reduces watering needs. Composting saves money by lowering garbage bills, increases the ability of soil to hold water, improves soil health, and helps extend the life of our landfills. Contact your local recycling agency listed on Page 2 for more information and discounts on compost bins.

B. Foundation

1. Incorporate Recycled Flyash in Concrete

Description:

Flyash is a byproduct of coal burning power plants and can be an inexpensive substitute for a portion of portland cement used in concrete.

Application:

Typically, 15-50% of cement can be replaced with flyash in residential concrete mixes, however it must be cured longer than standard concrete.

Benefit:

Flyash increases the strength and durability of the concrete. Using flyash also reduces the amount of cement needed, thereby decreasing the overall environmental impacts of cement production.

2. Reuse Form Boards

Description:

Form boards are often 2x10 or larger solid sawn lumber typically cut from old-growth trees.

Application:

Forms are used whenever concrete is poured. By carefully removing and separating the forms, they can be reused several times.

Benefit:

Reuse of forms saves money and conserves resources. Solid sawn lumber is becoming increasingly expensive and scarce.

3. Use Recycled Content Rubble for Backfill Drainage

Description:

Concrete and rubble can be crushed and used for backfill and drainage purposes at the base of foundations.

Application:

Use recycled materials for backfill.

Benefit:

Using recycled instead of virgin materials saves money and natural resources.



5. Use Aluminum Forms

Description:

Aluminum forms come in all sizes and shapes and produce a smooth finished surface on the concrete. They can be used repeatedly.

Application:

Aluminum forms can be used in most applications to replace wood forms.

Benefit:

Because they can be reused many times, aluminum forms reduce wood use and, despite higher initial cost, pay for themselves quickly.



Insulated Concrete Forms (ICFs)

4. Insulate Foundation Before Backfill

Description:

All foundations, including slab floors, can be insulated to minimize heat loss.

Application:

Insulate foundation with extruded polystyrene insulation of at least R-4 (1" or greater).

Benefit:

Insulating the foundation minimizes heat loss from the floors and basement, reduces energy loss and therefore reduces utility bills.

6. Install Rigid Foam, Insulated Concrete Forms (ICFs)

Description:

Rigid foam forming systems hold concrete in place during curing and remain in place afterwards to serve as thermal insulation for concrete walls.

Application:

Use rigid foam forming systems wherever an insulated foundation is desirable.

Benefit:

Unlike untreated lumber, ICFs are not subject to rot and result in a better insulated foundation.

C. Structural Frame

1. Substitute Solid Sawn Lumber with Engineered Lumber

Description:

Solid sawn lumber in sizes of 2x10 or greater typically comes from old-growth forests. Engineered lumber products, on the other hand, come from small-diameter and fast growing plantation trees. These products include glulams, laminated veneer lumber, wood I-joists, oriented strand board, parallel strand lumber, and other manufactured wood fiber structural materials.

Application:

A. Floor Joist

2x10 and larger lumber are typically used for floor and ceiling joists and some seismic applications. Large size lumber can be replaced with engineered lumber in most applications unless required by seismic codes.

B. Non-Load Bearing Header

Solid sawn 4x6 are often used for headers when smaller dimension lumber would suffice, such as double 2x6, unless solid 4x6 are required by seismic codes.

C. Structural Headers and Beams

Engineered lumber should be used whenever structural members are replaced. They substitute for 2x10 and 2x12 in most interior applications such as the structural framing of floors, walls and roofs.

Benefit:

Reducing demand for large dimensional lumber decreases pressure to cut down old-growth forests. Engineered lumber uses wood fiber more efficiently than conventional lumber, resulting in stronger and higher quality homes.

2. Use Forest Stewardship Council (FSC) Certified Wood for Framing

Description:

FSC certification assures that the forest from which the wood is produced is managed in an environmentally and socially responsible manner.

Application:

Use FSC wood whenever new wood framing is required. Certified framing materials and plywood are available.

Benefit:

FSC certification guarantees that forests are managed in a way that will assure the long-term availability of precious woods while protecting old-growth forests.

3. Use Wood I-Joists for Floors and Ceilings

Description:

Wood I-joists are engineered to use only the wood fiber necessary for the structural function required. They typically use oriented strand board (OSB) for the web and either laminated veneer lumber or solid sawn lumber for the chords (top and bottom pieces).

Application:

Replace solid sawn lumber with wood I-joists for floor and ceiling joists. Often they can be used at 19.2" centers to save material.

Benefit:

Wood I-joists use 50% less wood fiber to perform the same structural function as similar sized solid sawn lumber and will never twist, warp or split. They are stronger and lighter than 2x10 or 2x12 and can span greater distances.

Engineered Wood I-joist



4. Use Oriented Strand Board (OSB) for Subfloor and Sheathing

Description:

OSB is manufactured from fast growing farm trees. OSB comes in sheets and is used for sheathing and subfloors.

Application:

Use OSB as an alternative to plywood for sheathing or subfloors.

Benefit:

OSB is as strong as traditional plywood sheet material and is less expensive. OSB reduces the need for large diameter old-growth trees required for plywood. Some OSB uses lower formaldehyde content adhesives which contributes to a healthier indoor air quality.

Oriented Strand Board



5. Use Finger-Jointed Studs

Description:

Finger-jointed studs use short pieces of 2x4 or 2x6 material glued together to form standard stud lengths.

Application:

Use finger-jointed studs (graded equivalent to full dimensional studs – 1997 UBC Standard, Chapters 23 and 35) wherever conventional studs are typically used, in vertical applications. Use of finger-jointed studs may require code approval by your local jurisdiction, and may need to be submitted to the structural engineer of record for approval.

Benefit:

Finger-jointed studs reduce the use of solid sawn wood studs. They are straighter and stronger than solid sawn studs, eliminating crooked walls and reducing material waste.

6. Use Structural Insulated Panels (SIPs) for Walls and Roof

Description:

SIPs are a sandwich of rigid foam with OSB on either side. They come in nominal 4"-12" thickness and are about R-4 per inch.

Application:

Use SIPs for structural exterior walls and roofs in place of stick framing. SIPs can be designed to meet seismic Zone 4 requirements.

Benefit:

SIPs are more energy-efficient, provide excellent soundproofing and reduce infiltration relative to frame construction. They can be erected quickly, allowing for faster construction. They save wood by eliminating much of the conventional framing lumber.

7. Use Reclaimed Lumber

Description:

High quality dimensional lumber in long lengths can often be salvaged from old buildings that are being deconstructed or salvaged.

Application:

Use reclaimed lumber for non-structural applications, in place of new material. For structural applications, look for reclaimed lumber that is engineer-stamped and graded.

Benefit:

Reclaimed lumber from deconstructed buildings reduces resource consumption and landfill deposits. Reclaimed lumber is often of higher quality than new lumber.

D. Exterior Finish

1. Use Sustainable Decking Materials

A. Recycled Content Decking

Description:

There are two types of recycled content decking: plastic lumber and composite lumber. Recycled plastic lumber contains only recycled plastic resins, while composite lumber is made by combining recycled wood fiber and recycled plastic resins that are then formed into deck boards.

Application:

Use recycled content decking in all non-structural deck applications. Both products can be used in place of old-growth redwood, cedar and pressure treated pine. These products accept screws and nails, and cut like wood. Follow manufacturer recommendations closely regarding the amount of expansion that will occur when using plastic lumber.

Benefit:

The durability of these materials is greater than wood, providing cost savings to the homeowner over the life of the products. They will not rot, crack or splinter, do not require staining and are not treated with potentially toxic chemicals. Using recycled content decking also reduces pressure on old-growth forests.

Recycled Content Decking

B. Forest Stewardship Council (FSC) Certified Wood Decking

Description:

Certified, sustainably harvested lumber comes from forests managed in an environmentally and socially responsible manner.

Application:

Use FSC Certified lumber for all exterior decking applications or as structural deck members in conjunction with recycled content decking.

Benefit:

FSC certification guarantees that forests are managed in a way that will assure the long-term availability of precious woods while preserving old-growth forests.

2. Use Treated Wood That Does Not Contain Chromium or Arsenic for Decking and Sill Plates

Description:

Alkaline Copper Quaternary (ACQ) and Wolman Natural Select are alternative treated woods that do not contain chromium – a heavy metal – and arsenic, which are detrimental to human health. ACQ and Wolman Natural Select eliminates both of these components yet provide long-term protection.

Application:

Use non-chromium/arsenic treated wood for any application that specifies treated lumber including decking, fencing, and site furnishings.

Benefit:

ACQ and Wolman Natural Select use copper as its main component, and is a healthier alternative to lumber treated with chromium and arsenic, particularly for children who play on or near decks.



3. Use Alternative Siding Materials

A. Use Recycled Content Siding

Description:

Recycled content siding is often called hardboard. Hardboard includes varying amounts of recycled content materials and looks and performs like wood siding.

Application:

Use hardboard whenever wood siding is installed or replaced.

Benefit:

Siding that has been manufactured with recycled wood fiber will not crack, split or warp and holds paint longer than solid wood siding, therefore reducing maintenance costs and resources.

B. Use Fiber-Cement Exterior Siding

Description:

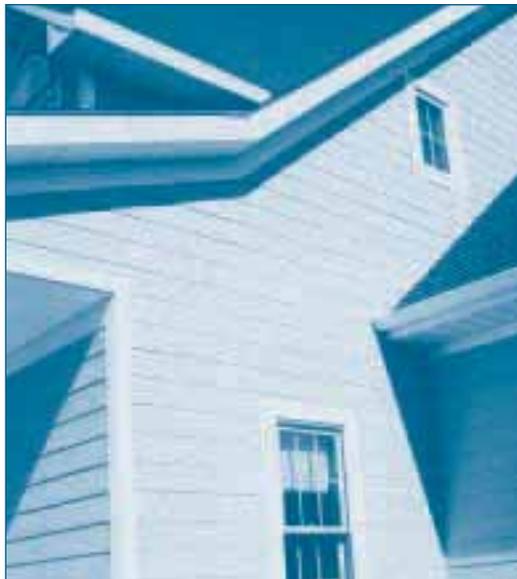
Fiber-cement siding is composed of cement, sand and cellulose fibers. It is available in shingles, planks or 4x8, 4x9, or 4x10 sheets. It is textured to look like wood siding or stucco finish.

Application:

Replace conventional wood siding or stucco finishes with fiber-cement siding. This product can be cut with a carbide-tipped saw blade, snapper shears or with a guillotine cutter. Dust protection and control are required when cutting with a circular saw.

Benefit:

Fiber-cement siding is more durable than wood, termite resistant, non-combustible and warranted to last 50 years. Using fiber-cement siding reduces the demand for old-growth redwood or cedar siding. It may also reduce homeowner's insurance rates due to fire resistance.



Fiber-Cement Siding

E. Plumbing

1. Install Hot Water Jacket Insulation

Description:

Water heater jacket insulation is an insulated wrapper that goes around the hot water tank and is secured in place.

Application:

Install on existing hot water heaters. For new water heaters, make sure that installation will not void warranty.

Benefit:

Jacket insulation reduces heat loss by about 10% and more on older water heaters.

2. Convert Gas to Tankless Water Heaters

Description:

Tankless water heaters (flash or on-demand heaters) heat water as needed rather than having a tank in which hot water is stored. Their capacity to provide hot water is virtually unlimited.

Application:

Install tankless water heater as close to the point of use as possible. The device should have a variable-set thermostat and be appropriately sized. Gas tankless water heaters typically have more capacity than electric tankless heaters.

Benefit:

Typical water heaters lose 15% of their energy through standing tank losses, whereas tankless heaters use energy only for immediate hot water needs. Tankless water heaters often are quicker and more reliable.

3. Insulate Hot and Cold Water Pipes

Description:

Insulating water pipes reduces heat loss or gain in the pipes while the water is standing.

Application:

Insulate hot water pipes in all runs through unconditioned spaces: basements, crawl spaces, attics, etc. At a minimum, insulate both hot and cold pipes at least 6 feet from the hot water heater to prevent convective circulation from the heater through the pipes.

Benefit:

Insulated pipes save energy and water. The water does not need to run as long to get hot water to a distant faucet, thereby reducing hot water heating costs.

4. Retrofit all Faucets and Showers with Flow Reducers

Description:

Flow reducers fit into the aerator at the tip of the faucet and reduce the rate of water flow through the faucet. Low flow showerheads replace standard showerheads.

Application:

Use flow reducers on all faucets and showers that accept reducers. Old fixtures may not accept reducers if they do not have screw-on aerators.

Benefit:

Flow reducers can cut water usage of faucets and showers by as much as 40% with little noticeable effect.

5. Replace Toilets with Low Flow Models

Description:

New toilets use 1.6 gallons per flush compared with old toilets that require 5-7 gallons per flush.

Application:

Whenever possible, replace existing toilets with new 1.6-gallon models.

Benefit:

It is estimated that low flow toilets alone can save up to 22,000 gallons of water per year for a family of four.

6. Install Chlorine Filter on Showerhead

Description:

Water filters on showerheads reduce chemicals and particulates from the water stream.

Application:

Install the water filter between the pipe and the existing showerhead.

Benefit:

Chlorine is absorbed 6 times faster through the skin than through the digestive system. It has been shown that chlorine absorption can have adverse health effects on some people and especially children.

7. Pre-Plumb for Graywater Conversion

Description:

Graywater is wastewater from sinks, showers and washing machines that is not contaminated by human waste.

Application:

Graywater plumbing separates the waste pipes from sinks, showers, and washing machines from the toilet waste. Graywater drains are run to a holding tank similar to a septic tank which, in turn, is used to water plants, lawns and gardens. Check with your local building department for requirements.

Benefit:

Graywater utilization cuts down on the use of potable water for outside irrigation and lawn watering. It is essentially recycling water at home.

8. Install Water Filtration Units at Faucets

Description:

Water filtration units can be installed at individual faucets or for the whole house. They reduce chlorine and many other chemicals, particulates and microorganisms.

Application:

Whole house filters are for drinking water and plumbing (not for hosebibs or toilets). Install filtration system between the cold water line and the main drinking water faucets in the house.

Benefit:

Agricultural run-off, chemical leaching and microorganisms increasingly contaminate public water systems across the country. House filtration systems reduce the health threat of these contaminants.

9. Install On-Demand Hot Water Circulation Pump

Description:

An on-demand hot water circulation pump can send hot water to fixtures in seconds; without wasting water while waiting for it to get hot. It uses a pump to rapidly move water from a water heater to fixtures. It stops when water reaches a pre-set temperature.

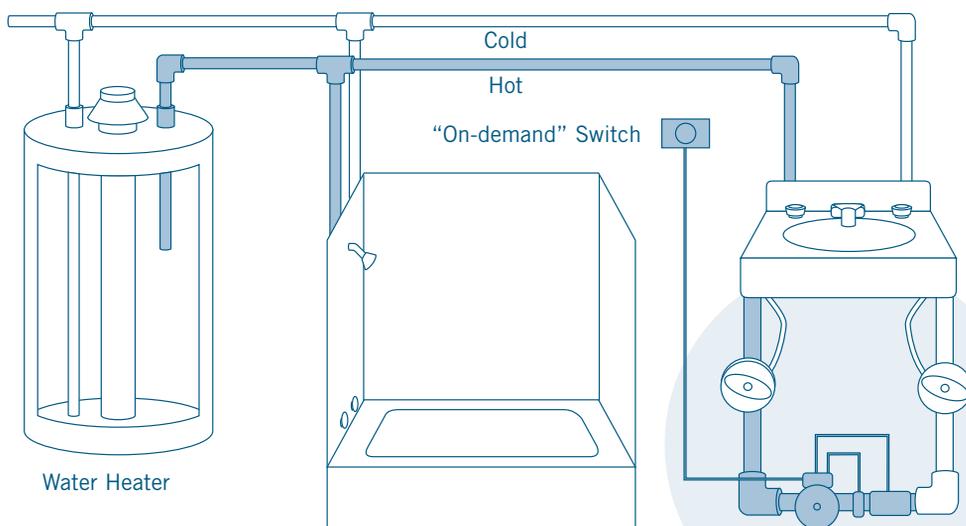
Application:

Install the pump at the furthest faucet from the water heater. Only one pump is needed to supply hot water to any fixture and can easily be installed.

Benefit:

Both water and energy are saved since water doesn't have to be wasted until it reaches the correct temperature for use. Hot water arrives to the fixture 5 times faster than on average.

On-Demand Water Circulation Pump



F. Electrical

1. Install Compact Fluorescent Light Bulbs (CFLs)

m:

CFLs screw in like conventional bulbs but consume up to one-fourth of the electricity used by incandescent bulbs to produce an equivalent amount of light.

Application:

Install CFLs in place of standard incandescent bulbs. CFLs are not recommended for fixtures that are turned on and off many times per day, i.e. a busy bathroom. Choose a CFL that is one-fourth the wattage of the incandescent bulb.

Benefit:

Compact fluorescent bulbs are a profitable investment, saving several times their purchase price through reduced electricity bills and fewer replacement bulbs because they last eight times longer.

2. Install Lighting Controls

Description:

Lighting controls use sensors and timers to turn lights off in unused areas or during times when lighting is not needed.

Application:

Install lighting controls either at specific locations or as a whole house system. Lighting controls are especially applicable for exterior uses but are not recommended for use in bathrooms with showers.

Benefit:

Lighting controls reduce energy use by having the lights on for shorter periods of time.

3. Install Ceiling Fans

Description:

Ceiling fans improve interior comfort by circulating cold and warm air. They can be adjusted to either draw warm air upward during summer months or push it downward during the winter.

Application:

Preferable locations are bedrooms and living rooms where occupants spend time. Ceiling fans must be supported adequately between ceiling joists.

Benefit:

Ceiling fans can reduce the need for air conditioning.



ENERGY STAR® qualified compact fluorescent lighting lasts up to eight times longer than incandescent lighting. Save \$22 to \$65 in energy costs over the life of a compact fluorescent bulb. You'll replace an incandescent eight times to match the life expectancy of a single compact fluorescent.

How do you choose the right compact fluorescent bulb? The following is a general guide to assist you:

Source: www.pge.com

Existing Incandescent Lamp	Proposed ENERGY STAR® Compact Fluorescent Bulb	Savings over the life of the bulb
40 - 60 watts	11 - 15 watts	\$22 - \$35
75 watts	16 - 20 watts	\$43 +
90 - 100 watts	23 - 40 watts	\$52 +

G. Roofing

1. Select Light Colored Roofing

Description:

Dark roofing materials absorb heat making the house warmer in summer months, whereas light colored roofing reflects heat away from the building.

Application:

For pitched roof buildings, use light colored roofing. For flat roofs, the black asphalt or roofing material should be coated with light colored gravel or painted with light colored or reflective paint.

Benefit:

Light colored roofing reduces heat buildup through the roof, increasing occupancy comfort, and decreasing air conditioning bills. Light colored roofing can also last longer because it does not thermally expand and contract as much as darker colors.

2. Select Safe and Durable Roofing Materials

Description:

40-year asphalt composition, tile, slate, fiber-cement and metal are examples of safe and durable roofing materials. Avoid cedar and wood shake shingles.

Application:

Applicable anytime roofing material is specified.

Benefit:

A durable and safe roof is cost effective and reduces landfill deposits.



Standing Seam Metal Roof (top)
Fiber-Cement Roofing Tiles (above)
40-year Composition Roofing (below)



HOMEOWNER TIP

INSTALL A REFLECTIVE WHITE COATING ON YOUR ROOF

A reflective white coating can increase the roof's reflectivity and reduce energy consumption. A number of studies have begun to quantify possible energy savings with reflective roofing materials. One study by the Florida Solar Energy Center found that air conditioning energy use was reduced by an average of 23% in houses with increased roof reflectance.

H. Appliances

1. Replace Dishwasher

Description:

New model dishwashers use water and energy more efficiently.

Application:

Select ENERGY STAR® dishwashers when replacing older models.

Benefit:

Water-efficient dishwashers are also energy-efficient because most energy consumed by dishwashers is used to heat water. These dishwashers are at least 30% more efficient than 1994 standard washers.

2. Install Horizontal Axis Washing Machine

Description:

Horizontal axis machines load from the front, spinning clothes in and out of the water to tumble them clean.

Application:

Install ENERGY STAR® horizontal axis washing machines when replacing older models.

Benefit:

Horizontal axis machines save resources by using less water and energy. They use up to 40% less water and 50% less energy than conventional top loading washers, translating into lower energy and water bills for the resident. Manufacturers claim that there is less wear and tear on clothes compared to the traditional agitator (top loading) machines



Horizontal Axis Washing Machines

3. Install Energy-Efficient Refrigerator

Description:

Refrigerators and freezers are among the largest users of electricity in most homes. They can account for up to 25% of household energy use. New appliances are much more energy-efficient.

Application:

Use ENERGY STAR® rated refrigerators when replacing old units.

Benefit:

New, efficient refrigerators can save over 10% of the total annual electrical bill. Check with your local utility company for rebate programs.



You will find the ENERGY STAR® label on products that exceed energy performance guidelines for energy efficiency. If all consumers, businesses, and organizations in the United States chose ENERGY STAR® products over the next decade, the national annual energy bill would be reduced by about \$200 billion. For more information, visit www.energystar.gov.

I. Insulation

1. Upgrade Wall and Ceiling Insulation to Exceed Title 24 Requirements

Description:

Insulation in exterior walls and ceilings can reduce the demand for air conditioning and heating and make homes more comfortable.

Application:

A. Wall Insulation

Insulate walls of existing wood frame houses to the capacity of the wall cavity, exceeding the Title 24 Standard of R-13 by 20%. Wall cavities with existing insulation can be blown full of new cellulose or fiberglass to increase the density, thereby increasing the R-value. Exterior walls can be wrapped with a minimum of 1" (R-4) rigid foam to increase R-value if total exterior refinish is being performed.

B. Ceiling Insulation

Increase ceiling insulation in existing structure to exceed Title 24 Standard of R-19 by 20%, where possible. Installation is generally intended to be in ceilings below attic space, with appropriate gable or soffit ventilation. If existing cathedral or flat ceilings are already insulated, it is not recommended to install more insulation in the cavity unless adequate insulation ventilation is provided. It is most cost-effective to add insulation to cathedral ceilings during construction or when remodeling other areas.

Benefit:

Increased wall and ceiling insulation improves comfort, decreases heating and cooling requirements, saves money, and makes the home quieter.

2. Install Recycled Content, Formaldehyde-Free Fiberglass Insulation

Description:

Many fiberglass insulation products include recycled glass, formaldehyde-free binders, no asphalt adhesives or colored dyes.

Application:

When using fiberglass insulation, specify recycled content and no formaldehyde. Fiberglass insulation can be used for any typical insulation installation.

Benefit:

Formaldehyde-free binders reduce indoor air quality problems and insulation contains up to 30% recycled glass.

Recycled Content, Formaldehyde-Free Fiberglass Insulation



3. Use Advanced Infiltration Reduction Practices

Description:

Expandable foam and caulk are used to prevent infiltration where wood connections are made or framing is drilled to provide plumbing and electrical runs.

Application:

These methods are especially important when fiberglass insulation is installed, since fiberglass does little to reduce infiltration. Seal holes between floors and between stud cavities around wire runs. Caulk top and bottom plates on all floors.

Benefit:

Reduction in infiltration increases comfort and reduces energy bills.

4. Use Cellulose Insulation

A. Walls

Description:

Cellulose is a highly effective insulation made out of recycled newspaper. Spray cellulose wall insulation is mixed with low-toxic binders to adhere to stud and joist cavity surfaces.

Application:

This installation is intended for new construction or total “gut” renovation, where existing wall surfaces have been removed to the studs. It is not cost effective in other applications.

Benefit:

Spray insulation completely fills cavities and penetrations, thus reducing air infiltration. The binder in the insulation also reduces the air movement within wall cavities, reducing moisture intrusion and flame spread. Using cellulose insulation makes the home quieter, more comfortable and energy-efficient.

B. Ceilings

Description:

Dry-blown or loose-fill cellulose is treated with borates for fire and insect resistance. Cellulose does not contain formaldehyde, which is common in many fiberglass insulations.

Application:

Spread cellulose over ceiling joists or blow into tight cavities to increase ceiling R-value. It is important to maintain attic or ceiling ventilation pathways, especially in cathedral ceiling applications.

Benefit:

Cellulose insulation is formaldehyde-free, fire-resistant, manufactured with recycled materials, reduces air leakage and contributes to a more comfortable and energy-efficient home.

Spray Cellulose Insulation



J. Windows

1. Install Energy-Efficient Windows

Windows play a big role in the energy efficiency of homes. In the summer, they can allow unwanted heat into the house, and in the winter, windows can account for as much as 25% of the heat loss. When replacing windows, look for models with the following energy saving features:

A. Double-Paned Windows

Description:

Double glazing insulates almost twice as well as single glazing.

Application:

Replace single-paned windows with double-paned windows whenever possible. Check with your local utility company for rebate programs.

Benefit:

High quality double-paned windows make the whole house quieter and more comfortable during all seasons, while saving energy and money.

B. Low-Emissivity (Low-E) Windows

Description:

Low-E coatings, virtually unnoticeable to the eye, are installed inside the air space of a double-paned window. The low-E coatings help prevent heat from escaping through the glass in winter and block heat from entering the home during summer.

Application:

Use low-E, double-paned windows whenever windows are replaced. Check with your local utility company for rebate programs.

Benefit:

Low-E windows reflect heat, making the home more comfortable in cold weather and on hot summer days. The cost premium of 10-15% for low-E glass typically pays for itself in a few years. Low-E, double-paned glass coating increases glass R-value to 3 compared to R-1 for single-glazed windows.

C. Low-Conductivity Frames

Description:

Most window frames and sashes are made of wood, vinyl, fiberglass or aluminum. Wood, vinyl and fiberglass generally insulate better than aluminum frames.

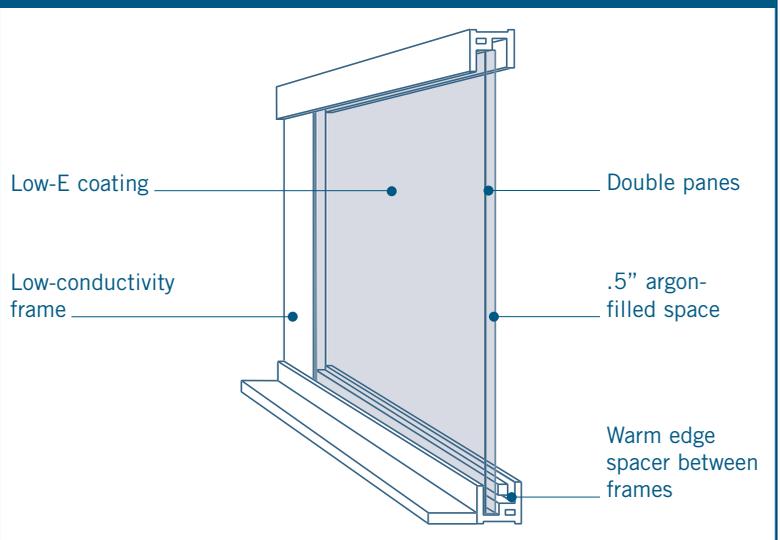
Application:

Consider wood windows for any window that is being replaced.

Benefit:

Wood windows create greater comfort and better energy efficiency and is an environmentally preferable material.

Low-E Glass and Window



2. Install Low Heat Transmission Glazing

Description:

Reflective film reduces heat gain from the sun, particularly during late afternoon and evening hours in hot climate areas.

Application:

Any unshaded, single-glazed west windows are good candidates for film application.

Benefit:

Reflective film reduces overheating and is an inexpensive option that can significantly lower the need for additional cooling.

Energy Rating Factors	Rating	Product Description
U-Factor <small>Determined in accordance with NFRC 100</small>	0.34 0.32	Model 888
Solar Heat Gain Coefficient <small>Determined in accordance with NFRC 100</small>	0.31 0.32	Double Line 1-1/2 x 4-1/2 x 17-1/2
Visible Transmittance <small>Determined in accordance with NFRC 100</small>	0.51 0.55	4-1/2 x 17-1/2

NFRC ratings are determined for a fixed set of environmental conditions and specific product sizes and may not be appropriate for directly measuring seasonal energy performance. For additional information, contact:

- Look for this label as your assurance that this window has been independently rated using a procedure established by the NFRC. Although other labels may be present, the NFRC label is your best source of energy performance information.
- U-factor is a measure of heat transferred by the entire window (frame, sash and glass) either into or out of the building. A smaller U-factor will provide a window which is more comfortable on cold days. Try to purchase a window with the lowest U-factor.
- Solar Heat Gain Coefficient (SHGC) is a measure of the solar energy entering the building through the entire window. A lower SHGV will reduce air conditioning costs and provide more comfort on hot days.
- Visible Transmittance (VT) is a measure of the amount of visible light entering the window. Try to select a window with a high VT. It will bring more natural day-light into your home.
- Independent Certification and Inspection Agency (IA) selected by the window manufacturer. All testing is done by an NFRC-accredited laboratory, and results are sent to the IA for evaluation. Both laboratories and manufacturers are inspected annually to ensure that NFRC standards are maintained.
- Name of the window manufacturer.
- NFRC technical procedures by which the window was evaluated.
- The NFRC "rating", a numerical value, represents the applicable energy performance characteristic. Residential (or "AA") and Non-residential (or "BB") are NFRC size designations. Representative test sizes are chosen for each product type and identical sizes are compared among different manufacturers.
- Manufacturer's description of the labeled product.

Source: www.pge.com



HOMEOWNER TIP

INSULATING EXISTING WINDOWS

If existing windows are in relatively good shape, it may be hard to justify replacing them. Consider installing weatherstripping, caulking, inner or outer storm windows and insulating drapes or curtains to improve performance of existing windows.

K. Heating, Ventilation and Air Conditioning (HVAC)

1. Use Duct Mastic on all Duct Joints

Description:

Leaks in the joints between ductwork allow conditioned air to escape into attics and basements. Duct tape loses its effectiveness in 3-5 years. Mastic maintains the seal for decades.

Application:

Install mastic at every metal duct joint and around the bends in elbows. It is important for all ducts to be sealed.

Benefit:

Leaky air ducts can cause negative pressure in the house which can allow carbon monoxide from gas water heaters and furnaces into the home. Well-sealed ductwork also keeps the house more comfortable.

2. Install New Ductwork within Conditioned Space

Description:

Ducts in exterior walls, attics and in uninsulated spaces lose a significant amount of heated or cooled air capacity.

Application:

All ductwork for heating or cooling should be run through conditioned space inside the insulated envelope. Duct runs require chases to be designed into the project from the beginning.

Benefit:

Locating ducts in the conditioned space significantly reduces energy loss and improves occupant comfort.

3. Vent Range Hood to the Outside

Description:

Stems, gases, smoke and other combustion by-products (such as unburned hydrocarbons) can result from cooking. Stovetop range hoods expel these by-products to the outside.

Application:

Range hoods are particularly important for gas stoves and can be installed where stoves are adjacent to exterior walls.

Benefit:

Range hoods improve indoor air quality, prevent overheating and excess moisture build-up.

4. Install 90% or Greater Efficiency Gas Forced Air Furnace

Description:

High efficiency furnaces convert gas to heat with greater efficiency.

Application:

Replace conventional furnaces with high efficiency models. Installing the proper size of furnace for the home is just as important as its efficiency. Check with your local utility company for rebate information.

Benefit:

A properly sized, high efficiency furnace costs less to operate. It saves natural resources, reduces air emissions and helps create a cleaner environment.

5. Install Solar Attic Fan

Description:

Solar attic fans exhaust heat from attic spaces in summer and clear condensation in the winter.

Application:

Solar attic fans are powered by the sun and are most effective when placed on the southern side of the roof and centered between the roof rafters. Avoid installing under overhanging trees or other structures creating shade.

Benefit:

In the summer, attics can reach up to 150°F. That heat radiates into the home and increases the temperature inside. A solar attic fan removes this hot air and reduces the need for air conditioning by as much as 50%. Fans can also increase the life of the roof by decreasing condensation.

6. Clean all Ducts Before Occupancy

Description:

Debris and dust from construction can cause allergic reactions in occupants.

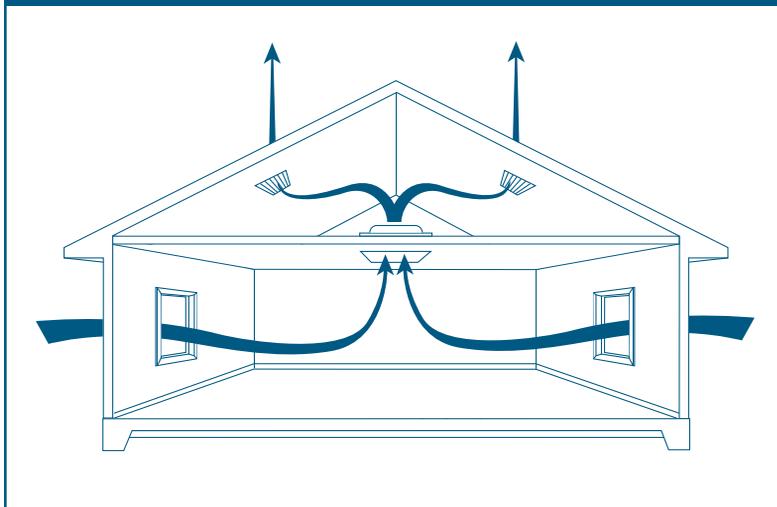
Application:

Clean or vacuum all ductwork before occupancy to eliminate dust. Clean ducts before carpet is laid and finishes are applied.

Benefit:

Children are especially sensitive to micro particulates like drywall dust. Cleaning and vacuuming ductwork reduces dust around the house after occupancy.

Air Flow with Whole-House Fan



7. Install Whole House Fan

Description:

Whole house fans work by continuously replacing warm indoor air with cooler outdoor air.

Application:

The fan must be mounted in a hallway ceiling on the top floor of a house. An insulated, airtight seal is required to prevent air infiltration or exfiltration in winter. Fans should be sized to produce between 4-5 air changes per hour within the home and should have two speeds: low speed for continuous ventilation and high speed.

Benefit:

An average whole house fan uses one-tenth the electricity of an air conditioning unit. Moving large volumes of air can achieve indoor comfort at higher temperatures without air conditioning.

8. Replace Electric Heaters and Wall-Mounted Gas Heaters with Through-the-Wall Heat Pumps

Description:

Wall-mounted electric and gas heating units are potential fire hazards. Gas units produce both unburned hydrocarbons and carbon monoxide, a deadly unnoticeable gas. A wall heat pump has an exterior compressor and an interior air handler that blows conditioned air throughout the home.

Application:

Replace any wall-mounted heater with a heat pump. Replacement with a heat pump is potentially expensive. Another option is to use the water heater as the heat source using a fan coil to distribute heat in the home.

Benefit:

Eliminating electric heaters and wall-mounted gas heaters results in greater safety and more energy efficiency.



HOMEOWNER TIP

INSPECT AIR DUCTS REGULARLY

Ducts should be inspected and sealed to ensure adequate airflow and eliminate loss of conditioned air. Ducts can leak as much as 15-20% of the air passing through them and can bring dust and humidity into living spaces. Thorough duct sealing can cut heating and cooling costs in many homes by 20%.

9. Install Zoned, Hydronic, Radiant Heating

Description:

Hydronic heating forces hot water through radiators located in different areas or zones throughout the house. It is typically installed as baseboards or in floors.

Application:

Use hydronic, radiant heating instead of forced air heating. The system must be designed before construction starts.

Benefit:

Hydronic heating is more comfortable and saves energy by heating only the zone that requires heat.



Radiant Floor Heating

10. Retrofit Wood Burning Fireplaces

Description:

The burning of wood in fireplaces is a major source of air pollution during the winter months, generating up to one-third of the particulate matter on cold evenings.

Application:

Retrofit wood burning fireplaces with EPA certified wood stoves or fireplace inserts, pellet stoves or natural gas units. These units should have direct outside combustion air vented into the insert.

Benefit:

The amount of pollutant particulate matter will be reduced by 75-90% compared a standard fireplace.

11. Install / Replace Dampers on Fireplaces

Description:

Dampers in the fireplace flue reduce down drafting and heat loss during cold weather.

Application:

Replace old damper if it no longer seals the flue due to mechanical failure, rust or soot buildup in the chimney.

Benefit:

A properly operating damper reduces drafts throughout the house when the fireplace is not in use.

12. Install Airtight Doors on Fireplaces

Description:

Open fireplaces suck air out of the house and extract more heat than they provide. Airtight doors reduce the amount of oxygen drawn from the house for combustion purposes.

Application:

Retrofit doors on fireplaces. Outside air, needed for combustion, should be brought in behind the doors. Some fireplaces provide for controlled air intake from inside the house that can be shut down when not in use.

Benefit:

When shut, airtight doors can reduce the heat taken from the house. They also reduce drafts when the fireplace is not in use.

13. Install Heat Recovery Ventilation Unit (HRV)

Description:

An HRV is a mechanical ventilation system that recovers heat from exhausted indoor air and transfers it to the incoming fresh air stream. HRV is an air-to-air exchanger in which outgoing exhaust air preheats or precools the incoming fresh air.

Application:

The unit should be designed into the HVAC system to capture heat out of exhausted air from the return ducts of the forced air furnace. Note: Use of this equipment is particularly appropriate with blower door test results of less than .35 Natural Air Changes per Hour (NACH).

Benefit:

Air to air heat exchangers provide for fresh air in winter while exhausting stale indoor air. Heat is captured from the exhausted air stream and transferred to the incoming air.

14. Install Separate Garage Exhaust Fan

Description:

According to the U.S. Environmental Protection Agency, an attached garage is the single most significant contributor to poor indoor air quality. Car exhaust contains many known carcinogens and can migrate into living spaces through doors and cracks in walls adjacent to the garage.

Application:

Install exhaust fan on the opposite wall from the door to the house. It can be wired to an electric garage door or put on a timer to run for 15 minutes after door has been opened or closed.

Benefit:

An exhaust fan creates a healthier indoor environment by reducing the potential hazard of car exhaust from entering the house.

15. Install High Efficiency Particulate Air (HEPA) Filter

Description:

HEPA filters remove over 90% of dust and particulates from the air.

Application:

HEPA filters are installed in the return air stream at the air handler, which should be sized to handle the reduced air pressure caused by the filter. Some units have an air conditioning setting for the fan that will handle the retrofit filter.

Benefit:

The EPA has identified microparticulates as a leading cause of respiratory discomfort. By removing these particles, the HEPA filter makes the living space healthier.



HOMEOWNER TIP

WASH AND CHANGE FURNACE FILTERS OFTEN

Furnace filters capture large particles of dust, pollen, and other indoor pollutants. Washable filters can be cleaned and reused. Non-washable filters must be replaced in keeping with the manufacturer's instructions. It is suggested to wash/change filters at least twice a year (preferably more often), preventing furnace air from becoming contaminated as it is blown into the living space.

L. Renewable and Solar Energy

1. Incorporate Natural Cooling

Description:

Natural cooling systems incorporate: shading from deciduous trees (for east and west-facing glass), window overhangs and awnings, and radiant heat-reflective barriers installed in the attic space.

Application:

Any combination of natural cooling techniques can be used to reduce overheating on homes. Use awnings and window overhangs primarily on south facing glass to provide a balance between summer cooling and winter heating through solar gain. Use landscaping to shade east and west-facing windows.

Benefit:

Natural cooling reduces the need for air conditioning, saves money on energy bills, and can make homes without air conditioning more comfortable.

2. Incorporate Passive Solar Heating

Description:

Passive solar systems provide heat to the structure through south facing windows in conjunction with thermal mass.

Application:

The house must incorporate windows that face within 30 degrees of due south and have the ability to store excess heat in massive elements such as a slab floor or stone fireplace.

Benefit:

Passive solar design can reduce heating requirements by 30-50%, saving energy and money.

3. Pre-Plumb for Solar Water Heating

Description:

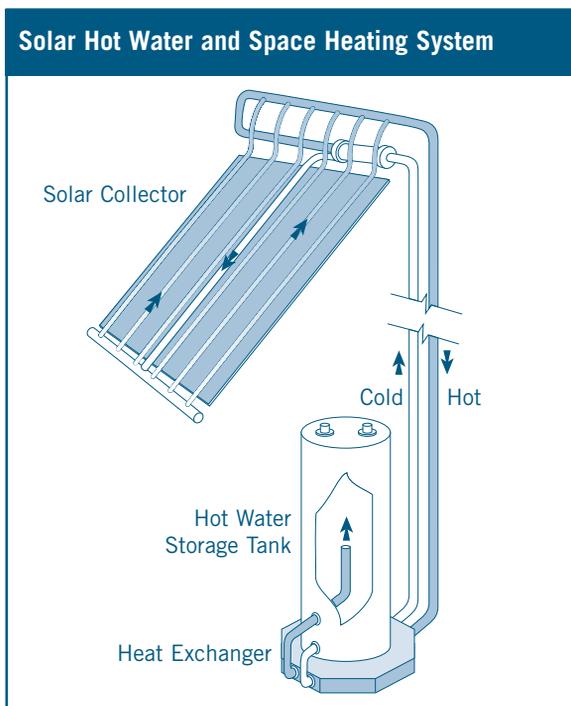
Insulated copper pipes are installed from the attic to a hot water closet or mechanical room for future solar installation. This option allows the homeowner to install an active solar system at a later date if they desire.

Application:

Provide south-facing roof area for collectors and access for piping to a mechanical room. This is primarily applicable to homes that are being extensively rehabilitated on the interior. The most cost-effective time to install this pre-plumbing is during construction.

Benefit:

Solar hot water pre-plumbing during the remodeling process can save money for the homeowner if, at some point in the future, they want to install a solar system.



4. Install Solar Water System

Description:

Solar water heating systems use solar panels to collect heat from the sun. The hot water is stored for use at a later time. Water pre-heated by a solar system can also supplement use of a standard water heater.

Application:

Provide sufficient south-facing roof area for collectors, and space in a hot water closet for the additional hot water storage tank.

Benefit:

Solar hot water systems can pay back in as little as seven years and reduce the use of gas or electricity for water heating.

5. Install Photovoltaic (PV) Panels

Description:

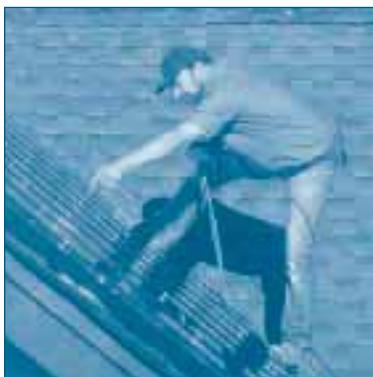
PV panels contain hundreds of small cells that collect the sun's energy and convert it into electricity. Excess electricity can be sent back into the utility grid for a credit on electric bills. The collected energy can also be stored in large batteries to meet the needs of nighttime energy requirements.

Application:

Mount photovoltaic panels on the roof or on the ground at an appropriate angle (usually 40-60°). The components for a residential, utility-tied system typically include panels, a power relay center, an inverter, and storage batteries. An alternative installation would be self-contained systems (battery included) for outside lighting, security lighting, or walkway illumination.

Benefit:

PV panels can be used as a means to decrease reliance on conventional power plants that contribute to air pollution. PV can be cost effective in areas that require night lighting such as outdoor lights.



Photovoltaic Panel System



HOMEOWNER TIP

CONSIDER THE BENEFITS OF INSTALLING PHOTOVOLTAIC (PV) PANELS

Reliability: Generate your own electricity using renewable resources. Your electric utility can “store” and buy the extra electricity you generate or supply it if your system does not generate enough. **Security:** PV Panels provide a secure source of electricity. **Environmentally Friendly:** PVs are a clean, replenishable resource that do not contribute to global warming. **Sustainability:** Use PVs to help ensure our energy future by tapping into an “infinite” power supply. Contact the California Energy Commission at 800.555.7794 for information on cash rebates on eligible renewable energy electric-generating systems.

M. Indoor Air Quality / Finishes

1. Use Low/No-VOC and Formaldehyde-Free Paint

Description:

Most paint releases volatile organic compounds (VOCs), a major indoor air pollutant, into the home. Once outside, VOCs react with other pollutants, producing ground-level ozone that also affects human health. Often low/no-VOC products are manufactured without mercury or mercury compounds, or pigments of lead, cadmium, chromium, or their oxides.

Application:

Paint with low/no-VOCs is available from most major manufacturers and is applied like traditional paint products. High washability should be specified for bathrooms, kitchens and children's bedrooms. Every finish and most colors are available in low/no-VOC paints.

Benefit:

Low/No-VOC paint reduces the emissions of VOCs into the home, improving indoor air quality and reducing the formation of urban smog.

2. Use Low VOC, Water-Based Wood Finishes

Description:

Conventional solvent-based wood finishes can offgas for months, and can be harmful to children. Low VOC finishes, such as water-borne urethane and acrylic, are lower in toxic compounds compared to conventional solvent-based finishes while providing similar durability.

Application:

Low VOC wood finishes can be used in most applications where solvent-based finishes are typically used. If solvent-based wood finishes must be used, they should be left to offgas for three to four weeks prior to occupancy.

Benefit:

Using low VOC wood finishes reduces offgassing into the home, improving indoor air quality, and reducing the formation of urban smog.



Low/No-VOC paint

3. Use Solvent-Free Adhesives

Description:

Unlike solvent-based adhesives that offgas toxic compounds for months, solvent-free adhesives reduce toxic gasses such as aromatic hydrocarbons or solvents that contribute to air pollution.

Application:

Use solvent-free products in place of standard adhesives for all interior applications such as installation of flooring, countertops, wall coverings, paneling and tub/shower enclosures.

Benefit:

Solvent-free adhesives are often stronger, emit fewer pollutants, and reduce the potential harmful impacts on the health of the occupants and installers.



HOMEOWNER TIP

PROPERLY DISPOSE OF HOUSEHOLD HAZARDOUS WASTES

Contact your local Household Hazardous Waste facility (listed on page 2) for more information on ways to dispose of household hazardous wastes (paints, stains, adhesives, etc.)

4. Substitute Particleboard with Formaldehyde-Free Materials

Description:

Particleboard is made from wood fibers and an adhesive that contains urea formaldehyde, a suspected human carcinogen. The formaldehyde is continuously released, referred to as “off-gassing”, for years after installation. Formaldehyde offgassing contributes to poor indoor air quality. Particleboard is typically used for cabinets, counter tops, stair treads, and shelving.

Application:

Whenever possible, eliminate new particleboard inside houses by using solid wood for stair treads, certified exterior grade plywood or formaldehyde-free medium density fiberboard (MDF) for shelving, cabinets and substrate for countertops.

Benefit:

Elimination of particleboard reduces formaldehyde exposure to residents, particularly children, who are most susceptible.



Formaldehyde-Free Medium Density Fiberboard (MDF)

5. Use Exterior Grade Plywood for Interior Uses

Description:

Exterior plywood uses phenolic resins that offgas one-tenth as much as interior plywood. Interior plywood typically uses urea-formaldehyde glue which offgasses into the house.

Application:

Substitute interior plywood with exterior plywood for custom cabinets and shelving.

Benefit:

Formaldehyde is a suspected human carcinogen and should be avoided whenever possible.

6. Substitute Formaldehyde-Based Medium Density Fiberboard (MDF) with Formaldehyde-Free Materials

Description:

Most MDF is made from sawdust and an adhesive that contains urea formaldehyde, a suspected human carcinogen. MDF without formaldehyde binders is now available. Other alternatives include boards made from agricultural waste, such as wheatboard, a straw-based particleboard manufactured with non-formaldehyde and emission-free binder.

Application:

Whenever possible, eliminate formaldehyde-based MDF inside the home. MDF is typically used for cabinets, trim, and shelving. Use alternatives such as certified plywood, formaldehyde-free MDF, wheatboard, tile and stone for shelving, cabinets and countertops.

Benefit:

Reduces formaldehyde exposure to residents, particularly children, who are more susceptible. Some boards made from agricultural waste are superior to wood-based particleboard in moisture resistance and structural properties, and provides for the reuse of a former waste product.



HOMEOWNER TIP

SELECT LOW-TOXIC OR CITRUS-BASED CLEANING SUPPLIES

High-quality, non-toxic and environmentally responsible cleaning products are readily available. Choose products that are non-toxic, ammonia and chlorine-free, as well as biodegradable. These cleaning products are as effective as conventional cleaners, without harsh chemicals that can lead to health problems and atmospheric ozone loss.

7. Use Forest Stewardship Council (FSC) Certified Trim Material

Description:

FSC certified trim material comes from forests that are managed in accordance with sustainable forest practices. It is particularly important to specify certified wood instead of clear, knot-free trim as this material is typically harvested from non-sustainable, old-growth forests.

Application:

Use certified trim in any application that normally uses conventional stain-grade trim.

Benefit:

Sustainable forest certification assures that the forest from which the trim is produced is managed in a way that will assure the long-term availability of these precious woods while protecting ancient, old-growth forests.



Forest Stewardship Council

The FSC logo on a product provides consumers with an assurance that the wood they use comes from forests managed in an environmentally and socially responsible manner.



Smart Wood and Scientific Certification Series

These groups verify that forest management is accomplished according to the FSC program.



8. Seal all Exposed Particleboard or MDF

Description:

Using non-toxic, low permeability paint or sealer to seal exposed particleboard or MDF will reduce the release of harmful gasses and is the next best solution to elimination of particleboard.

Application:

Whenever MDF or particleboard is used, seal all exposed edges of cabinets, undersides of countertops, stairs, shelving, etc. with at least two coats of less-toxic, low permeability paint or sealer prior to installation.

Benefit:

Sealing all exposed particleboard reduces exposure of harmful emissions to residents, particularly children, who are most susceptible.

9. Use Finger-Jointed Trim

Description:

Finger-jointed trim is manufactured from short pieces of clear wood glued together to create finished trim.

Application:

Use finger-jointed trim in any application where trim is to be painted.

Benefit:

Finger-jointed trim is straighter and more stable than conventional clear wood, uses material more effectively, and saves both money and resources.



HOMEOWNER TIP

PURCHASE VACUUM CLEANER WITH HEPA FILTER

High efficiency particulate air (HEPA) filters catch small dust particles that are typically blown around the house during vacuuming. The EPA has determined that indoor particulate dust is a significant health hazard. HEPA filters reduce exposure to these harmful particulates. Children, asthmatics, senior citizens and others with respiratory diseases can benefit from reduced dust in the living environment.

N. Flooring

1. Select Forest Stewardship Council (FSC) Certified Wood Flooring

Description:

Certified wood flooring comes from forests that are managed in accordance with sustainable forest practices. Certified wood flooring products are available in a wide variety of domestic and exotic species.

Application:

Use FSC certified wood in place of conventional hardwood flooring.

Benefit:

Sustainable forest certification assures that the forest from which the flooring is produced is managed in a way that will assure the long-term availability of these precious woods while protecting ancient, old-growth forests.

2. Use Rapidly Renewable Flooring Materials

Description:

Bamboo and cork flooring are alternatives to hardwood flooring. Bamboo is a fast growing grass that can be harvested in three to five years. Cork is a natural flooring material that is obtained from the outer bark of the cork oak tree that is regenerated every 10 years.

Application:

Use these alternative flooring materials in place of conventional hardwood.

Benefit:

Fast growing, rapidly renewable floor substitutes are attractive and reduce pressure on hardwood forests. Bamboo is as durable as wood; cork is naturally fire and moisture resistant as well as sound absorbing.

3. Use Recycled Content Ceramic Tile

Description:

Recycled content ceramic tile can contain up to 70% recycled glass. Originally developed for high traffic commercial conditions, recycled content tiles are very durable and wear well in residential applications.

Application:

Install recycled content tiles wherever conventional tiles are specified.

Benefit:

Some recycled content ceramic tile is very dense which significantly reduces the amount of moisture and stains that are absorbed into the tile, making it more durable and easier to maintain.



Bamboo Flooring

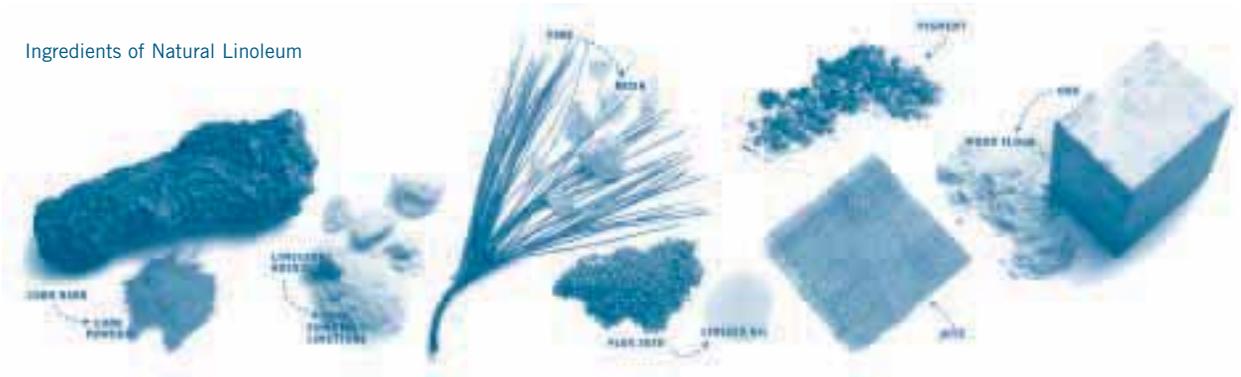


CONTRACTOR TIP

MINIMIZING OFFGASSING FROM ADHESIVES

Use low VOC, water-based sealants and solvent-free adhesives when installing flooring. When installing laminate flooring, use glueless installation to minimize offgassing from adhesives.

Ingredients of Natural Linoleum



4. Replace Vinyl Flooring with Natural Linoleum

Description:

Natural linoleum is manufactured from natural materials such as cork and linseed oil. Unlike vinyl, linoleum does not contain petroleum-based products or chlorinated chemicals such as PVC, which may be a source of VOC offgassing. There is also concern of byproducts such as cancer causing dioxins, which may be produced during the manufacturing of vinyl.

Application:

Use natural linoleum in place of vinyl flooring.

Benefit:

Linoleum is low-toxic, easy to repair, durable, and stain resistant. Linoleum can last up to 40 years whereas vinyl lasts typically 7-10 years.

5. Use Exposed Concrete as Finish Floor

Description:

For slab-on-grade additions, the concrete can be polished, finished with expansion joints in various patterns or stained with pigments to make an attractive finish floor. This approach is especially appropriate for radiant, in-floor heating systems.

Application:

Use this approach for finished basements or additions on slab construction. Finish must be designed and constructed when slab is being poured.

Benefit:

When using the slab as a floor finish, it eliminates the need to use other flooring materials. Additionally, it is durable and easy to clean.

6. Install Recycled Content Carpet and Underlayment

Description:

Recycled content carpet is made from recycled plastic bottles, recycled wool or recycled cotton. Recycled content carpet does not differ in appearance or performance and the price is comparable to conventional carpet. Recycled content underlayment and padding are also available.

Application:

Use recycled content carpet, underlayment and padding in all applications where conventional carpet is installed.

Benefit:

Recycled content carpet saves resources and diverts waste from landfills. Approximately 40 two-liter soda bottles are recycled per square yard of carpeting. Recycled carpet is often more resilient and colorfast than carpet made from virgin fibers.



HOMEOWNER TIP

PLACE ALL DOORMATS AT ALL EXTERIOR DOORS

Dust, dirt-borne contaminants, and chemicals such as fertilizer and pesticides are tracked into the house on shoes. Using a doormat, or preferably leaving shoes at the door, reduces this source of toxic contaminants. A doormat is an easy and inexpensive method to reduce toxic materials that would otherwise be brought into the home.

Chapter Three:

Green Building Checklist and Illustrations

The checklist and illustrations are intended to serve as tools for project planning and design, materials selection, and construction. When building or remodeling, it is important to look carefully at the type of project and incorporate as many green features as possible. The items listed on the checklist represent a variety of green building opportunities; however, not all of them may apply to your remodeling project. There is no standard definition for what constitutes a “green building”, but in general, a green project will incorporate as many items on this checklist that is practical and applicable to your project.

Green Remodeler Checklist

✓ A. Site

- 1. Recycle Job Site Construction and Demolition Waste 
- 2. Salvage Reusable Materials 
- 3. Install Drip Irrigation 
- 4. Incorporate Permeable Paving
- 5. Design Resource-Efficient Landscapes and Gardens 
- 6. Provide for On-Site Water Catchment / Retention
- 7. Remodel for Mixed Use, Adaptive Reuse, and Historic Preservation

B. Foundation

- 1. Incorporate Recycled Flyash in Concrete
- 2. Reuse Form Boards
- 3. Use Recycled Content Rubble for Backfill Drainage
- 4. Insulate Foundation Before Backfill
- 5. Use Aluminum Forms
- 6. Install Rigid Foam, Insulated Concrete Forms (ICFs)

C. Structural Frame

- 1. Substitute Solid Sawn Lumber with Engineered Lumber
- 2. Use FSC Certified Wood for Framing
- 3. Use Wood I-Joists for Floors and Ceilings
- 4. Use OSB for Subfloor and Sheathing
- 5. Use Finger-Jointed Studs
- 6. Use Structural Insulated Panels (SIPs) for Walls / Roof
- 7. Use Reclaimed Lumber

D. Exterior Finish

- 1. Use Sustainable Decking Materials
- 2. Use Treated Wood that Does Not Contain Chromium or Arsenic for Decking and Sill Plates
- 3. Use Alternative Siding Materials

✓ E. Plumbing

- 1. Install Hot Water Jacket Insulation
- 2. Convert Gas to Tankless Water Heaters
- 3. Insulate Hot and Cold Water Pipes
- 4. Retrofit all Faucets and Showers with Flow Reducers 
- 5. Replace Toilets with Low Flow Models
- 6. Install Chlorine Filter on Showerhead
- 7. Pre-Plumb for GrayWater Conversion 
- 8. Install Water Filtration Units at Faucets
- 9. Install On-Demand Hot Water Circulation Pump

F. Electrical

- 1. Install Compact Fluorescent Light Bulbs 
- 2. Install Lighting Controls
- 3. Install Ceiling Fans

G. Roofing

- 1. Select Light Colored Roofing
- 2. Select Safe and Durable Roofing Materials

H. Appliances

- 1. Replace Dishwasher with Low Water Use Model 
- 2. Install Horizontal Axis Washing Machine 
- 3. Install Energy-Efficient Refrigerator 

I. Insulation

- 1. Upgrade Wall and Ceiling Insulation to Exceed Title 24 Requirements 
- 2. Install Recycled Content, Formaldehyde-Free Fiberglass Insulation 
- 3. Use Advanced Infiltration Reduction Practices 
- 4. Use Cellulose Insulation 

✓ J. Windows

- 1. Install Energy-Efficient Windows 
- 2. Install Low Heat Transmission Glazing

K. Heating, Ventilation and Air Conditioning (HVAC)

- 1. Use Duct Mastic on all Duct Joints
- 2. Install New Ductwork within Conditioned Space
- 3. Vent Range Hood to the Outside
- 4. Install 90% or Greater Efficiency Gas Forced Air Furnace 
- 5. Install Solar Attic Fan
- 6. Clean all Ducts Before Occupancy
- 7. Install Whole House Fan
- 8. Replace Electric and Wall-Mounted Gas Heaters with Heat Pumps
- 9. Install Zoned, Hydronic, Radiant Heating
- 10. Retrofit Wood Burning Fireplaces
- 11. Install / Replace Dampers on Fireplaces
- 12. Install Airtight Doors on Fireplaces
- 13. Install Heat Recovery Ventilation Unit (HRV)
- 14. Install Separate Garage Exhaust Fan
- 15. Install High Efficiency Particulate Air (HEPA) Filter

L. Renewable and Solar Energy

- 1. Incorporate Natural Cooling
- 2. Incorporate Passive Solar Heating
- 3. Pre-Plumb for Solar Water Heating
- 4. Install Solar Water System 
- 5. Install Photovoltaic (PV) Panels

✓ M. Indoor Air Quality / Finishes

- 1. Use Low/No-VOC and Formaldehyde-Free Paint
- 2. Use Low VOC, Water-Based Wood Finishes
- 3. Use Solvent-Free Adhesives
- 4. Substitute Particleboard with Formaldehyde-Free Materials
- 5. Use Exterior Grade Plywood for Interior Uses
- 6. Substitute Formaldehyde-Based Medium Density Fiberboard (MDF) with Formaldehyde-Free Materials
- 7. Use FSC Certified Trim Material
- 8. Seal all Exposed Particleboard or MDF
- 9. Use Finger-Jointed Trim

N. Flooring

- 1. Select FSC Certified Wood Flooring
- 2. Use Rapidly Renewable Flooring Materials
- 3. Use Recycled Content Ceramic Tile
- 4. Replace Vinyl Flooring with Natural Linoleum
- 5. Use Exposed Concrete as Finish Floor
- 6. Install Recycled Content Carpet and Underlayment

	For information on energy saving programs, refer to your local utility listed on Page 2
	For information on water-saving programs, refer to your local utility listed on Page 2
	For information on construction and demolition, recycling and composting, refer to your city/county recycling agency listed on Page 2

New Addition

Consider the following green remodeling options in a new addition.

Site

- Recycle Job Site Construction and Demolition Waste
- Salvage Reusable Materials
- Install Drip Irrigation
- Incorporate Permeable Paving
- Design Resource-Efficient Landscapes and Gardens
- Provide for On-Site Water Catchment / Retention
- Remodel for Mixed Use, Adaptive Reuse, and Historic Preservation

Foundation

- Incorporate Recycled Flyash in Concrete
- Reuse Form Boards
- Use Recycled Content Rubble for Backfill Drainage
- Insulate Foundation Before Backfill
- Use Aluminum Forms
- Install Rigid Foam, Insulated Concrete Forms (ICFs)

Structural Frame

- Substitute Solid Sawn Lumber with Engineered Lumber
- Use FSC Certified Wood for Framing
- Use Wood I-Joists for Floors and Ceilings
- Use OSB for Subfloor and Sheathing
- Use Finger-Jointed Studs
- Use Structural Insulated Panels (SIPs) for Walls / Roof
- Use Reclaimed Lumber

Exterior Finish

- Use Sustainable Decking Materials
- Use Treated Wood that Does Not Contain Chromium or Arsenic for Decking and Sill Plates
- Use Alternative Siding Materials

Plumbing

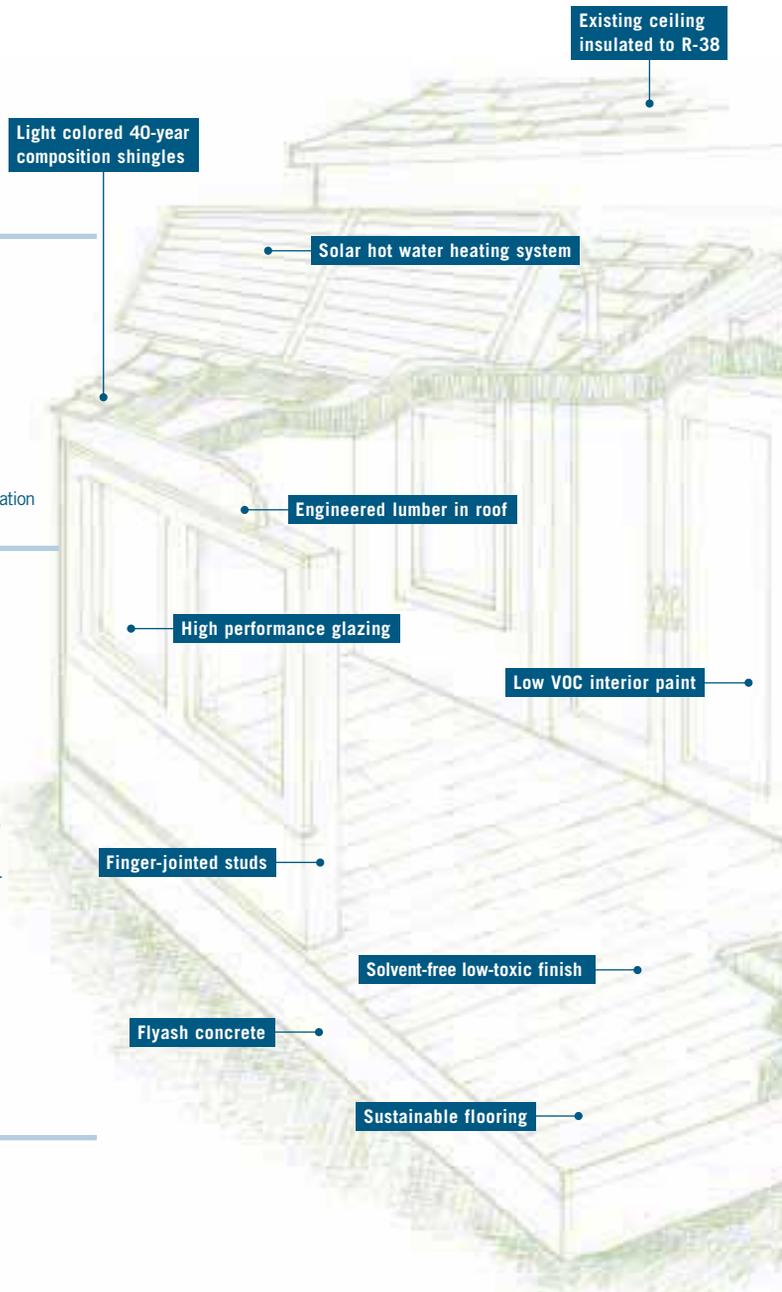
- Install Hot Water Jacket Insulation
- Convert Gas to Tankless Water Heaters
- Insulate Hot and Cold Water Pipes
- Retrofit all Faucets and Showers with Flow Reducers
- Replace Toilets with Low Flow Models
- Install Chlorine Filter on Showerhead
- Pre-Plumb for Graywater Conversion
- Install Water Filtration Units at Faucets
- Install On-Demand Hot Water Circulation Pump

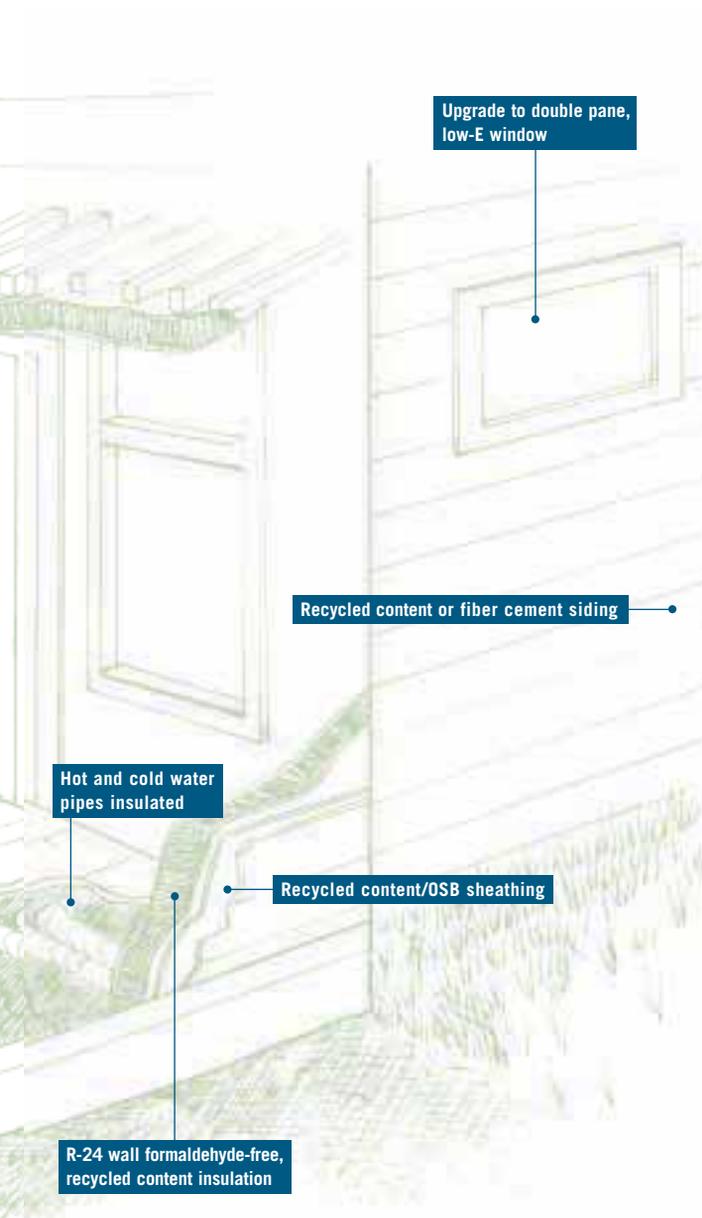
Electrical

- Install Compact Fluorescent Light Bulbs
- Install Lighting Controls
- Install Ceiling Fans

Roofing

- Select Light Colored Roofing
- Install Minimum 40-Year Composition Roofing





Insulation

- Upgrade Wall and Ceiling Insulation to Exceed Title 24 Requirements
- Install Recycled Content, Formaldehyde-Free Fiberglass Insulation
- Use Advanced Infiltration Reduction Practices
- Use Cellulose Insulation

Windows

- Install Energy-Efficient Windows
- Install Low Heat Transmission Glazing

Heating, Ventilation and Air Conditioning (HVAC)

- Use Duct Mastic on all Duct Joints
- Install New Ductwork within Conditioned Space
- Vent Range Hood to the Outside
- Install 90% or Greater Efficiency Gas Forced Air Furnace
- Install Solar Attic Fan
- Clean all Ducts Before Occupancy
- Install Whole House Fan
- Replace Electric and Wall-Mounted Gas Heaters with Heat Pumps
- Install Zoned, Hydronic, Radiant Heating
- Retrofit Wood Burning Fireplaces
- Install / Replace Dampers on Fireplaces
- Install Airtight Doors on Fireplaces
- Install Heat Recovery Ventilation Unit (HRV)
- Install High Efficiency Particulate Air (HEPA) Filter

Renewable and Solar Energy

- Incorporate Natural Cooling
- Incorporate Passive Solar Heating
- Pre-Plumb for Solar Water Heating
- Install Solar Water System
- Install Photovoltaic (PV) Panels

Indoor Air Quality / Finishes

- Use Low/No-VOC and Formaldehyde-Free Paint
- Use Low VOC, Water-Based Wood Finishes
- Use Solvent-Free Adhesives
- Substitute Particleboard with Formaldehyde-Free Materials
- Use Exterior Grade Plywood for Interior Uses
- Substitute Formaldehyde-Based Medium Density Fiberboard (MDF) with Formaldehyde-Free Materials
- Use FSC Certified Trim
- Seal all Exposed Particleboard or MDF
- Use Finger-Jointed Trim

Flooring

- Select FSC Certified Wood Flooring
- Use Rapidly Renewable Flooring Materials
- Use Recycled Content Ceramic Tile
- Replace Vinyl Flooring with Natural Linoleum
- Use Exposed Concrete as Finish Floor
- Install Recycled Content Carpet and Underlayment

Second Floor

Consider the following green remodeling options in a second floor.

Site

- Recycle Job Site Construction and Demolition Waste
- Salvage Reusable Materials

Structural Frame

- Substitute Solid Sawn Lumber with Engineered Lumber
- Use FSC Certified Wood for Framing
- Use Wood I-Joists for Floors and Ceilings
- Use OSB for Subfloor and Sheathing
- Use Finger-Jointed Studs
- Use Structural Insulated Panels (SIPs) for Walls / Roof
- Use Reclaimed Lumber

Exterior Finish

- Use Treated Wood that Does Not Contain Chromium or Arsenic for Decking and Sill Plates
- Use Alternative Siding Materials

Plumbing

- Insulate Hot and Cold Water Pipes
- Install Chlorine Filter on Showerhead
- Pre-Plumb for GrayWater Conversion
- Install Water Filtration Units at Faucets
- Install On-Demand Hot Water Circulation Pump

Electrical

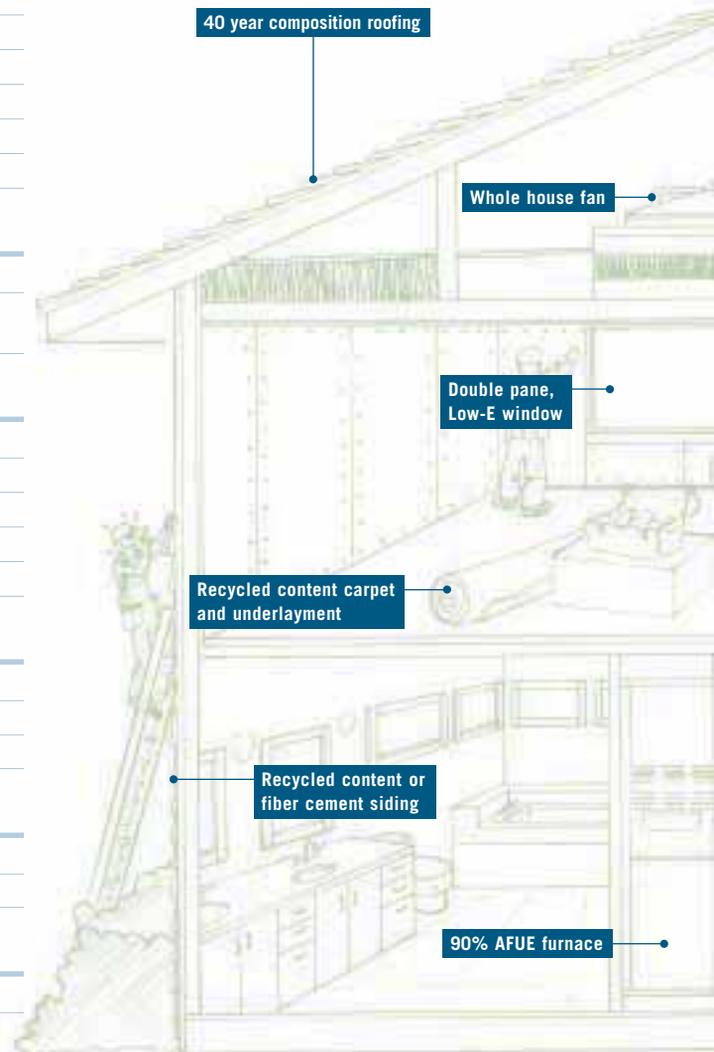
- Install Compact Fluorescent Light Bulbs
- Install Lighting Controls
- Install Ceiling Fans

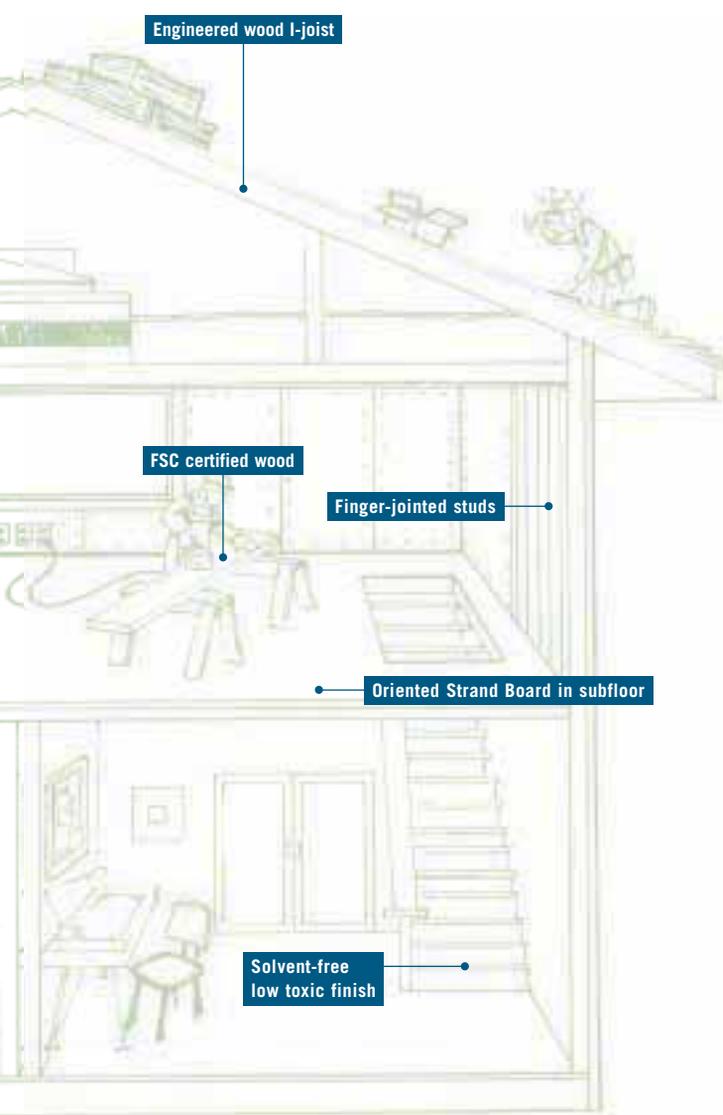
Roofing

- Select Light Colored Roofing
- Install Minimum 40-Year Composition Roofing

Insulation

- Upgrade Wall and Ceiling Insulation to Exceed Title 24 Requirements
- Install Recycled Content, Formaldehyde-Free Fiberglass Insulation
- Use Advanced Infiltration Reduction Practices
- Use Cellulose Insulation





Windows

- Install Energy-Efficient Windows
- Install Low Heat Transmission Glazing

Heating, Ventilation and Air Conditioning (HVAC)

- Use Duct Mastic on all Duct Joints
- Install New Ductwork within Conditioned Space
- Install Solar Attic Fan
- Clean all Ducts Before Occupancy
- Install Whole House Fan
- Install 90% or Greater Efficiency Gas Forced Air Furnace
- Install Heat Recovery Ventilation Unit (HRV)
- Install High Efficiency Particulate Air (HEPA) Filter

Renewable and Solar Energy

- Incorporate Natural Cooling
- Incorporate Passive Solar Heating
- Install Photovoltaic (PV) Panels

Indoor Air Quality / Finishes

- Use Low/No-VOC and Formaldehyde-Free Paint
- Use Low VOC, Water-Based Wood Finishes
- Use Solvent-Free Adhesives
- Substitute Particleboard with Formaldehyde-Free Materials
- Use Exterior Grade Plywood for Interior Uses
- Substitute Formaldehyde-Based Medium Density Fiberboard (MDF) with Formaldehyde-Free Materials
- Use FSC Certified Trim Material
- Seal all Exposed Particleboard or MDF
- Use Finger-Jointed Trim

Flooring

- Select FSC Certified Wood Flooring
- Use Rapidly Renewable Flooring Materials
- Use Recycled Content Ceramic Tile
- Replace Vinyl Flooring with Natural Linoleum
- Install Recycled Content Carpet and Underlayment

Bathroom

Consider the following green remodeling options in a bathroom.

Site

- Recycle Job Site Construction and Demolition Waste
- Salvage Reusable Materials

Structural Frame

- Substitute Solid Sawn Lumber with Engineered Lumber
- Use FSC Certified Wood for Framing
- Use Wood I-Joists for Floors and Ceilings
- Use OSB for Subfloor and Sheathing
- Use Finger-Jointed Studs
- Use Reclaimed Lumber

Plumbing

- Install Hot Water Jacket Insulation
- Convert Gas to Tankless Hot Water Heaters
- Insulate Hot and Cold Water Pipes
- Retrofit all Faucets and Showers with Flow Reducers
- Replace Toilets with Low Flow Models
- Install Chlorine Filter on Showerhead
- Pre-Plumb for Gray Water Conversion
- Install Water Filtration Units at Faucets
- Install On-Demand Hot Water Circulation Pump

Electrical

- Install Compact Fluorescent Light Bulbs
- Install Lighting Controls
- Install Ceiling Fans

Insulation

- Upgrade Wall and Ceiling Insulation to Exceed Title 24 Requirements
- Install Recycled Content, Formaldehyde-Free Fiberglass Insulation
- Use Advanced Infiltration Reduction Practices
- Use Cellulose Insulation

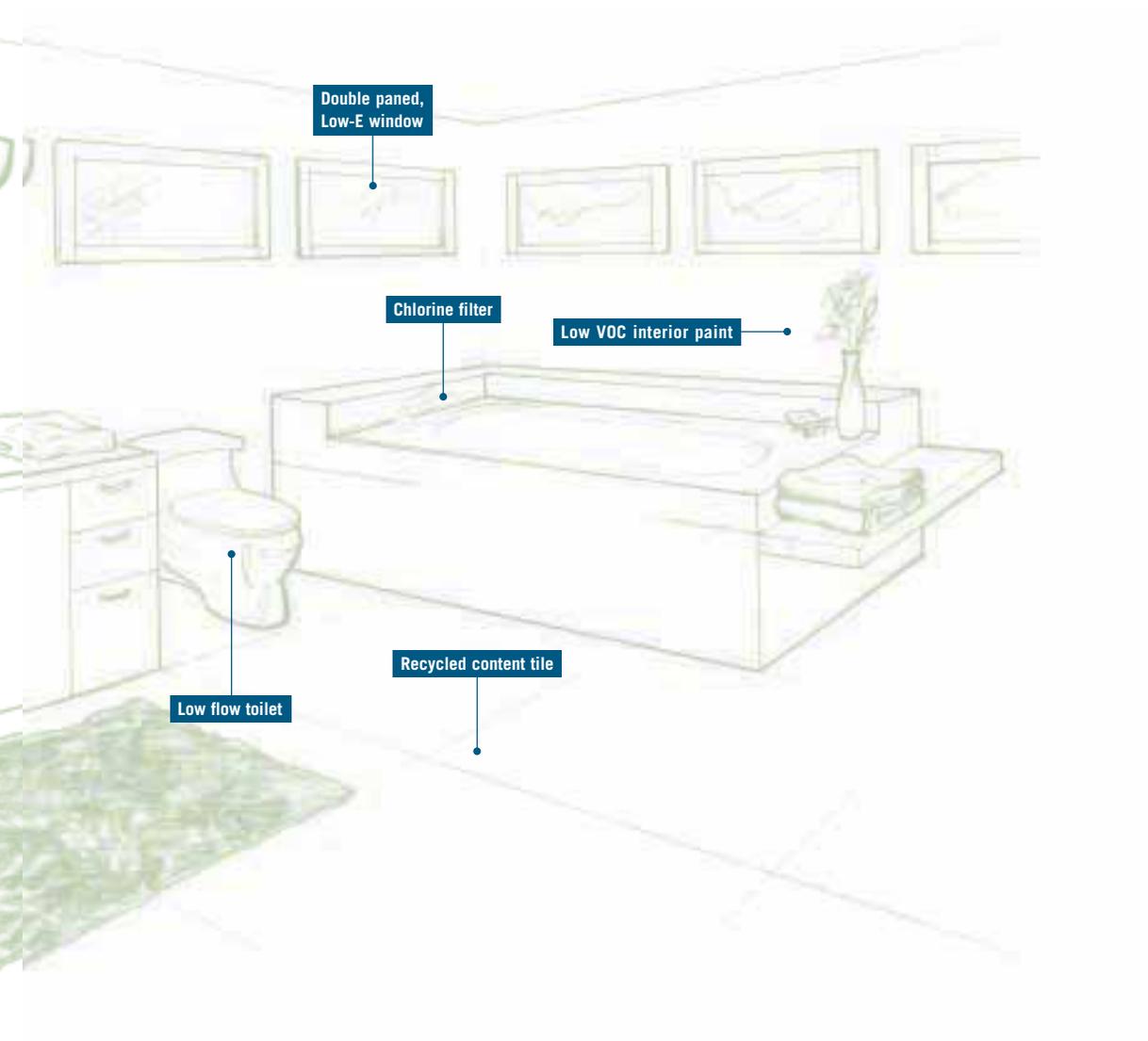


Windows

- Install Energy-Efficient Windows
- Install Low Heat Transmission Glazing

Heating, Ventilation and Air Conditioning (HVAC)

- Use Duct Mastic on all Duct Joints
- Install New Ductwork within Conditioned Space
- Clean all Ducts Before Occupancy



Indoor Air Quality / Finishes

- Use Low/ No-VOC and Formaldehyde-Free Paint
- Use Low VOC, Water-Based Wood Finishes
- Use Solvent-Free Adhesives
- Substitute Particleboard with Formaldehyde-Free Materials
- Use Exterior Grade Plywood for Interior Uses
- Substitute Formaldehyde-Based Medium Density Fiberboard (MDF) with Formaldehyde-Free Materials
- Use FSC Certified Trim Material
- Seal all Exposed Particleboard or MDF
- Use Finger-Jointed Trim

Flooring

- Select FSC Certified Wood Flooring
- Use Rapidly Renewable Flooring Materials
- Use Recycled Content Ceramic Tile
- Replace Vinyl Flooring with Natural Linoleum
- Use Exposed Concrete as Finish Floor
- Install Recycled Content Carpet and Underlayment

Kitchen Remodel

Consider the following green remodeling options in a kitchen remodel.

Site

- Recycle Job Site Construction and Demolition Waste
- Salvage Reusable Materials

Plumbing

- Insulate Hot and Cold Water Pipes
- Retrofit all Faucets with Flow Reducers
- Install Water Filtration Units at Faucets
- Install On-Demand Hot Water Circulation Pump

Electrical

- Install Compact Fluorescent Light Bulbs
- Install Lighting Controls
- Install Ceiling Fans

Appliances

- Replace Dishwasher with Low Water Use Model
- Install Horizontal Axis Washing Machine
- Install Energy-Efficient Refrigerator

Insulation

- Upgrade Wall and Ceiling Insulation to Exceed Title 24 Requirement
- Install Recycled Content, Formaldehyde-Free Fiberglass Insulation
- Use Infiltration Reduction Practices
- Use Cellulose Insulation

Windows

- Install Energy-Efficient Windows
- Install Low Heat Transmission Glazing

Heating, Ventilation and Air Conditioning (HVAC)

- Use Duct Mastic on all Duct Joints
- Vent Range Hood to the Outside

Flooring

- Select FSC Certified Wood Flooring
- Use Rapidly Renewable Flooring Materials
- Use Recycled Content Ceramic Tile
- Replace Vinyl Flooring with Natural Linoleum
- Use Exposed Concrete as Finish Floor
- Install Recycled Content Carpet and Underlayment

Indoor Air Quality / Finishes

- Use Low/No-VOC and Formaldehyde-Free Paint
- Use Low VOC, Water-Based Wood Finishes
- Use Solvent-Free Adhesives
- Substitute Particleboard with Formaldehyde-Free Materials
- Use Exterior Grade Plywood for Interior Uses
- Substitute Formaldehyde-Based Medium Density Fiberboard (MDF) with Formaldehyde-Free Materials
- Use FSC Certified Trim Material
- Seal all Exposed Particleboard or MDF
- Use Finger-Jointed Trim

